11. Capsule according to any of claims 1 to 10, wherein the container comprises a body and a lid connected to the body and wherein the code is present on the lid of the container.

12. Capsule according to any of claims 1 to 10, wherein the code is present on the rim of the capsule.

13. Capsule according to claim 12, wherein the code is present on the bottom of the rim of the capsule which is opposed to the lid or foil of the capsule.

14. System for preparing a beverage from a capsule according to any of the preceding claims and further comprising a beverage preparation device; wherein the device comprises capsule holding means for holding the capsule and rotational drive means for driving the holding means and capsule in rotation along said axis of rotation and reading means arranged for reading the code when the capsule is rotated along said axis.

15. System according to claim 14, wherein the reading means comprises a light emitter and a light sensor or an inductive sensor.

16. System according to claims 14 or 15, wherein the optical reading means or inductive sensor is arranged to detect a code on the rim of the capsule.

17. Method for preparing a beverage from a system according to any one of claims 14 to 16, wherein the beverage is extracted from the capsule by rotating the capsule along said axis.

18. Method according to claim 17, wherein the code is read at a first rotational speed and the beverage is extracted from the capsule at a second rotational speed.

K-FEE SYSTEM GMBH, EX2009, page 3064
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

ABSTRACT:

Capsule for the preparation of a beverage comprising a container and a beverage ingredient contained therein, wherein the container comprises a code adapted for being identified or read by external reading means, wherein the code is arranged on the container to be read while the capsule is rotated around an axis of rotation traversing the capsule.

Figures 2 and 3

K-FEE SYSTEM GMBH, EX2009, page 3065
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

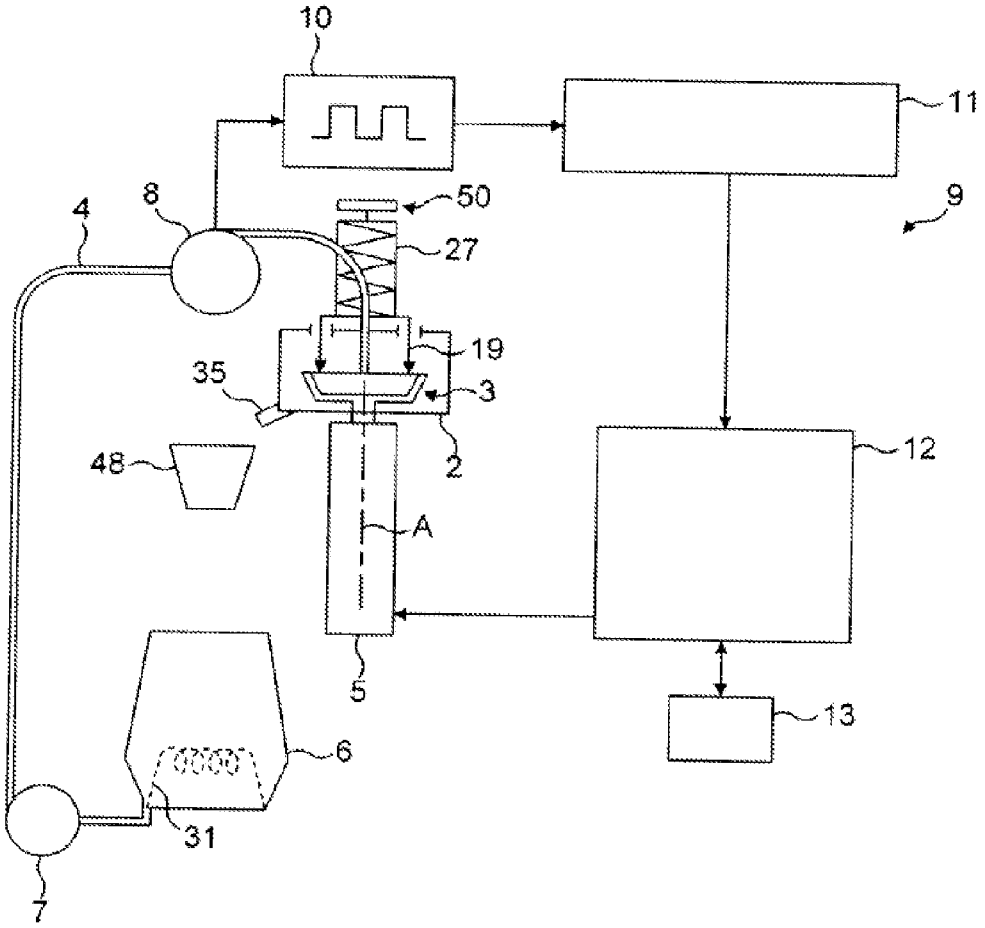


Fig. 1

K-FEE SYSTEM GMBH, EX2009, page 3066
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

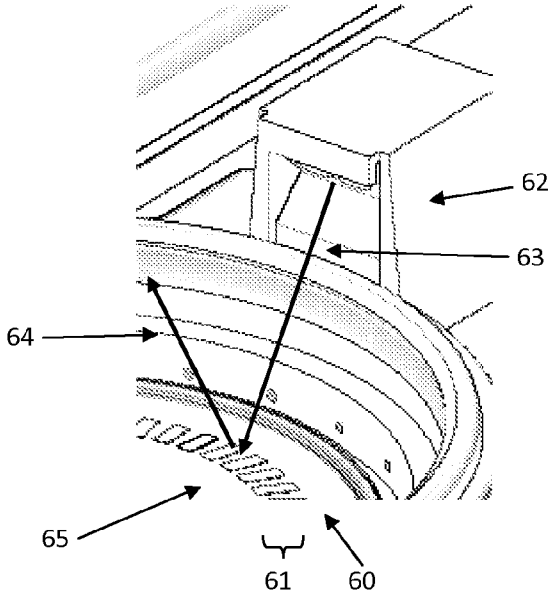


Fig. 2

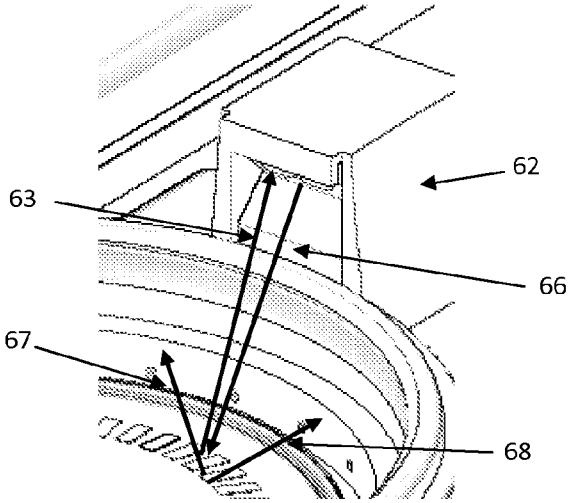


Fig. 3

K-FEE SYSTEM GMBH, EX2009, page 3067
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

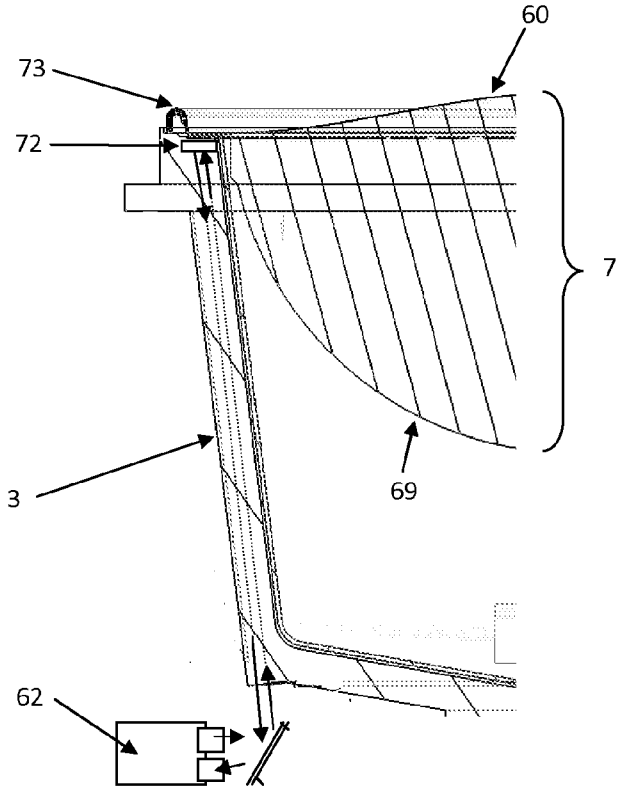


Fig. 4

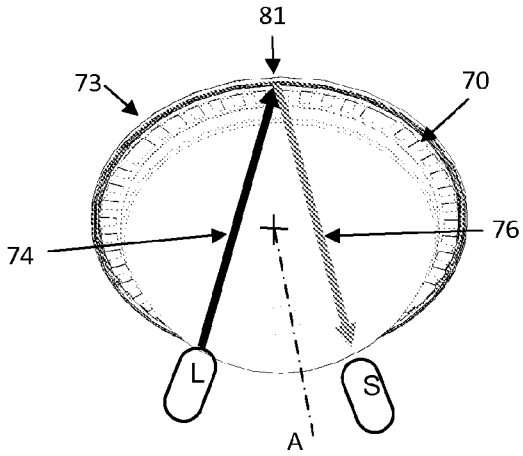


Fig. 5

K-FEE SYSTEM GMBH, EX2009, page 3068
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

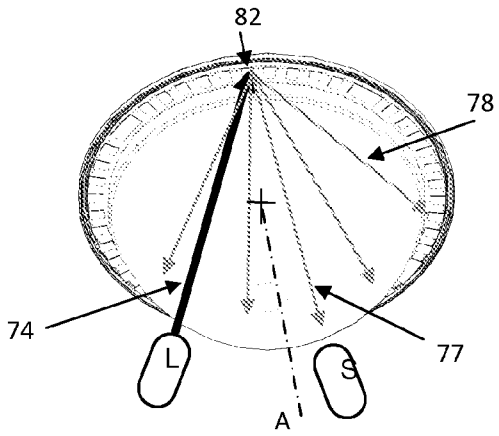


Fig. 6

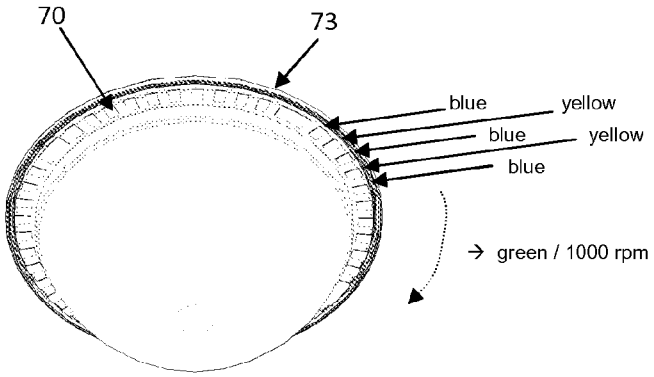


Fig. 7

K-FEE SYSTEM GMBH, EX2009, page 3069
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

REMARKS

This Response, the enclosed Interference Suggestion and the enclosed IDS are respectfully submitted in reply to the Non-Final Office Action dated August 7, 2019. The Director is authorized to charge any fee that may be required or to credit any overpayment to Deposit Account No. 02-1818. If such a withdrawal is made, please indicate the Attorney Docket No. 3712036-01693 on the account statement.

Claims 1, 2, 5-10 and 19-28 are currently pending and under consideration. Claims 3, 4 and 11-13 were previously canceled without prejudice or disclaimer; and Claims 14-18 were withdrawn. Claims 1, 2, 5-10, 19, 20, 24 and 26-28 are allowed; and Claims 21-23 and 25 are rejected under 35 U.S.C. § 112.

As a preliminary matter, Applicant notes that this Response cancels withdrawn Claims 14-18 without prejudice or disclaimer. Applicant expressly reserves the right to pursue these canceled and withdrawn claims in a continuation application and/or a divisional application.

In addition, an IDS is enclosed which provides Intl. App. Pub. No. WO2003/039309, which is the PCT counterpart of RU2306839 / RU2004-117537 previously submitted only in Russian; and the PCT counterpart contains an English translation of the abstract of RU2306839 / RU2004-117537. The IDS also provides English translations of previously submitted German non-patent literature.

For at least the reasons set forth below, Applicant respectfully requests that the rejections be reconsidered and withdrawn.

In the Office Action, Claim 21 is rejected under 35 U.S.C. §112, first paragraph, as allegedly lacking written description. Claim 21 recites "The single-serve capsule according to Claim 20, wherein the barcode is printed by material removal." On page 4 of the Office Action, the Patent Office alleges the following:

> Claim 21 recites that the barcode on the single-serve capsule is printed by material removal. The specification does not disclose or otherwise suggest that the barcode would be printed, i.e. created by the removal of any material, therefore this constitutes an issue of new matter and as such must be deleted.

However, Applicant respectfully submits that at least the following disclosures in the specification establish written description for the subject matter of Claim 21 (emphasis added):

K-FEE SYSTEM GMBH, EX2009, page 3070
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

> Preferably, the code is an optical code. The code may be a bit code formed by a series of discrete polygonal (e.g., rectangles or squares) or dot surfaces printed on the container and/or **embossed** in the container.[1]
>
> Preferably, the code is printed or **embossed** to form a pattern which possesses surfaces having different reflective and/or absorbing properties to light. In particular, the pattern possesses first surfaces and second surfaces having different reflective and/or absorbing properties to light. More particularly, the pattern possesses first surfaces inclined mirroring or absorbing properties to light and second surfaces having flat mirroring or flat reflective properties to light.[2]
>
> In a possible mode, the code is **mechanically embossed or engraved** on the container by laser or by other means such as a press.[3]
>
> The code can be applied on the capsule by:
> Printing (absorbing/reflecting + diffusing), visible, invisible or,
> **Laser engraving** (e.g. for absorbing/reflecting−diffusing) surfaces or,
> **Embossing**: Flat and inclined mirroring surfaces.[4]

Applicant respectfully submits that "engraving" and "embossing" as explicitly disclosed by the specification both constitute an express disclosure of removing material from the substrate. The specification does not provide a specific definition, let alone a definition that would preclude the plain and ordinary meaning of these terms to the skilled artisan; and thus Applicant respectfully submits that "engrave" means "**cut or carve** (a text or design) on the surface of a hard object"[5] and "emboss" means "**carve**, mould, or stamp a design on (a surface or object) so that it stands out in relief."[6] Therefore, the specification provides written description for the subject matter of Claim 21, namely, "the barcode is printed by material removal."

---

[1] PCT/EP2011/057657: page 3, lines 15-17; see also European Patent App. No. EP 10162741.2, 2010 at page 3-5.

[2] PCT/EP2011/057657, page 3, lines 20-25; see also European Patent App. No. EP 10169374.5, 2010 at page 6, lines 21-24, 27-29.

[3] PCT/EP2011/057657, page 3, lines 26-27; see also European Patent App. No. EP 10169374.5, 2010 at page 7, lines 9-12.

[4] PCT/EP2011/057657, page 7, lines 15-18; see also European Patent App. No. EP 10169374.5, 2010 at page 7, lines 9-12 and European Patent App. No. EP 10162741.2, 2010 at page 4.

[5] Emphasis added; Lexico dictionary definition for "engrave" at https://www.lexico.com/en/definition/engrave.

[6] Emphasis added; Lexico dictionary definition for "emboss" at https://www.lexico.com/en/definition/emboss.

K-FEE SYSTEM GMBH, EX2009, page 3071
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Written description of a claim limitation does not require a verbatim disclosure in the specification. Instead, if a skilled artisan would have understood the inventor to be in possession of the claimed invention at the time of filing, even if every nuance of the claims is not explicitly described in the specification, then the adequate description requirement is met.[7] Therefore, the subject matter recited by dependent Claim 21 has written description.

Accordingly, Claim 21 fully complies with 35 U.S.C. § 112, first paragraph; and Applicant respectfully requests withdrawal of the written description rejection. Additionally, although Claim 21 complies with 35 U.S.C. § 112, Applicant also includes new Claims 29 and 30 using identical language to the above-noted disclosures.

In the Office Action, Claim 22 is rejected under 35 U.S.C. §112, first paragraph, as allegedly lacking written description. Claim 22 recites "The single-serve capsule according to Claim 20, wherein the base element is made of metal." On page 4 of the Office Action, the Patent Office alleges the following (emphasis added):

> Claim 22 recites that the base element of the single-serve capsule is made of metal. Whilst applicant's specification discloses "the capsule raw material (foil)" on page 9, line 28, it is noted that the term "foil" can be defined as "anything flat and thin" which is to say "a thin layer of any material" (Oxford English Dictionary). **Applicant's specification does not further define what material would constitute said foil**. Further, while the applicant does disclose on page 1, lines 4 - 6, of the specification that the "the capsule comprises a circumferential metal rim" there is no support found for other portions of the capsule to be made of metal, therefore the recitation that the base element of said capsule would be made of metal is seen to constitute an issue of new matter and as such must be deleted.

However, Applicant respectfully submits that the subject of Claim 22 requiring the base element to be made of metal is supported at least because the pending application explicitly identifies manufacturing the capsule out of aluminum. For example, the application recites (emphasis added):

> The codes described in the previous examples can be applied by different methods onto a capsule such as by:

---

[7] See, e.g., *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555,1563 (CAFC 1991); *Martin v. Johnson*, 454 F.2d 746, 751 (C.C.P.A. 1972) (stating "the description need not be in *ipsis verbis* [i.e., "in the same words"] to be sufficient"); see also *In re Wertheim*, 541 F.2d 257 (C.C.P.A. 1976) (the specification need not provide *ipsis verbis* (word for word) support for all claim elements; rather, support for the claim elements may be found in the express, implicit, and inherent disclosure of the as-filed specification and claims).

K-FEE SYSTEM GMBH, EX2009, page 3072
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

> Printing or mechanical deforming on a formed capsule or,
> Printing or mechanical deforming on the capsule raw material (foil) before container forming or,
> Printing on outer surface of a capsule container or,
> Printing on the inner surface of a capsule container, using the curl as information support (**Aluminum capsule technology**).[8]

In view of this explicit disclosure regarding a capsule made by "aluminum capsule technology," the recitation "the base element is made of metal" in Claim 22 is fully supported by the specification. Indeed, it is well known in the art that aluminum capsules involve manufacturing the body of the capsule from aluminum. For example, U.S. Pat. No. 4,136,202, filed December 7, 1977, discloses an aluminum capsule comprising "a body 1 composed of sheet aluminium. . . ." (1:40-44.) As another example, PCT publication WO 2010/034663 filed September 17, 2009 discloses an aluminium container "made of an aluminium foil that has been stamped in order to form a container body 7." (p. 5, l. 15-17.)

In fact, the present application explicitly identifies that the "capsule" includes the container body, such that an aluminum capsule would necessarily include an aluminum body:

> The term "capsule" refers to **any flexible, rigid or semi-rigid container** containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use.[9]
>
> *See also* [0036] "In the following examples (see FIG. 4), **the capsule comprises a cup-shaped body** 69 extending by a flange-like rim. . . ."

Moreover, the present application expressly states that the capsule can be made of a metallic surface, on which to place the code (emphasis added):

> Another mode consists in sensing a code provided on **a metallic surface of the capsule** using an inductive sensor. The code is formed by reliefs or recesses in the **metallic surface**. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of

[8] PCT/EP2011/057657: page 9, lines 25-page 10, line 2; see also European Patent App. No. EP 10169374.5, 2010 at page 8, lines 7-14.

[9] PCT/EP2011/057657: page 1, lines 19-22; see also European Patent App. No. EP 10169374.5, 2010 at page 1, lines 19-22.

K-FEE SYSTEM GMBH, EX2009, page 3073
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

> the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device.[10]

The Examiner argues that this paragraph is limited to the "metal rim" based on the example provided. However, the specification confirms that the code can be placed on any portion of the container body, not simply the rim. In particular, the specification recites, "[i]n case that the code is located on the body, it is then necessary to rotate the capsule to have access, for the sensor, to the entire set of marks composing the code." (*See, e.g.,* [0037].)

Therefore, the specification provides written description for the subject matter of Claim 22, namely, "the base element is made of metal."

Further in this regard, as noted above, written description of a claim limitation does not require a verbatim disclosure in the specification. Instead, if a skilled artisan would have understood the inventor to be in possession of the claimed invention at the time of filing, even if every nuance of the claims is not explicitly described in the specification, then the adequate description requirement is met.[11] Therefore, the subject matter recited by dependent Claim 22 has written description.

Accordingly, Claim 22 fully complies with 35 U.S.C. § 112, first paragraph, and Applicant respectfully requests withdrawal of the written description rejection. Additionally, although Claim 22 complies with 35 U.S.C. § 112, Applicant also includes new Claims 31 and 32 using identical language to the above-noted disclosures.

In the Office Action, Claim 23 is rejected under 35 U.S.C. §112, first paragraph, as allegedly lacking written description. Claim 23 recites "The single-serve capsule according to Claim 20, wherein the base element comprises a bottom and a wall region that extends between the flange and the bottom, the side wall has an electrically conductive section." On pages 4-5 of the Office Action, the Patent Office alleges the following (emphasis added):

---

[10] PCT/EP2011/057657: page 10, lines 4-10; see also European Patent App. No. EP 10169374.5, 2010 at page 8, lines 15-22.

[11] See, e.g., *Vas-Cath Inc. v. Mahurkar*, 935 F.2d at 1563; *Martin v. Johnson*, 454 F.2d at 751 (stating "the description need not be in *ipsis verbis* [i.e., "in the same words"] to be sufficient"); see also *In re Wertheim*, 541 F.2d at 257 (the specification need not provide *ipsis verbis* (word for word) support for all claim elements; rather, support for the claim elements may be found in the express, implicit, and inherent disclosure of the as-filed specification and claims).

K-FEE SYSTEM GMBH, EX2009, page 3074
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

> Claim 23 recites that "the base element comprises a bottom and a wall region that extends between the flange and the bottom, the side wall has an electrically conductive section". While it is seen that **applicant discusses one or more electrically conductive areas formed on the body of the package which can be sensed electrically this is not disclosed as a feature of the claimed invention but in reference to a prior art package containing comestibles for the preparation of beverages**. Thus, as above since applicant's disclosure does not define what material the sidewall of the base element would be made of no support is found in applicant's specification for the sidewall having an electrically conductive section and said recitation is seen to constitute an issue of new matter and as such must be deleted.

As an initial matter, for at least the reasons set forth above in discussion of Claim 22, the present application discloses a capsule body made of metal, which is an explicit disclosure of a capsule wall having electrically conductive sections. Moreover, in addition to the disclosure in the background that is cited by the Patent Office, the specification also includes disclosures regarding application of codes onto a capsule in the presently claimed embodiments of the invention:

> The codes described in the previous examples can be applied by different methods onto a capsule such as by:
> Printing or mechanical deforming on a formed capsule or,
> Printing or mechanical deforming on the capsule raw material (foil) before container forming or,
> Printing on outer surface of a capsule container or,
> Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology).[12]

After disclosing application of codes onto a capsule, the specification discloses inductive code reading for such codes:

> Another mode consists in sensing a code provided on **a metallic surface of the capsule using an inductive sensor**. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device.[13]

---

[12] PCT/EP2011/057657: page 9, lines 25-page 10, line 2; see also European Patent App. No. EP 10169374.5, 2010 at page 8, lines 7-14.

[13] PCT/EP2011/057657: page 10, lines 4-10; see also European Patent App. No. EP 10169374.5, 2010 at page 8, lines 15-22.

K-FEE SYSTEM GMBH, EX2009, page 3075
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

In view of these disclosures, the recitation "the base element comprises a bottom and a wall region that extends between the flange and the bottom, the side wall has an electrically conductive section" in Claim 23 has written description in the specification.

Further in this regard, as noted above, written description of a claim limitation does not require a verbatim disclosure in the specification. Instead, if a skilled artisan would have understood the inventor to be in possession of the claimed invention at the time of filing, even if every nuance of the claims is not explicitly described in the specification, then the adequate description requirement is met.[14] Therefore, the subject matter recited by dependent Claim 23 has written description.

Accordingly, Claim 23 fully complies with 35 U.S.C. § 112, first paragraph, and Applicant respectfully requests withdrawal of the written description rejection. Additionally, although Claim 23 complies with 35 U.S.C. § 112, Applicant also includes new Claim 33 using identical language to the above-noted disclosures.

In the Office Action, Claim 25 is rejected under 35 U.S.C. §112, fourth paragraph, as allegedly improper dependent form. In response, Applicant notes that independent Claim 20 in the present application is identical to Claim 1 of U.S. App. No. 15/646,980 ("the '980 Application"), for which Applicant requests an interference. Claim 25 depending from Claim 20 in the present application is identical to dependent Claim 20 in the '980 application.

Therefore, Applicant respectfully submits that consistent examination across patent applications requires that allowance of Claim 20 in the '980 application must be accompanied by allowance of Claim 25 in the present application. Alternatively, if the improper dependent form rejection is maintained for Claim 25 in the present application, then Claim 20 in the '980 application must also be rejected for improper dependent form.

Nevertheless, without acquiescing to the rejection, Claim 34 is newly submitted and combines the subject matter of dependent Claim 25 with all of the subject matter of independent

[14] See, e.g., *Vas-Cath Inc. v. Mahurkar*, 935 F.2d at 1563; *Martin v. Johnson*, 454 F.2d at 751 (stating "the description need not be in *ipsis verbis* [i.e., "in the same words"] to be sufficient"); see also *In re Wertheim*, 541 F.2d at 257(the specification need not provide *ipsis verbis* (word for word) support for all claim elements; rather, support for the claim elements may be found in the express, implicit, and inherent disclosure of the as-filed specification and claims).

K-FEE SYSTEM GMBH, EX2009, page 3076
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claim 20 except for the recitation "the identifier extends around an entire circumference of the flange" which is not included in the newly submitted claim.

For the reasons set forth herein, Applicant respectfully requests an early allowance of the application. If any impediment to allowance could be clarified in a telephonic interview, the Examiner is respectfully requested to initiate such an interview with the undersigned.

Respectfully submitted,

K&L GATES LLP

BY /Aaron J. Morrow/
Aaron J. Morrow
Reg. No. 55,819
Customer No.: 29157
Telephone No. 312-781-6043

Dated: September 30, 2019

K-FEE SYSTEM GMBH, EX2009, page 3077
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors:	Jarisch et al.
Applicant:	Société des Produits Nestlé S.A.
Appl. No.:	13/697,297
Conf. No.:	1065
Filed:	November 9, 2012
Title:	CAPSULE, SYSTEM AND METHOD FOR PREPARING A BEVERAGE BY CENTRIFUGATION
Art Unit:	1792
Examiner:	Chaim A. Smith
Docket No.:	3712036-01693

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO NON-FINAL OFFICE ACTION

Examiner:

This Response, the enclosed Suggestion for Declaration of Interference Pursuant to 37 C.F.R. § 41.202 ("Interference Suggestion") and the enclosed Information Disclosure Statement (IDS) are respectfully submitted in reply to the Non-Final Office Action dated August 7, 2019. **Amendments to the Claims** are reflected in the Listing of Claims which begins on page 2 of this paper. **Remarks** begin on page 6 of this paper.

K-FEE SYSTEM GMBH, EX2009, page 3078
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

APPENDIX C

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 November 2011 (17.11.2011)

PCT

(10) International Publication Number
WO 2011/141532 A1

(51) International Patent Classification:
B65D 85/804 (2006.01) *A47J 31/22* (2006.01)

(21) International Application Number:
PCT/EP201 1/057657

(22) International Filing Date:
12 May 201 1 (12.05.201 1)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

10162741 .2	12 May 2010 (12.05.2010)	EP
10169374.5	13 July 2010 (13.07.2010)	EP

(71) Applicant *(for all designated States except US):* **NESTEC S.A.** [CH/CH]; Av. Nestle 55, CH-1800 Vevey (CH).

(72) Inventors; and

(75) Inventors/ Applicants *(for US only):* **JARISCH, Christian** [CH/CH]; Chemin de Fenix 122, CH-1095 Lutry (CH). **PERENTES, Alexandre** [CH/CH]; Avenue Virgile Rossel 10, CH-1012 Lausanne (CH). **KAESER, Stefan** [CH/CH]; Goldernstrasse 6, CH-5000 Aarau (CH). **MAGRI, Carlo** [IT/CH]; Route d'Outre-Vieze 10, CH-1870 Monthey (CH). **GERBAULET, Arnaud** [FR/FR]; 24 rue du chalet, F-25 160 Oye et Pallet (FR). **KAESER, Thomas** [DE/CH]; rte de Brent 30 Fontanivent, CH-1817 Brent (CH). **ABEGGLEN, Daniel** [CH/CH]; Le Bugnon, CH-1439 Ranees (CH).

(74) Agent: **BORNE, Patrice;** Avenue Nestle 55, -, CH-1800 Vevey (CH).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available):* AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available):* ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,

[Continued on nextpage]

(54) Title: CAPSULE, SYSTEM AND METHOD FOR PREPARING A BEVERAGE BY CENTRIFUGATION

(57) Abstract: Capsule for the preparation of a beverage comprising a container and a beverage ingredient contained therein, wherein the container comprises a code (65) adapted for being identified or read by external reading means (62), wherein the code is arranged on the container to be read while the capsule is rotated around an axis of rotation traversing the capsule.

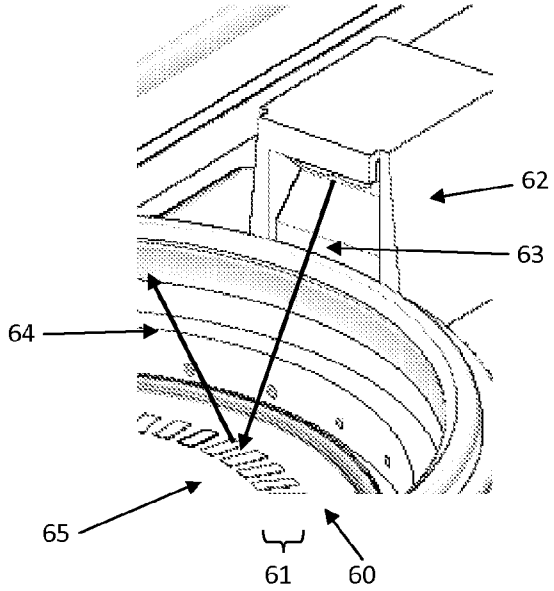


Fig. 2

WO 2011/141532 A1

K-FEE SYSTEM GMBH, EX2009, page 3080
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

CAPSULE, SYSTEM AND METHOD FOR PREPARING A BEVERAGE BY CENTRIFUGATION

Introduction

The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device. The present invention in particular focuses on the detection of the capsule.

Background art

The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity.

The preparation of a beverage by using the centrifugation is known. The principle mainly consists in providing beverage ingredient in a container of the capsule, feeding liquid in the receptacle and rotating the receptacle at elevated speed to ensure interaction of liquid with powder while creating a gradient of pressure of liquid in the receptacle; such pressure increasing gradually from the centre towards the periphery of the receptacle. As liquid traverses the coffee bed, extraction of the coffee compounds takes place and a liquid extract is obtained that flows out at the periphery of the receptacle.

The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use.

The term ingredient means any suitable beverage substance such as ground coffee, soluble coffee, leaf tea, soluble tea, herbal tea, dairy powder, baby food, culinary powder and combination thereof.

The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof.

EP0451980 relates to packages containing comestibles for the preparation of beverages. Recognition means can comprise one or more strips of a magnetic material applied to the body of the package which can be read by an appropriate magnetic sensor, one or more

K-FEE SYSTEM GMBH, EX2009, page 3082
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

shaped or divided areas of metal foil applied to the package body which cause an inductive effect on movement of the package in the machine, which inductive effect can be sensed; or one or more electrically conductive areas formed on the body of the package which can be sensed electrically.

WO02/28241 relates to an encoded coffee packet for use in the preparation of hot or cold beverages comprising a filter defining a cavity and a brewing ingredient within the cavity. The packet further comprises a machine-interpretable feature located on the filter such as a color, a shape, a glyph, a text string, a barcode or a digital watermark.

WO02/078498 relates to a machine-readable identifier on a portion package which contains ground coffee for espresso machine. The identifier can be a concentric barcode which is read when the capsule turns around an axis which is placed outside of its perimeter such as when the capsule is stored in a carousel.

WO2005044067 relates to a system for identifying a capsule having a code visible under UV light printed thereon or a magnetic code such as a ribbon or label. The code may be read by a turning magnetic reading head. However, such system is not adapted for detecting a capsule in a device using centrifugal forces for extracting the beverage.

WO2009007292 relates to a method for reading barcodes in a drinks machine when the brewing chamber is being closed from an open position to a closed position.

WO2010/026053 relates to a controlled beverage production device using centrifugal forces. The capsule may comprise a barcode provided on an outside face of the capsule and which enables a detection of the type of capsule and/or the nature of ingredients provided within the capsule in order to apply a predefined extraction profile for the beverage to be prepared.

A problem with identifying a capsule in a beverage preparation machine is that the retrieving or reading information from the capsule is not always reliable or convenient. The present invention brings a solution to this problem.

Brief description of the invention

The aim of the present invention is to propose an improved way to identify the capsule within a beverage production machine to ensure a more reliable and convenient retrieval or reading of information so as to adjust working parameters of the machine.

K-FEE SYSTEM GMBH, EX2009, page 3083
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

This aim is achieved by a capsule for the preparation of a beverage comprising a container and a beverage ingredient contained therein, wherein the container comprises a code adapted for being identified or read by external reading means, wherein the code is arranged on the container to be read while the capsule is rotated around an axis of rotation traversing the capsule.

More particularly, the capsule has a circumference wherein the code is arranged on the container along an arc-shaped or circular path of the circumference. In a particular mode, the capsule has a circumference wherein the code comprises successive segments which are individually rectilinear but extend substantially along at least a part of the circumference. More particularly, the code is arranged along at least a eighth of the circumference. This configuration provides a reliable reading or retrieval of information as well as an effective portion for information. In order to ensure a reliable reading or retrieval of information, the code is repeated along said circumference. The repetition ensures a higher probability that at least one code is readable but also may potentially reduce the reading time.

Preferably, the code is an optical code. The code may be a bit code formed by a series of discrete polygonal (e.g., rectangles or squares) or dot surfaces printed on the container and/or embossed in the container.

The code may printed by a visible ink by human eyes under natural light or, alternatively, an ink which is not visible by human eyes under natural light (e.g., ink visible under UV).

Preferably, the code is printed or embossed to form a pattern which possesses surfaces having different reflective and/or absorbing properties to light. In particular, the pattern possesses first surfaces and second surfaces having different reflective and/or absorbing properties to light. More particularly, the pattern possesses first surfaces inclined mirroring or absorbing properties to light and second surfaces having flat mirroring or flat reflective properties to light.

In a possible mode, the code is mechanically embossed or engraved on the container by laser or by other means such as a press.

In an embodiment, the container comprises a body and a lid connected to the body and wherein the code is present on the lid of the container. The lid may be a closed foil and/or a filter, for example.

In another embodiment, the code is present on the rim of the capsule. In the most preferred embodiment, the code is present on the bottom of the rim of the capsule which is opposed to

K-FEE SYSTEM GMBH, EX2009, page 3084
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

the lid of the capsule. The bottom of the rim is sufficiently away from the liquid injection and beverage delivery areas so that there is a lower risk for the code to become unreadable such if partly or totally hidden or soiled by beverage residues or otherwise (e.g., coffee particles). As a result, the reading is made more reliable. The reading may also be carried out while the capsule is in place in the beverage production device. Therefore, the preparation of the beverage is simplified and the preparation time can be reduced.

The invention further relates to a system for preparing a beverage from a capsule as aforementioned and further comprising a beverage preparation device; wherein the device comprises capsule holding means for holding the capsule and rotational drive means for driving the holding means and capsule in rotation along said axis of rotation and reading means arranged for reading the code when the capsule is rotated along said axis.

In particular, the reading means may comprise a light emitter and a light sensor. In an alternative, the reading means comprises an inductive sensor. The optical reading means or inductive sensor may be arranged to detect a code on the rim of the capsule.

The invention further relates to a method for preparing a beverage from a system comprising a capsule as aforementioned and a beverage preparation device; wherein the device comprises capsule holding means for holding the capsule therein and rotational drive means for driving the holding means and capsule in rotation along said axis of rotation and reading means arranged for reading the code when the capsule is rotated along said axis.

The invention is further described in the appended claims and the following detailed description.

Brief description of the figures

The present invention will be better understood thanks to the detailed description which follows and the accompanying drawings, which are given as non-limiting examples of embodiments of the invention, namely:

- figure 1 illustrates the basic principle of the centrifugal extraction,

- figure 2 illustrates the reading method of a mark on the lid surface of the capsule,

- figure 3 illustrates the reading method of an absence of the mark,

- figure 4 illustrates an alternate position of the code on the capsule, in particular, when placed on the underside of the rim of the capsule, and the capsule fitted into a capsule holder of the extraction device,

K-FEE SYSTEM GMBH, EX2009, page 3085
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

- figures 5 and 6 illustrate the combination of a laser source and a detector in positive and negative detection, for example, for the alternate position of the code of figure 4,

- figure 7 illustrates the detection of a color code on the capsule, for example, for the alternate position of the code of figure 4.

Detailed description

Figure 1 illustrates an example of a beverage preparation system 1 as described in WO2010/026053 for which the capsule of the invention can be used.

The centrifugal unit 2 comprises a centrifugal cell 3. The cell 3 may comprise a capsule holder and a capsule received therein. The centrifugal unit is connected to driving means 5 such as a rotary motor. The centrifugal unit comprises a collecting part and an outlet 35. A receptacle 48 can be disposed below the outlet to collect the extracted beverage. The system further comprises liquid supply means such as a water reservoir 6 and a fluid circuit 4. Heating means 31 may also be provided in the reservoir or along the fluid circuit. The liquid supply means may further comprise a pump 7 connected to the reservoir. A flow restriction means 19 is provided to create a restriction to the flow of the centrifuged liquid which leaves the capsule. The system may further comprise a flow meter such as a flow-metering turbine 8 for providing a control of the flow rate of water supplied in the cell 3. The counter 11 can be connected to the flow-metering turbine 8 to enable an analysis of the generated impulse data 10. The analysed data is then transferred to the processor 12. Accordingly, the exact actual flow rate of the liquid within the fluid circuit 4 can be calculated in real-time. A user interface 13 may be provided to allow the user to input information that is transmitted to the control unit 9. Further characteristics of the system can be found in WO2010/026053.

In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee.

The capsule is designed for rotating around an axis A. This axis A crosses perpendicularly the center of the membrane which has the form of a disk. This axis A exits at the center of the bottom of the body. This axis A will help to define the notion of "circumference" which is a circular path located on the capsule and having the axis A as reference axis. This circumference can be on the lid, e.g., membrane or on the body part such as on the flange-like rim. The lid may be impervious to liquid before insertion in the device or it may be pervious

K-FEE SYSTEM GMBH, EX2009, page 3086
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

to liquid by means of small openings or pores provided in the center and/or periphery of the lid. The code is spread along the circumference or a part of the circumference. The code may comprise successive arch-shaped segments. The code may also comprise successive segments which are individually rectilinear but extend along at least a part of the circumference.

According to one embodiment, the sensor cannot read the code without the rotation of the capsule. This is the case where the code is spread along at least a eighth, preferably at least a quarter of the circumference or even more. The fact that the code is placed along an arc-shaped line render the reading by a sweep beam very difficult. This is why the rotation of the capsule plays an important role. In case that the code is located on the body, it is then necessary to rotate the capsule to have access, for the sensor, to the entire set of marks composing the code. The code is further located close to the peripheral edge of the capsule. The peripheral edge is defined as the outermost circular line of the capsule. Preferably, the distance of the code from the peripheral edge is not more than 10 mm, more preferably not more than 8 mm.

According to an embodiment, the code is printed by an ink which is not visible by human eyes under natural light (e.g., ink visible under UV). In this case, the sensor further comprises a UV-light beam source and a UV detector.

The code is preferably repeated along the circumference in order to ensure a reliable reading. The code is repeated at least twice on the circumference. Preferably, the code is repeated three to six times on the circumference. Repetition of the code means that the same code is duplicated and the successive codes are positioned in series along the circumference so that upon a 360-degree rotation of the capsule, the same code can be detected or read more than one time.

EXAMPLES:

1) Optical reading on foil, respectively on top side rim of capsule (figures 2 and 3):

A light beam is projected onto the capsule's lid, e.g., membrane or foil 60, as illustrated on figure 2.

Onto the capsule foil 60, a plurality of bits forming the code 61 is applied along a circular or arc-shaped path.

Preferably, the code is placed on a flat portion of the lid and close to the peripheral edge of the capsule. The code is preferably placed the lid that is supported by the flange-like

K-FEE SYSTEM GMBH, EX2009, page 3087
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

rim of the capsule or overlaps with the rim. Hence, the code is not distorted due to mechanical constraints and can be read more reliably.

The marks may consist of:

- Mirroring or absorbing surfaces for providing bit "0" and,
- Diffusing and reflective surfaces for providing bit "1"

The binary values "0" and "1" are arbitrary chosen and can be inversed.

The code is read by rotating the capsule along a central axis A (figure 1).

The reader or sensor 62 is part of the centrifugal unit 2 and consists of

- A light source with or without focusing optic and
- A light sensor with or without focusing optic.

The light can be:

- Non polarized or
- Polarized (laser) or
- Spectrum: Any, but preferably infra red.

The code can be applied on the capsule by:

- Printing (absorbing / reflecting + diffusing), visible, invisible or
- Embossing (mirroring + rough reflecting + diffusing) or
- Laser engraving.

Optionally, the bit code may also consist of different color patterns combined with a color reading device. The combination of different colors and reading at a specific rotational speed results in a well defined "mixed color". As an example, a capsule with half the circumference in blue and the other half in yellow would result in reading a green color during rotation. In the same manner, one third in blue and the remaining part in yellow will give another color. In this case, the light could be a simple light source without specific convergence means.

As illustrated in figure 2, when the light beam 63, sent by the light source of the sensor 62, touches the mirror code pattern (small rectangles 65) it reflects in a reflective beam 64 which is not received by the sensor.

K-FEE SYSTEM GMBH, EX2009, page 3088
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

As the capsule is rotated (figure 3), the light beam 63 touches a diffuse reflecting surface (surface between the small rectangles) and is partially reflected to the sensor. A reflective beam 66 is received by the sensor whereas other beams 67, 68 are diffused or reflected outside the sensor.

2) Optical reading on rim bottom side of capsule (figures 4 to7):

The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties. The surfaces are arranged in a circular pattern or an arc-shaped pattern at least along an angular portion of the rim.

A light beam 74 is projected to the capsule's rim 73.

Onto the capsule rim, a bit code is applied along a circular or arc-shaped path of the rim.

The bit code may consist of:

- Inclined mirroring or (flat) absorbing surfaces for bit "0" and
- Flat mirroring or flat reflective (diffusing) surfaces for bit "1"

The bit code is read by rotating the capsule along its central axis A.

The reader may consist of

- A light source with/without focusing optic and,
- A light sensor with/without focusing optic.

The light can be:

- Non polarized or
- Polarized (laser) or
- Spectrum: Any, but preferably infra red.

The code can be applied on the capsule by:

- Printing (absorbing / reflecting + diffusing), visible, invisible or,
- Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or,
- Embossing: Flat and inclined mirroring surfaces.

K-FEE SYSTEM GMBH, EX2009, page 3089
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

In the embodiment of the figure 4, the light source is placed at the bottom of the centrifugal cell 3. This cell is light conductive allowing the beam to reach the bottom side 72 of its rim 73. The reflected light is conducted by the transparent (or light conductive) centrifugal cell 3 to reach the sensor 62. In case that the sensor 62 cannot be aligned with the transparent part of the centrifugal cell 3, a mirror can be placed as illustrated in the figure 4 to defiect the forward and backward beams.

On figure 5, the light beam 74 from the light source "L" touches the mirror surface of the code (small rectangle 81) and is reflected into a reflective beam 76 to the sensor "S" with high intensity. A bit such as "0" or "1" is thereby provided to the control unit.

On figure 6, the light beam 74 from the light source "L" touches diffusing or absorbing surfaces (surface 82 between two small rectangles). The light beam 77 that reaches the sensor S is of small intensity. Other beams such as beam 78 are diffused outside the sensor S due to the diffusing properties of the surface.

In each configuration (e.g., Figs. 5-6), a bit such as "1" or "0" is provided to the control unit.

Therefore, the number of bits and their bit code depend on the number and specific arrangement of mirror surfaces (e.g. rectangles) and diffusing or absorbing surfaces (e.g., zones between the rectangles). The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provides redundancy and more reliability to the reading.

Optionally (figure 7), the code comprises different color patterns combined with a color reading device. The combination of different colors and reading at a specific rotational speed results in a well defined "mixed color". As an example, a capsule with half the "dots" in blue and the other half in yellow would result in reading a green color during rotation.

3) Application modes of codes onto a capsule

The codes described in the previous examples can be applied by different methods onto a capsule such as by:

- Printing or mechanical deforming on a formed capsule or,

- Printing or mechanical deforming on the capsule raw material (foil) before container forming or,

- Printing on outer surface of a capsule container or,

K-FEE SYSTEM GMBH, EX2009, page 3090
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

- Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology).

4) Inductive code reading:

Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device.

5) Other general characteristics to all embodiments:

The speed for reading can, for instance, be comprised between 0.1 and 1000 rpm.

When reading the code, liquid can already be fed in the capsule for providing a pre-wetting of the beverage ingredients.

The code preferably comprises three sections, the synchronization section, the payload section and the verification section. The synchronization section serves for the synchronization purpose i.e. to inform the sensor when the code begins. Since the speed of the rotation of the capsule can vary, the synchronization is achieved through a known sequence of bits such as 0,1,0,1. Then the payload of the code identifying the capsule can be read. In order to avoid misinterpretation of the code, the payload can be followed by verification bits. These bits can be a checksum on the payload or a similar verification function.

The code can be replicated along the code path so that if one code gives a wrong verification value, the other code(s) can be taken into account.

K-FEE SYSTEM GMBH, EX2009, page 3091
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

CLAIMS :

1. Capsule for the preparation of a beverage comprising a container and a beverage ingredient contained therein, wherein the container comprises a code adapted for being identified or read by external reading means, wherein the code is arranged on the container to be read while the capsule is rotated around an axis of rotation traversing the capsule.
2. Capsule according to claim 1, having a circumference wherein the code is arranged on the container along an arc-shaped or circular path of the circumference.
3. Capsule according to claim 1, having a circumference wherein the code comprises successive segments which are individually rectilinear but extend substantially along at least a part of the circumference.
4. Capsule according to claims 2 or 3, wherein the code is arranged along at least a eighth of the circumference.
5. Capsule according to any of claims 2 to 4, wherein the code is repeated along said circumference.
6. Capsule according to any of the preceding claims, wherein the code is a bit code formed by a series of discrete polygonal (e.g., rectangles or squares) or dot surfaces printed on and/or embossed in the container.
7. Capsule according to any of claims 1 to 5, wherein the code is printed by an ink which is not visible by human eyes under natural light (e.g., ink visible under UV).
8. Capsule according to any of claims 1 to 5, wherein the code is printed or embossed by a pattern which possesses surfaces having different reflective and/or absorbing properties to light.
9. Capsule according to claim 8, wherein the pattern possesses first surfaces having inclined mirroring or absorbing properties to light and second surfaces having flat mirroring or flat reflective properties to light.
10. Capsule according to any of claims 1 to 6 and 8 to 9, wherein the code is mechanically embossed or engraved on the container by laser.

K-FEE SYSTEM GMBH, EX2009, page 3092
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

11. Capsule according to any of claims 1 to 10, wherein the container comprises a body and a lid connected to the body and wherein the code is present on the lid of the container.

12. Capsule according to any of claims 1 to 10, wherein the code is present on the rim of the capsule.

13. Capsule according to claim 12, wherein the code is present on the bottom of the rim of the capsule which is opposed to the lid or foil of the capsule.

14. System for preparing a beverage from a capsule according to any of the preceding claims and further comprising a beverage preparation device; wherein the device comprises capsule holding means for holding the capsule and rotational drive means for driving the holding means and capsule in rotation along said axis of rotation and reading means arranged for reading the code when the capsule is rotated along said axis.

15. System according to claim 14, wherein the reading means comprises a light emitter and a light sensor or an inductive sensor.

16. System according to claims 14 or 15, wherein the optical reading means or inductive sensor is arranged to detect a code on the rim of the capsule.

17. Method for preparing a beverage from a system according to any one of claims 14 to 16, wherein the beverage is extracted from the capsule by rotating the capsule along said axis.

18. Method according to claim 17, wherein the code is read at a first rotational speed and the beverage is extracted from the capsule at a second rotational speed.

K-FEE SYSTEM GMBH, EX2009, page 3093
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

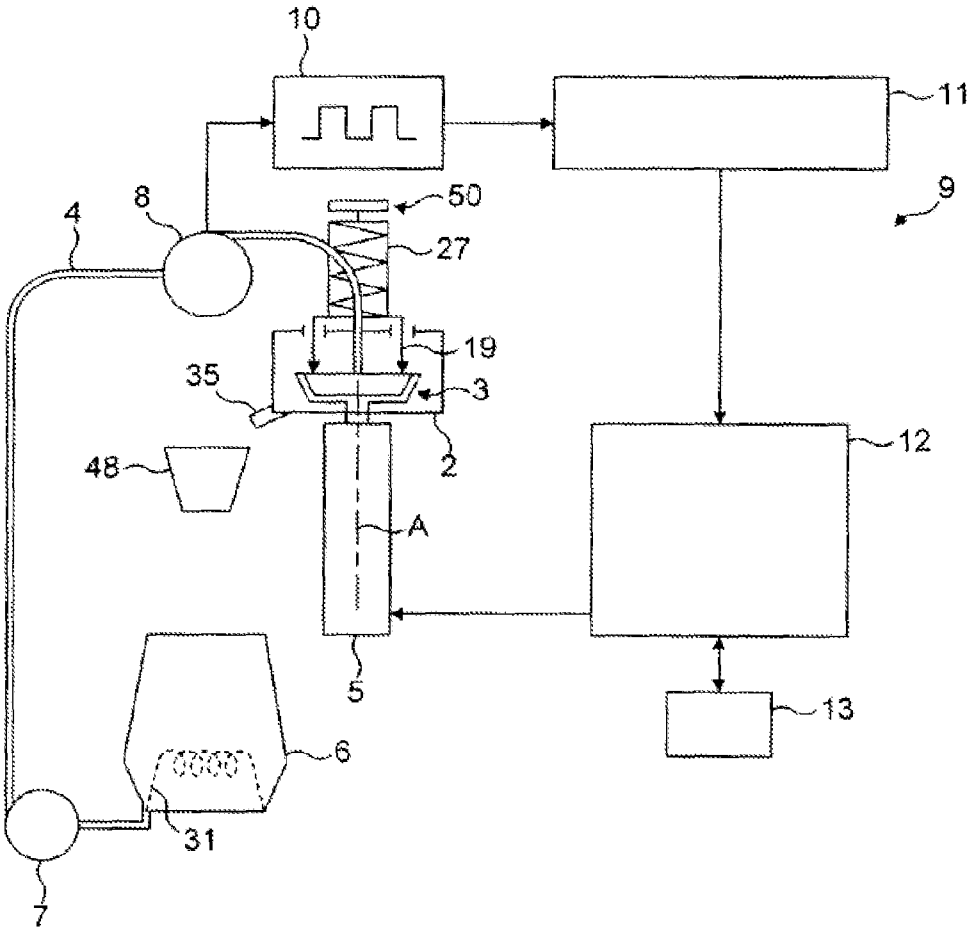


Fig. 1

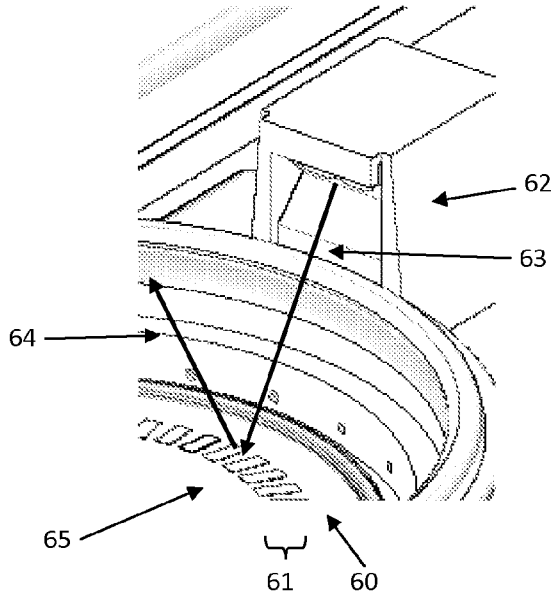


Fig. 2

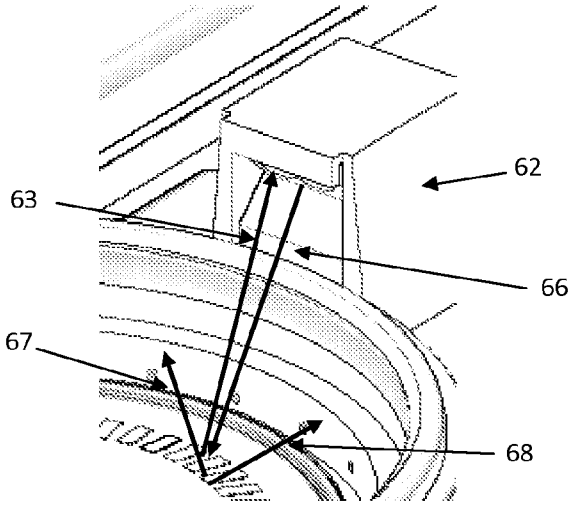


Fig. 3

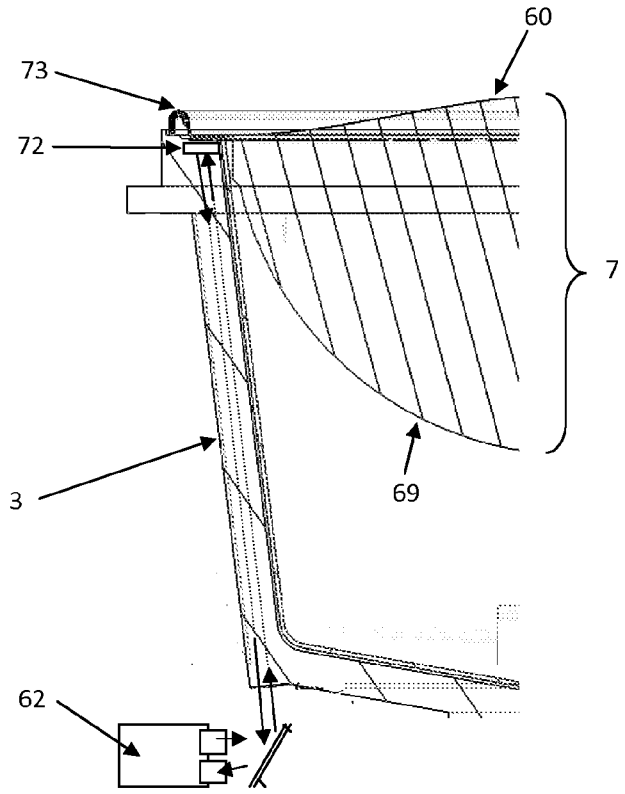


Fig. 4

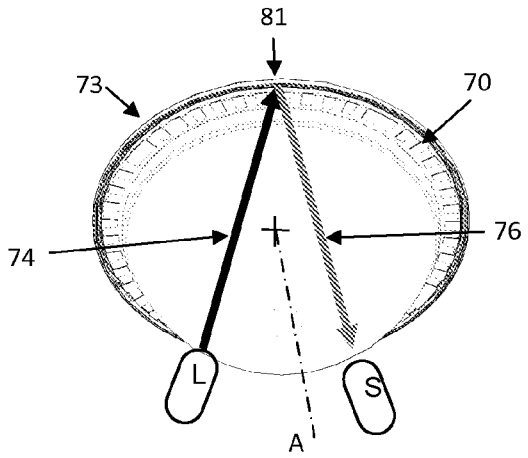


Fig. 5

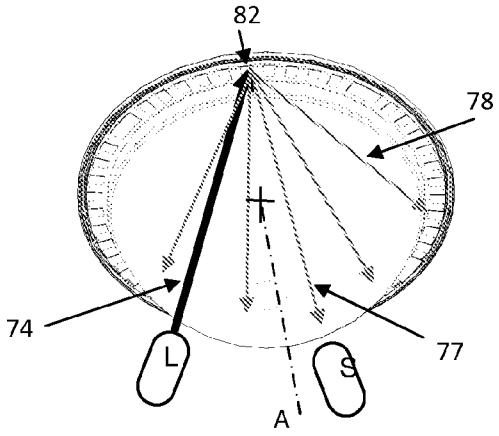

82
78
74
77
L
S
A

Fig. 6

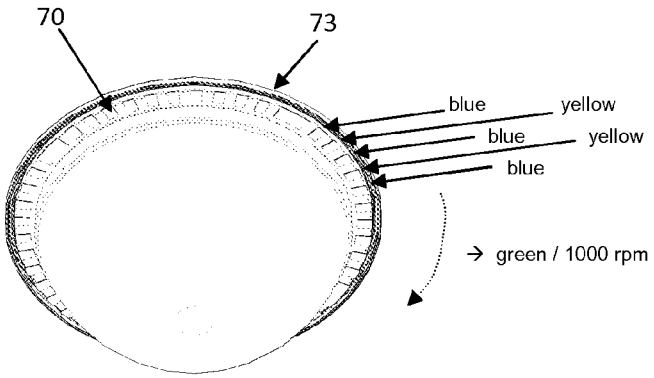

70
73
blue
yellow
blue
yellow
blue
→ green / 1000 rpm

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/057657

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D85/804 A47J31/22
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65D A47J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 764 015 A1 (GRIMAC S R L [IT]) 21 March 2007 (2007-03-21)	1-10, 12
A	paragraph [0019]; figure 4	14, 17
X	WO 02/28241 A1 (BOYD COFFEE CO [US]) 11 April 2002 (2002-04-11) cited in the application claim 1; figure 2f	1,2,6-13
A	WO 2010/026053 A1 (NESTEC SA [CH]; DENISART JEAN-PAUL [CH]; RYSER ANTOINE [CH]) 11 March 2010 (2010-03-11) cited in the application page 9, line 28 - line 33; claim 5	1, 14, 17

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" documentwhich may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 August 2011	24/08/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Bridault, Alain

1

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2011/057657

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1764015 A1	21-03-2007	NONE	
WO 0228241 A1	11-04-2002	AU 1148902 A	15-04-2002
WO 2010026053 A1	11-03-2010	AU 2009289682 A1	11-03-2010
		CA 2734935 A1	11-03-2010
		EP 2317897 A1	11-05-2011

K-FEE SYSTEM GMBH, EX2009, page 3099
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Amendments to the Claims:

This Listing of Claims replaces all prior versions and listings of claims in the application:

Listing of Claims:

Claim 1 (Previously Presented): A capsule for the preparation of a beverage, the capsule comprising a container configured to house a beverage ingredient, the container comprises a cup-shaped body having a flange-like rim, a lid connected to the cup-shaped body, and a code adapted for being identified or read by an external reader, the code is arranged on a bottom of the flange-like rim, which is opposed to the lid, to be read while the capsule is rotated around an axis of rotation traversing the capsule,

wherein the container comprises a circumference, the code comprises successive segments that extend substantially along at least an eighth of the circumference, the cup-shaped body extends from a bottom end of the cup-shaped body to a top end of the cup-shaped body where the cup-shaped body terminates such that a height of the cup-shaped body is the distance from the bottom end to the top end, the flange-like rim extends from the top end of the cup-shaped body, and the lid has a height that is less than the height of the cup-shaped body.

Claim 2 (Previously Presented): The capsule of Claim 1, wherein the code is arranged on the container along an arc-shaped or circular path of the circumference of the container.

Claims 3-4 (Canceled).

Claim 5 (Previously Presented): The capsule of Claim 1, wherein the code is repeated along the circumference of the container.

Claim 6 (Previously Presented): The capsule of Claim 1, wherein the code is a bit code formed by a series of discrete polygonal or dot surfaces printed on and/or embossed in the container.

Claim 7 (Previously Presented): The capsule of Claim 1, wherein the code is printed by an ink which is not visible by a human eye under natural light.

K-FEE SYSTEM GMBH, EX2009, page 3100
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claim 8 (Previously Presented): The capsule of Claim 1, wherein the code is printed or embossed by a pattern which possesses surfaces having different reflective and/or absorbing properties to light.

Claim 9 (Previously Presented): The capsule of Claim 8, wherein the pattern possesses a first surface having inclined mirroring or absorbing properties to light and a second surface having flat mirroring or flat reflective properties to light.

Claim 10 (Previously Presented): The capsule of Claim 1, wherein the code is mechanically embossed or engraved on the container by a laser.

Claims 11-18 (Canceled).

Claim 19 (Previously Presented): The capsule of Claim 1, comprising a peripheral edge that is an outermost circular line of the capsule, wherein the code is positioned within 10 mm of the peripheral edge.

Claim 20 (Previously Presented): A single-serve capsule for making a beverage, comprising:

a base element with a cavity, in which a raw beverage material is provided,

a flange horizontally extending from the base element,

a membrane that is configured to close the cavity, the membrane is fastened to a top side of the flange, and

an identifier, which makes it possible to individualize the respective single-serve capsule,

wherein the identifier is a barcode that is provided on a bottom side of the flange, the identifier extends around an entire circumference of the flange, the bottom side of the flange is opposite the top side of the flange to which the membrane is fastened.

Claim 21 (Previously Presented): The single-serve capsule according to Claim 20, wherein the barcode is printed by material removal.

Claim 22 (Previously Presented): The single-serve capsule according to Claim 20, wherein the base element is made of metal.

K-FEE SYSTEM GMBH, EX2009, page 3101
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claim 23 (Previously Presented): The single-serve capsule according to Claim 20, wherein the base element comprises a bottom and a wall region that extends between the flange and the bottom, the side wall has an electrically conductive section.

Claim 24 (Previously Presented): The single-serve capsule according to Claim 20, wherein the identifier comprises metal.

Claim 25 (Previously Presented): The single-serve capsule according to Claim 20, wherein the barcode extends around an entire perimeter of the base element.

Claim 26 (Previously Presented): The single-serve capsule according to Claim 20, wherein the barcode has at least two areas which differ in their optical properties.

Claim 27 (Previously Presented): The single-serve capsule according to Claim 20, wherein the identifier is electrically conductive.

Claim 28 (Previously Presented): The single-serve capsule according to Claim 20, wherein the identifier is a machine-readable imprint.

Claim 29 (New): The single-serve capsule according to Claim 20, wherein the identifier is mechanically embossed on the capsule.

Claim 30 (New): The single-serve capsule according to Claim 20, wherein the identifier is mechanically engraved on the capsule.

Claim 31 (New): The single-serve capsule according to Claim 20, wherein the base element is made of aluminum.

Claim 32 (New): The single-serve capsule according to Claim 20, wherein the identifier is provided on a metallic surface of the capsule.

K-FEE SYSTEM GMBH, EX2009, page 3102
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claim 33 (New): The single-serve capsule according to Claim 32, wherein the identifier is configured to be sensed by an inductive sensor.

Claim 34 (New): A single-serve capsule for making a beverage, comprising:

a base element with a cavity, in which a raw beverage material is provided,

a flange horizontally extending from the base element,

a membrane that is configured to close the cavity, the membrane is fastened to a top side of the flange, and

an identifier, which makes it possible to individualize the respective single-serve capsule,

wherein the identifier is a barcode that is provided on a bottom side of the flange, the barcode extends around an entire perimeter of the base element, the bottom side of the flange is opposite the top side of the flange to which the membrane is fastened.

K-FEE SYSTEM GMBH, EX2009, page 3103
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

APPENDIX B

Claim 1. A capsule for the preparation of a beverage, the capsule comprising a container configured to house a beverage ingredient, the container comprises a cup-shaped body having a flange-like rim, a lid connected to the cup-shaped body, and a code adapted for being identified or read by an external reader, the code is arranged on a bottom of the flange-like rim, which is opposed to the lid, to be read while the capsule is rotated around an axis of rotation traversing the capsule,

wherein the container comprises a circumference, the code comprises successive segments that extend substantially along at least an eighth of the circumference, the cup-shaped body extends from a bottom end of the cup-shaped body to a top end of the cup-shaped body where the cup-shaped body terminates such that a height of the cup-shaped body is the distance from the bottom end to the top end, the flange-like rim extends from the top end of the cup-shaped body, and the lid has a height that is less than the height of the cup-shaped body.

Claim 2. The capsule of Claim 1, wherein the code is arranged on the container along an arc-shaped or circular path of the circumference of the container.

Claim 5. The capsule of Claim 1, wherein the code is repeated along the circumference of the container.

Claim 6. The capsule of Claim 1, wherein the code is a bit code formed by a series of discrete polygonal or dot surfaces printed on and/or embossed in the container.

Claim 7. The capsule of Claim 1, wherein the code is printed by an ink which is not visible by a human eye under natural light.

Claim 8. The capsule of Claim 1, wherein the code is printed or embossed by a pattern which possesses surfaces having different reflective and/or absorbing properties to light.

Claim 9. The capsule of Claim 8, wherein the pattern possesses a first surface having inclined mirroring or absorbing properties to light and a second surface having flat mirroring or flat reflective properties to light.

K-FEE SYSTEM GMBH, EX2009, page 3105
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claim 10. The capsule of Claim 1, wherein the code is mechanically embossed or engraved on the container by a laser.

Claim 19. The capsule of Claim 1, comprising a peripheral edge that is an outermost circular line of the capsule, wherein the code is positioned within 10 mm of the peripheral edge.

Claim 20. A single-serve capsule for making a beverage, comprising:

a base element with a cavity, in which a raw beverage material is provided,

a flange horizontally extending from the base element,

a membrane that is configured to close the cavity, the membrane is fastened to a top side of the flange, and

an identifier, which makes it possible to individualize the respective single-serve capsule,

wherein the identifier is a barcode that is provided on a bottom side of the flange, the identifier extends around an entire circumference of the flange, the bottom side of the flange is opposite the top side of the flange to which the membrane is fastened.

Claim 21. The single-serve capsule according to Claim 20, wherein the barcode is printed by material removal.

Claim 22. The single-serve capsule according to Claim 20, wherein the base element is made of metal.

Claim 23. The single-serve capsule according to Claim 20, wherein the base element comprises a bottom and a wall region that extends between the flange and the bottom, the side wall has an electrically conductive section.

Claim 24. The single-serve capsule according to Claim 20, wherein the identifier comprises metal.

Claim 25. The single-serve capsule according to Claim 20, wherein the barcode extends around an entire perimeter of the base element.

K-FEE SYSTEM GMBH, EX2009, page 3106
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claim 26. The single-serve capsule according to Claim 20, wherein the barcode has at least two areas which differ in their optical properties.

Claim 27. The single-serve capsule according to Claim 20, wherein the identifier is electrically conductive.

Claim 28. The single-serve capsule according to Claim 20, wherein the identifier is a machine-readable imprint.

Claim 29. The single-serve capsule according to Claim 20, wherein the identifier is mechanically embossed on the capsule.

Claim 30. The single-serve capsule according to Claim 20, wherein the identifier is mechanically engraved on the capsule.

Claim 31. The single-serve capsule according to Claim 20, wherein the base element is made of aluminum.

Claim 32. The single-serve capsule according to Claim 20, wherein the identifier is provided on a metallic surface of the capsule.

Claim 33. The single-serve capsule according to Claim 32, wherein the identifier is configured to be sensed by an inductive sensor.

Claim 34. A single-serve capsule for making a beverage, comprising:

a base element with a cavity, in which a raw beverage material is provided,

a flange horizontally extending from the base element,

a membrane that is configured to close the cavity, the membrane is fastened to a top side of the flange, and

an identifier, which makes it possible to individualize the respective single-serve capsule,

K-FEE SYSTEM GMBH, EX2009, page 3107
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

wherein the identifier is a barcode that is provided on a bottom side of the flange, the barcode extends around an entire perimeter of the base element, the bottom side of the flange is opposite the top side of the flange to which the membrane is fastened.

K-FEE SYSTEM GMBH, EX2009, page 3108
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
1. April 2010 (01.04.2010)

PCT

(10) Internationale Veröffentlichungsnummer
WO 2010/034662 A1

(51) Internationale Patentklassifikation:
C07K 14/435 (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2009/062024

(22) Internationales Anmeldedatum:
16. September 2009 (16.09.2009)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
08164921.2 23. September 2008 (23.09.2008) EP

(71) Anmelder *(für alle Bestimmungsstaaten mit Ausnahme von US)*: **RHEINISCHE -FRIEDRICH-WILHELMS-UNIVERSITÄT BONN** [DE/DE]; Regina-Pacis-Weg 3, 53113 Bonn (DE).

(72) Erfinder; und

(75) Erfinder/Anmelder *(nur für US)*: **PESHEVA, Penka** [DE/DE]; Röckesbergstr. 6, 53227 Bonn (DE). **PROBSTMEIER, Rainer** [DE/DE]; Röckesbergstr. 6, 53227 Bonn (DE).

(74) Anwälte: **HELBING, Jörg** et al.; Von Kreisler Selting Werner, Postfach 10 22 41, 50462 Köln (DE).

(81) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Veröffentlicht:

— *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

— *mit dem Sequenzprotokollteil der Beschreibung (Regel 5 Absatz 2 Buchstabe a)*

WO 2010/034662 A1

(54) **Title**: METHOD FOR ISOLATING NEURAL CELLS WITH TENASCIN-R COMPOUNDS

(54) **Bezeichnung** : VERFAHREN ZUR ISOLIERUNG NEURALER ZELLEN MIT TENASCIN-R-VERBINDUNGEN

(57) **Abstract**: The invention relates to a method for isolating neural cells using tenascin-R compounds, tenascin-R fragments particularly suited for said method and tenascin-R fusion proteins, to recombinant preparation of said tenascin-R compounds, and to a kit for carrying out said method and to the use of said method for preparing high-purity neural cell populations. The invention further relates to antibodies suitable for detecting and isolating tenascin-R compounds.

(57) **Zusammenfassung**: Die Erfindung betrifft ein Verfahren zur Isolierung von neuralen Zellen unter Verwendung von Tenascin-R-Verbindungen, besonders für dieses Verfahren geeignete Tenascin-R-Fragmente und Tenascin-R-Fusionsproteine, die rekombinante Herstellung dieser Tenascin-R-Verbindungen, sowie einen Kit zur Durchführung dieses Verfahrens und die Verwendung des Verfahrens zur Herstellung hochreiner neuraler Zellpopulationen. Die Erfindung betrifft weiterhin Antikörper, die für die Detektion und Isolation von Tenascin-R-Verbindungen geeignet sind.

K-FEE SYSTEM GMBH, EX2009, page 3109
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Verfahren zur Isolierung neuraler Zellen mit Tenascin-R-Verbindungen

Die Erfindung betrifft ein Verfahren zur Isolierung von neuralen Zellen unter Verwendung von Tenascin-R-Verbindungen, besonders für dieses Verfahren geeignete Tenascin-R-Fragmente und Tenascin-R-Fusionsproteine, die rekombinante Herstellung dieser Tenascin-R-Verbindungen, sowie einen Kit zur Durchführung dieses Verfahrens und die Verwendung des Verfahrens zur Herstellung hochreiner neuraler Zellpopulationen. Die Erfindung betrifft weiterhin Antikörper, die für die Detektion und Isolation von Tenascin-R-Verbindungen geeignet sind.

Hintergrund der Erfindung

Bei der Kontaktaufnahme von Zellen mit dem sie umgebenden extrazellulären Milieu kann es zu vielfältigen Antworten der Zelle kommen, die von Abstoßung und Vermeidung des Milieus auf der einen bis zur stabilen Zelladhäsion auf der anderen Seite reichen können. Das Wechselspiel zwischen Komponenten der extrazellulären Umgebung, der Extrazellulärmatrix, einerseits, und auf der Zelloberfläche vorhandenen Rezeptoren für solche Komponenten andererseits, bildet die Grundlage für viele entwicklungsbiologische Prozesse, die für eine Zelle unter anderem durch Proliferations-, Migrations- oder Differenzierungsverhalten gekennzeichnet sind. Solch zelluläres Verhalten führt auf Organismenebene zur Musterbildung oder auf Gewebe- oder Organebene zur Neubildung als Folge einer Verletzung (Boudreau, N. J., Jones, P. L., Biochem. J. 339:481-488 (1999); Sobeih, M. M., Corfas, G., Int. J. Dev. Neurosci. 148:971-84 (2002); Schmid, R. S., Anton, E. S., Cereb. Cortex. 13:219-24 (2003)). Im Zentralnervensystem (ZNS) korreliert die regulierte Expression von Extrazellulärmatrixkomponenten wie Chondroitinsulfat-Proteoglykanen oder Proteinen der Tenascin-Familie mit biologischen Prozessen, welche sowohl die Adhäsion und Migration von Neuronen, die Navigation von Axonen, die Synapsenbildung und –plastizität, die Wirkung von Wachstumsfaktoren und Cytokinen als auch das Überleben von Neuronen und die strukturelle Organisation der Extrazellulärmatrix umfassen (Dow, K. E., Wang, W., Cell Mol. Life Sci. 54:567-81 (1998); Wright, J. W. et al., Peptides 23:221-46 (2002); Grimpe, B., Silver, J., Prog. Brain Res. 137:333-49 (2002); Bosman, F. T., Stamenkovic, I., J. Pathol. 200:423-8 (2003)).

Tenascin-R (TN-R) (ehemals als J1-160/180, Janusin oder Restrictin bezeichnet) ist ein Mitglied der Tenascin-Familie von Extrazellulärmatrixproteinen, das exklusiv im ZNS von Vertebraten auftritt und dort von Oligodendrozyten und manchen Gruppen von Neuronen, i.e. Motoneurone und Interneurone, während späterer Entwicklungsstadien und im erwachsenen Zustand exprimiert wird (Pesheva, P., Probstmeier, R., Prog. Neurobiol. 61:465-93 (2000); Scherberich, A. et al., J. Cell Sci. 117-571-81 (2004)). Das Protein tritt in zwei molekularen Formen auf, mit Molekulargewichten von 160 kD (TN-R 160) oder 180 kD (TN-R 180). TN-R findet sich im Gewebe primär in Assoziation mit Oligodendrozyten, myelinisierten Axonen, perineuronalen Netzen von Moto- und Interneuronen, sowie dendriten- und synapsenreichen Regionen.

TN-R ist aus vier unterschiedlichen Domänenstrukturen aufgebaut. Der N-Terminus, dessen Sequenz nur in Tenascin-Proteinen vorkommt, enthält ein Cystein-reiches Segment (Cys-rich), und wird gefolgt von viereinhalb EGF-ähnlichen Segmenten (EGF-like) sowie 9 Fibronektin Typ III (FN III)-ähnlichen Domänen (von denen die 6. Domäne alternativ gespleisst werden kann). Den C-Terminus des TN-R Proteins bildet eine globuläre, Fibrinogen-ähnliche Domäne (FNG). Einzelne TN-R Polypeptidketten sind an ihren N-Termini über Disulfidbrücken miteinander verbunden und bilden so Homotrimere (TN-R 180) oder -dimere (TN-R 160), wobei letztere durch proteolytische Spaltung von TN-R 180 nahe des N-Terminus entstehen (Woodworth, A. et al., J. Biol. Chem. 279:10413-21 (2004)).

Die Funktionsweite von TN-R umfasst die molekulare Kontrolle neuraler Zelladhäsion, Migration und Differenzierung (von der Axonnavigation Fortsätze bildender Neuronen bis zur Reifung myelinbildender Oligodendrozyten) während normaler entwicklungsbiologischer Vorgänge sowie regenerativer Prozesse nach Verletzung im erwachsenen Gehirn (Pesheva, P., Probstmeier, R., Prog. Neurobiol. 61:465-93 (2000); Chiquet-Ehrismann, R., Int. J. Biochem. Cell. Biol. 36:986-90 (2004)). TN-R wirkt u.a. als adhäsives oder antiadhäsives Molekül, als Differenzierungsfaktor für Oligodendrozyten, oder als "Stopmolekül" für wachsende Axone. Diese Eigenschaften sind von den entsprechenden Rahmenbedingungen abhängig: dem jeweiligen Zelltyp, dem Vorhandensein zellulärer Rezeptoren und Signalkaskaden, der räumlichen Verteilung und der posttranslationalen Modifikation des TN-R Glykoproteins. Einige der zellulären Rezeptoren von TN-R, die identifiziert wurden (F3/F11, Disialoganglioside, Sulfatide), induzieren unterschiedliche zelluläre Wirkmechanismen, die einerseits bei der Musterbildung während der Ontogenese,

andererseits bei regenerativen Prozessen von Bedeutung sind (Angelov, D. et al., J. Neurosci. 18:6218-29 (1998); Probstmeier, R. et al., J. Neurosci. Res. 60:21-36 (2000); Montag-Sallaz, M., Montag, D., Genes Brain Behav. 2:20-31 (2003); Saghatelyan, A. et al., Nat. Neurosci. 7:347-56 (2004); Brenneke, F. et al., Epilepsy Res. 58:133-43 (2004)). Die beiden wesentlichen Effekte von TN-R auf das Verhalten neuraler Zellen sind die Inhibition der Zelladhäsion und des Neuritenwachstums einerseits und die Förderung der Oligodendrozytenadhäsion und –differenzierung andererseits. Letztere erfolgt vermittelt durch Sulfatide und bewirkt letztendlich Oligodendrozytenmigration und Myelinisierung/Remyelinisierung. Erstere kann entweder substratunabhängig erfolgen (vermittelt durch F3/F11 und andere, noch unbekannte Faktoren), oder Substrat/Integrin-abhängig (vermittelt durch Fibronektin und GD2/GD3). Die inhibitorische Wirkung von TN-R hat letztlich einen Einfluss auf die neurale Zellmigration, das räumlich koordinierte Axonwachstum und die Synaptogenese, oder sie trägt unter Verletzungsbedingungen zur Verhinderung der Axon-Regeneration und der Adhäsion aktivierter Mikroglia in einer TN-R-reichen Umgebung bei.

Einige neurale Rezeptoren und intrazelluläre Signalwege, die die Wirkung von TN-R in neuronalen und glialen Zellen vermitteln, sind bekannt, ebenso konnten molekulare Komponenten identifiziert werden, die an der Expression von TN-R durch Oligodendrozyten und Motoneurone beteiligt sind (Tab. 1; Pesheva, P. et al., Prog. Brain Res. 132:103-14 (2001)).

Tab.1: Für TN-R identifizierte zelluläre Rezeptoren und Liganden der Extrazellulärmatrix. In der rechten Tabellenhälfte sind die für die jeweilige Interaktion relevanten Domänen von TN-R angegeben; CS GAG: Chondroitinsulfat-Glykosaminoglykane; EGF-L: EGF-ähnliche Segmente und Cystein-reiches Segment.

Zelluläre Rezeptoren	Tenascin-R Bindungsdomäne
F3/F11	EGF-L, FN2-3
ß2 Untereinheit von Na-Kanälen	FN1-2, FN6-8
Neurofascin	FN2-5
CALEB	FNG
MAG	EGF-L, FNG
Sulfatide	Unbekannt
Ganglioside	Unbekannt

Liganden der Extrazellulärmatrix	Tenascin-R Bindungsdomäne
Fibronektin	CS GAG, unbekannt
Collagene	Unbekannt
Tenascin-C	CS GAG, Ca^{2+}-abhängig
Tenascin-R	Unbekannt, $Kation^{2+}$-abhängig
Lecticane	FN3-5, Ca^{2+}-abhängig
Phosphacan	EGF-L, Ca^{2+}-abhängig

Als aus mehreren Domänen aufgebautes Extrazellulärmatrixprotein erscheint eine Aufteilung der distinkten biologischen Funktionen auf distinkte Domänenbereiche und/oder distinkte Glykostrukturen von TN-R nahe liegend. Ähnlich wie die anderen bekannten TN-R Proteine, setzt sich das humane TN-R Protein aus verschiedenen distinkten Domänen zusammen (Carnemolla et al., 1996). Beginnend mit einer Cystein-reichen Region am N-Terminus, gefolgt von 4.5 EGF-ähnlichen Domänen und 9 FN III-ähnlichen Domänen (von denen die 6. Domäne alternativ gespleisst werden kann), endet das Molekül am C-Terminus mit einer Fibrinogen-ähnlichen Domäne. Die publizierte humane TN-R mRNA-Sequenz umfasst mit 9 FN III-ähnlichen Domänen 4716 Basen. Hiervon entfällt auf den kodierenden Bereich der Abschnitt zwischen den Basen 82 bis 4158, auf das Signalpeptid (zur Sekretion des TN-R Proteins) der Basenbereich 82 bis 150 (SEQ ID NO:2).

Es ist bekannt, dass aus adultem Nagergehirn aufgereinigte TN-R Proteine die Adhäsion und Fortsatzbildung von aus früh postnatalem Gehirn isolierten O4/Sulfatid-positiven Oligodendrozyten fördern (Pesheva, P. et al., J. Neurosci. 17:4642-51 (1997)). Diese Vorgänge werden durch Sulfatide vermittelt, einer Gruppe von in der Zellmembran von Oligodendrozyten vorkommenden Glykolipiden. Eine wichtige Konsequenz der Interaktion von TN-R mit Sulfatid-exprimierenden Oligodendrozyten ist eine Stimulierung der Reifung dieser Zellen; i.e. die vermehrte Expression myelinspezifischer Proteine und Glykolipide, was eine Sulfatid-vermittelte Wirkungsweise des Differenzierungspotentials von TN-R auf Oligodendrozyten nahe legt (Pesheva, P. et al., J. Neurosci. 17:4642-51 (1997)).

EP 0759987, US 5,635,360, US 5,681,931 und US 5,591,583 beschreiben humanes TN-R und dessen immunologischen Nachweis unter Verwendung von Antikörpern gegen ein Proteinfragment, welches den Nukleotiden 2686-3165 der cDNA-Sequenz und somit den FN III-Domänen 6 und 7 des humanen TN-R entspricht.

Die frühesten Stadien sich entwickelnder Gliazellen finden sich in Säugern im Rückenmark in ventralen Bereichen des Neuralrohrs, im Gehirn in den ventrikulären Zonen des Vorderhirns. In diesen Regionen proliferieren erste Vorläuferzellen von Oligodendrozyten, die durch eine einfache Morphologie und die Expression des Disialogangliosids GD3 und/oder von O4 Antigenen gekennzeichnet sind, und wandern in der Folgezeit in Bereiche der später entstehenden weißen Substanz ein (Miller, R. H. Prog. Neurobiol. 67:451-67 (2002); Noble, M. et al., Dev. Biol. 265:33-52 (2004); Liu, Y. Rao, M. S., Biol. Cell. 96:279-90 (2004)). Dort werden die Zellen postmitotisch und differenzieren in reife Oligodendrozyten mit einer

komplexen Morphologie. Dieser Reifungsprozess korreliert mit der Expression myelinspezifischer Lipide (Sulfatide und Galactocerebroside) und Proteine (MBP, MAG, und PLP). Die Entstehung, das Überleben und die Differenzierung von Oligodendrozyten in myelinbildende Zellen werden über verschiedene Wachstumsfaktoren (bFGF, PDGF, CNTF, IGF-1, NT-3), Hormone und Extrazellulärmatrixmoleküle (Thyroidhormone, Retinolsäure, TN-R) reguliert (Dubois-Dalcq, M., Murray, K., Pathol. Biol. (Paris) 48:80-6 (2000); Kagawa, T. et al., Microsc. Res. Tech. 52:740-5 (2001); Noble, M. et al., Dev. Neurosci. 25:217-33 (2003)).

Da insbesondere für gliale Zellen (wie Oligodendrozyten und neurale Stammzellen) keine adäquaten Modellsysteme in Gestalt von Zelllinien vorhanden sind, muss zu ihrer Gewinnung sowohl in der Grundlagenforschung als auch im Rahmen potentieller diagnostischer/therapeutischer Anwendungsbereiche bisher auf relativ zeitaufwendige und niedrig effiziente Anreicherungsverfahren von Primärzellen zurückgegriffen werden. Diese Verfahren ermöglichen außerdem oftmals nur die Herstellung angereicherter Mischzellpopulationen. Die bisherigen Verfahren zur Isolierung definierter Zellpopulationen nutzen unterschiedliche Techniken wie Dichtegradientenzentrifugationen oder immunologische Verfahren (Fluorescence-activated cell sorting, biomagnetic cell sorting, Antikörper- und Komplement-vermittelte Zelltötung, Antikörper-Panning) (Luxembourg, A. T. et al., Nat. Biotechnol. 16:281-5 (1998); Uchida, N. et al., Proc. Natl. Acad. Sci. 97:14720-5 (2000); Nistri, S. et al., Biol. Proced. Online 4:32-37 (2002); Nunes, M. C. et al., Nat. Med. 9:439-47 (2003); Vroemen, M., Weidner, N., J. Neurosci. Methods 124:135-43 (2003)). Solche Verfahren sind nicht sehr effizient und ergeben nur eine unvollständige Anreicherung (durch Dichtegradientenzentrifugationen sind z. B. nur Anreicherungen distinkter Zellpopulationen möglich), oder sie sind zeitintensiv und/oder von hohen Zellverlusten begleitet (wie bei immunologischen Verfahren). Dies gilt insbesondere für Oligodendrozyten, die bisher durch eine mehrwöchige Kultivierung gemischter glialer Kulturen (McCarthy, K. D., DeVellis, J., J. Cell Biol. 85:890-902 (1980); Kramer, E.M. et al., J. Biol. Chem. 274:29042-9 (1999); Testai, F. D. et al., J. Neurosci. Res. 75:66-74 (2004)) oder über mehrere Selektionsschritte mit Hilfe von Fluorescence-activated/biomagnetic cell sorting oder Antikörper-Panning gewonnen werden (Scarlato, M. et al., J. Neurosci. Res. 59:430-5 (2000); Tang, D. G. et al., J. Cell Biol. 148:971-84 (2000); Diers-Fenger, M. et al., Glia 34:213-28 (2001); Crang, A. J. et al., Eur. J. Neurosci. 20:1445-60 (2004)).

In WO2006/067094 sind gereinigte TN-R Proteine die stabile Adhäsion von Oligodendrozyten unterschiedlicher Reifestadien unterstützen und auf neuronale und mikrogliale Zellen antiadhäsiv wirken beschrieben. Dieses ermöglicht die Isolierung und Reinigung definierter Zellpopulationen aus neuralem Primärgewebe, insbesondere zur direkten selektiven Aufreinigung von Oligodendrozyten aus gemischten neuralen Zellpopulationen. Es wird hierin ein Verfahren zur Verfügung gestellt, das es ermöglicht, in einem einzigen Reinigungsschritt eine hochreine definierte Zellpopulation, insbesondere eine Oligodendrozytenpopulation, aus Primärgewebe neuralen Ursprungs zu isolieren. Die Aufreinigung der Zellen erfolgt dabei über einen Selektionsschritt, in dem aus einer Einzelzellsuspension mittels einer Tenascin-R-haltigen Sonde, welche Tenascin-R-Verbindungen ausgewählt aus nativem Tenascin-R (nachfolgen kurz "TN-R") sowie Homologen und Fragmenten desselben und Fusionsproteine derartiger Verbindungen umfasst. Ein bevorzugtes Tenascin-R-Fragment enthält dabei den C-Terminus von nativem Tenascin-R oder eine Substitutions-, Deletions- und/oder Additionsmutante desselben, besonders bevorzugt denjenigen Bereich, der durch die Nukleotide 3439-4155 der SEQ ID NO:1 kodiert wird.

Es wurde nunmehr gefunden, dass ein Fragment, das die Aminosäurereste 24 bis 189 der SEQ ID NO:2 des humanen TN-R umfasst, oder ein Homolog oder Fragment desselben wie z. B. das Fragment H-TNR-Cys, das Aminosäurereste 24 bis 189 der SEQ ID NO:2 aufweist, ebenso gut wie das in der WO WO2006/067094 beschriebene H-TNR-S3 Fragment mit den Aminosäureresten 1120 bis 1358 von SEQ ID NO:2 zur Isolierung hochreiner glialer, insbesondere oligodendroglialer, Zellpopulationen in einem Einstufenverfahren angewendet werden. Im Gegensatz zu H-TNR-S3, bindet das H-TNR-Cys Fragment zusätzlich Sphingomyelin (ein in der Zellmembran verschiedener Zelltypen vorkommendes und an zellulären Signalmechanismen beteiligtes Phospholipid) und unterstützt das Überleben und die Transdifferenzierung adulter humaner mesenchymaler Stammzellen in neuronale oder oligodendrogliale Zellen.

Die vorliegende Erfindung betrifft somit

(1) ein Verfahren zur Isolierung und Reinigung von neuralen Zellen aus neuralem Primärgewebe von Vertebraten, umfassend die Selektion der Zellen aus einer Einzelzellsuspension mittels einer Tenascin-R-haltigen Sonde ("Tenascin-R-Sonde"), welche ein N-terminales Fragment von nativem Tenascin-R (TN-R) sowie

Homologen und Fragmenten desselben und Fusionsproteine derartiger Verbindungen umfasst;

(2) eine bevorzugte Ausführungsform von (1), wobei das Tenascin–R-Fragment ein Peptid mit der Sequenz der Aminosäurereste 24-189 von SEQ ID NO:2 ist und das Überleben und/oder die Transdifferenzierung adulter humaner mesenchymaler Stammzellen in neuronale oder oligodendrogliale Zellen, insbesondere unter definierten serumfreien Kulturbedingungen ermöglicht;

(3) ein Tenascin-R-Fragment oder ein Tenascin-R-Fusionsprotein wie in (1) oder (2) definiert;

(4) eine DNA, die ein Tenascin-R-Fragment oder ein Tenascin-R-Fusionsprotein von (3) kodiert;

(5) einen Vektor, der eine DNA nach (4) umfasst;

(6) einen Wirtsorganismus, der mit einem Vektor nach (5) transformiert/transfiziert ist und/oder eine DNA nach (4) aufweist;

(7) ein Verfahren zur Herstellung eines Tenascin-R-Fragments oder Tenascin-R-Fusionsproteins nach (3), umfassend das Kultivieren des Wirtsorganismus nach (6);

(8) einen Antikörper, insbesondere ein monoklonaler Antikörper, der durch Immunisierung eines geeigneten Wirtsorganismus mit einem Tenascin-R-Fragment nach (3) erhältlich ist;

(9) eine Zelllinie oder Hybridomzelllinie, die einen monoklonalen Antikörper nach (8) produziert;

(10) ein Kit zur Isolierung und Reinigung von neuralen Zellen, insbesondere von Oligodendrozyten, nach dem Verfahren von (1) oder (2), insbesondere enthaltend

(i) eine wie in (1) oder (2) definierte Tenascin-R-Sonde, und/oder

(ii) einen Vektor, der für die in (i) definierte Tenascin-R-Sonde kodiert, und/oder

(iii) eine Stammkultur einer Zelllinie, die dazu geeignet ist, die wie in (1) oder (2) definierte Tenascin-R-Sonde zu exprimieren;

(11) die Verwendung eines Tenascin-R-Fragments oder eines Tenascin-R-Fusionsproteins wie in (3) definiert, zur Gewinnung von neuralen Zellen, insbesondere von Oligodendrozyten, für die Anzucht differenzierter Zellen, insbesondere neuraler Zellen, in neurobiologischen und zellphysiologischen Untersuchungen, in der biologischen und klinischen Forschung und für diagnostische und therapeutische Verfahren *in vitro* und *in vivo*, insbesondere für die Herstellung eines Medikaments zur Zelltherapie und zur Therapie von neurodegenerativen Krankheiten, die mit einem Verlust von Oligodendrozyten oder

Myelin einhergehen, insbesondere Multipler Sklerose und periventrikulärer Leukomalazie (PVL);

(12) ein Verfahren zur Herstellung von Oligodendrozyten aus isolierten Stammzellen *in vitro* durch Inkubation der Stammzellen in Anwesenheit eines Tenascin-R-Fragments oder eines Tenascin-R-Fusionsproteins wie in (3) definiert;

(13) ein Verfahren zur Zelltherapie oder zur Therapie von neurodegenerativen Krankheiten, die mit einem Verlust von Oligodendrozyten oder Myelin einhergehen, insbesondere von Multipler Sklerose und periventrikulärer Leukomalazie (PVL), umfassend die Gabe eines Tenascin-R-Fragments oder eines Tenascin-R-Fusionsproteins wie in (3) definiert, an einen menschlichen oder tierischen Patienten;

(14) ein Verfahren zur Therapie und Prophylaxe traumatischer Nervenläsionen oder zur gezielten Beeinflussung der Neuralentwicklung, umfassend die Verabreichung einer pharmakologisch ausreichenden Menge des Antikörpers nach (8) an einen menschlichen oder tierischen Patienten, der einer solchen Behandlung bedarf.

Kurzbeschreibung der Figuren

Fig. 1: Charakterisierung der Spezifität und funktionellen Aktivität des monoklonalen Antikörpers R4. A) Westernblot-Analyse affinitätsgereinigter H-TNR-S3 und H-TNR-Cys Fragmente mit Tag-spezifischen (V5) und TN-R-spezifischen (R4) monoklonalen Antikörpern. Die über Nickel-Agarose gereinigten rekombinanten Fragmente (20 ng/Tasche) H-TNR-S3 (S3) und H-TNR-Cys (Cys) wurden gelelektrophoretisch aufgetrennt, auf Nitrozellulosefilter transferiert und mit V5 oder R4 Antikörper inkubiert. Immunreaktive Proteinbanden wurden durch Inkubation mit Peroxidase-gekoppelten anti-Maus IgG Antikörpern nachgewiesen. Pfeile zeigen das Molekulargewicht von H-TNR-S3 (40 kD), bzw. von H-TNR-Cys (34 kD). B) Einfluss von polaren Glykolipiden, Lysenin (Sphingomyelin-bindenden Protein), O4- und TN-R-spezifischen Antikörpern auf die TN-R-vermittelte Zelladhäsion. TN-R Substrate (TNR, H-TNR-Cys, H-TNR-S3) wurden in der Abwesenheit (- GL/Ab) oder Anwesenheit von Monosialogangliosiden (+ GM1), Sulfatiden (+ Sulf) und TN-R-spezifischen Antikörpern (R4, R6) vorinkubiert. Erythrozyten wurden in Ab- oder Anwesenheit von Lysenin (100 µg/ml) und O4 Antikörpern (+ O4 Ab) auf die entsprechende Substrate ausgesät. Die Zahl adhärenter Zellen nach einstündiger Inkubationszeit auf unbehandelten TN-R Substraten (- GL/Ab) wurde als 100% gesetzt. C) Interaktion R4 Epitop-tragender

TN-R/TN-R Fragmente mit polaren Glykolipiden im Festphasen-Bindungsassay. Mikrotiterplatten wurden mit Sulfatiden (Sulf), Galactocerebrosiden (GalC), Sphingomyelin (SM) oder Sialogangliosiden (GM1, GD1a; alle bei 100 pmol/Vertiefung) beschichtet und mit TN-R oder rekombinanten TN-R Fragmenten (H-TNR-Cys, H-TNR-S3) für 2 h bei RT inkubiert. Die Bindung von TN-R/TN-R Fragmenten wurde mit R6 (für TN-R) oder V5 Antikörper (nach 1,5 Stunden Inkubation bei RT) mit Peroxidase-gekoppelten anti-Maus IgG Antikörpern nachgewiesen. Die maximale Bindung auf Sulfatide wurde für das jeweilige Protein als 100% gesetzt.

Fig. 2: Selektion von Oligodendrozyten aus Einzelzellsuspensionen (aus Gehirngewebe von 2 Tage alten Mäusen) auf substratgebundenen TN-R Fragmenten (H-TNR-Cys, H-TNR-S3). Auf diesen Substraten wachsende Zellen wurden für 3 Tage in serumfreiem Wachstumsmedium (3 div, obere Abbildungen) und für weitere 3 Tage (6 div, untere Abbildungen) in serumfreiem Differenzierungsmedium kultiviert. Adhärente Zellen konnten mit Hilfe indirekter Immunfluoreszenzfärbung mit Sulfatid-spezifischem Antikörper (O4) als Oligodendrozyten identifiziert werden. 99±1% der isolierten Zellen waren O4-positiv. Übersichts- (10x) und Detailaufnahmen (20x und 40x) zeigen O4-positive Zellen auf den verschiedenen Substraten nach unterschiedlichen Kulturzeiten.

Fig. 3: H-TNR-Cys-vermittelte neurale Differenzierung humaner mesenchymaler Stammzellen (hMSC) aus adultem Knochenmark. Auf den verschiedenen Substraten wachsende Zellen wurden nach den angegebenen Kultivierungszeiten mit Antikörpern gegen Markermoleküle für Neurone (ßIII tubulin), neurale/gliale Vorläuferzellen (nestin), Oligodendrozyten (sulfatide, GalC) oder Astrozyten (GFAP) mittels indirekter Immunfluoreszenz angefärbt. Zur Bestimmung der Überlebensrate (cell survival) wurden adhärente Zellen auf den verschiedenen Substraten am Anfang und am Ende der Kultivierungsperiode mit DAPI angefärbt und die entsprechende Gesamtzellzahl zueinander in Relation gesetzt. A) hMSC (linkes Bild) wurden auf substratgebundenen Laminin und TN-R Fragmenten (H-TNR-Cys, H-TNR-S3) für 5 Tage in serumfreiem Wachstumsmedium kultiviert. B) Gliale Differenzierung von hMSC auf substratgebundenen TN-R Fragmenten (H-TNR-Cys, H-TNR-S3). Auf TN-R Fragmenten oder Laminin ausplattierte Zellen wurden für 2 Tage in serumfreiem Wachstumsmedium und für weitere 3 Tage in serumfreiem glialem Differenzierungsmedium kultiviert. Die Zahl der mit Antikörpern markierten Zellen auf dem jeweiligen Substrat wurde zur Gesamtzellzahl (100%) in Relation

gesetzt. Über 80% der Zellen auf H-TNR-Cys Substraten waren Sulfatid-/GalC-positiv und konnten als Oligodendrozyten identifiziert werden. C) Neuronale Differenzierung von hMSC auf substratgebundenen TN-R Fragmenten (H-TNR-Cys, H-TNR-S3). Auf TN-R Fragmenten oder poly-D-Lysin (PDL) ausplattierte, aus Neurosphären stammende Zellen wurden für 10 Tage in serumfreiem neuronalem Differenzierungsmedium kultiviert. Die Zahl der mit Antikörpern markierten Zellen auf dem jeweiligen Substrat wurde zur Gesamtzellzahl (100%) in Relation gesetzt. 80% der Zellen auf H-TNR-Cys Substraten waren ßIII Tubulin-positiv und konnten als Neurone identifiziert werden. D) Zusammenfassung über den Einfluss von H-TNR-Cys auf die neurale Transdifferenzierung von hMSC unter definierten serumfreien Kulturbedingungen. Überlebensrate und Expression Neuron- (ßIII Tubulin) und Oligodendrozyten-spezifischer Moleküle (Sulfatid/GalC) von auf H-TNR-Cys Substraten wachsenden Zellen kultiviert in glialem (glial) oder neuronalem (neuronal) Differenzierungsmedium.

Fig. 4: CLUSTAL W (1.82)-Alignment der bekannten Aminosäuresequenzen von Tenascin-R aus verschiedenen Vertebraten, nämlich Hausmaus (SEQ ID NO:6), Ratte (SEQ ID NO:7), Mensch (SEQ ID NO:8), Huhn (SEQ ID NO:9) und Zebrafisch (SEQ ID NO:10), "*" kennzeichnet identische Aminosäuren, ":" kennzeichnet konservativen Aminosäureaustausch, "." kennzeichnet semi-konservativen Aminosäureaustausch.

Sequenzprotokoll – freier Text

SEQ ID NO:	Beschreibung
1 & 2	TN-R Nukleinsäuresequenz und Protein
3-4	Primer
5	Vektor pIN-II-omp A2
6-10	TNR Protein von Hausmaus, Ratte, Mensch, Huhn und Zebrafisch

Detaillierte Beschreibung der Erfindung

Die Erfindung betrifft eine Methode zur Isolierung hochreiner Zellpopulationen aus neuralem Primärgewebe in einem Einstufenverfahren mit Hilfe nativer Tenascin-R-Proteine oder TN-R-Fragmente von Vertebraten, bevorzugt von Fischen, Amphibien, Reptilien, Vögeln und Säugetieren, besonders bevorzugt von Hai, Karpfen, Huhn, Nagern einschließlich Maus und Ratte, Rind, Schwein und Mensch, ganz besonders bevorzugt aus Nagern und Mensch, durch selektive Substratadhäsion.

Phylogenetische Studien zur Funktion von Tenascin-R im Nervensystem von Vertebraten zeigen als stammesgeschichtlich hoch konservierte Funktion von Tenascin-R-Proteinen die Unterstützung der Adhäsion und Fortsatzbildung von Oligodendrozyten. Die vorliegende Erfindung zeigt, dass diese Eigenschaft des gesamten Tenascin-R-Proteins auch auf distinkten rekombinanten Fragmenten des humanen Tenascin-R Proteins lokalisierbar ist.

"Tenascin-R-Sonde" bedeutet im Kontext der vorliegenden Erfindung ein N-terminales Fragment von nativem Tenascin-R, welches *in vivo* und *in vitro* durch Oligodendrozyten erkannt und gebunden wird, und/oder weitere Tenascin-R-Verbindungen einschließlich Tenascin-R-Homologe und Tenascin-R-Fragmente, die ebenfalls mit hoher Sensitivität und Spezifität *in vivo* und *in vitro* durch Oligodendrozyten und/oder durch andere neurale Zellen aus Primärgewebe gebunden werden, enthalten kann, wobei "Tenascin-R-Verbindungen" die an anderer Stelle definierte Bedeutung hat. Dies schließt auch Fusionsproteine aus mehreren solcher N-terminalen Tenascin-R-Fragmente ein, bevorzugt aus zwei oder drei Tenascin-R-Verbindungen. Die Bestandteile dieser Fusionsproteine können direkt oder mittels eines (flexiblen) Linkerpeptids miteinander verknüpft sein. Besonders bevorzugt enthält die Tenascin-R-Sonde humane Tenascin-R-Fragmente, ganz besonders bevorzugt die Teilsequenz der humanen TN-R, welche die Aminosäurereste 24 bis 189 der SEQ ID NO:2 umfasst. Die Tenascin-R-Sonde kann neben ihren TN-R-Anteilen auch Nicht-TN-R-Anteile besitzen, welche die Stabilität des TN-R-Anteils gewährleisten und/oder die Immobilisierbarkeit und Kopplungsfähigkeit an andere Moleküle erhalten oder erhöhen. Insbesondere ist eine erfindungsgemäße Tenascin-R-Sonde rekombinant hergestellt.

"Tenascin-R-Verbindungen" sind erfindungsgemäß Proteine oder Peptide, welche entweder N-terminale Fragmente von nativen TN-R oder deren substantiell identische Homologe sind.

"Primärgewebe" ist ein biologisches Gewebe, das direkt aus einem Organismus entnommen und ohne weitere Veränderung seines genetischen Materials verwendet wird. "Primärzellen" sind aus Primärgewebe stammende Zellen. Primärzellen sind gegenüber Zelllinien vorteilhaft, weil sie aufgrund ihrer Herkunft den Zellen im intakten Organismus strukturell und funktionell am nächsten stehen.

"Isoliert" bedeutet im Falle eines Proteins, dass es von anderen Proteinen, mit denen es normalerweise in demjenigen Organismus assoziiert ist, in welchem es natürlicherweise vorkommt, getrennt oder gereinigt wurde. Dies umfasst biochemisch gereinigte Proteine, rekombinant hergestellte Proteine und auf chemischem Wege synthetisierte Proteine. Die Definition gilt übertragen auch für Nukleinsäuren, insbesondere DNA, und Peptide.

"Nativ" wird gleichbedeutend mit "natürlich" bzw. "natürlich vorkommend" verwendet.

Für die erfindungsgemäße "rekombinante Herstellung" werden in der Fachwelt übliche Methoden zur rekombinanten Herstellung eukaryotischer Proteine verwendet, insbesondere die Expression als Fusionsprotein in pro- und eukaryotischen Zellen, ganz besonders bevorzugt die Expression als Fusionsprotein mit Polyhistidinschwanz. Des Weiteren bevorzugt ist die Verwendung von DNA, die für das entsprechende Protein kodiert.

Nukleinsäuresequenzen, insbesondere DNA-Sequenzen, die für erfindungsgemäße Proteine oder Peptide kodieren, sind im Rahmen der vorliegenden Erfindung entweder identisch oder substantiell identisch zur nativen oder zu der ihr zugrundeliegenden künstlichen erfindungsgemäßen Sequenz. Wenn im Rahmen dieser Erfindung eine spezielle Nukleinsäuresequenz genannt wird, so sind damit diese Sequenz selbst und die zu ihr substantiell identischen Sequenzen erfasst. "Substantiell identisch" bedeutet hierbei, dass nur ein Austausch von Basen in der Sequenz im Rahmen des degenerierten Nukleinsäure-Codes erfolgt ist, dass also dadurch die Codons innerhalb kodierender Sequenzen der substantiell identischen Nukleinsäure lediglich gegenüber dem ursprünglichen Molekül in einer Weise verändert sind, welche nicht zu einer Veränderung der Aminosäuresequenz des Translationsprodukts führt (in der Regel Austausch des Codons durch ein anderes Codon seiner Codon-Familie). Bevorzugt sind im Rahmen der vorliegenden Erfindung die Sequenzen, welche im Sequenzprotokoll benannt werden, und deren erfindungsgemäße Fragmente.

Proteinsequenzen und Peptidsequenzen können im Rahmen der vorliegenden Erfindung durch Substitution von Aminosäuren modifiziert werden. Bevorzugt sind solche Substitutionen, bei denen die Funktion und/oder Konformation des Proteins oder Peptids erhalten bleibt, besonders bevorzugt jene Substitutionen, bei denen eine oder mehrere Aminosäuren durch Aminosäuren ersetzt werden, die ähnliche chemische Eigenschaften besitzen, z. B. Valin durch Alanin ("konservativer Aminosäureaustausch"). Der Anteil der substituierten Aminosäuren im Vergleich zum nativen Protein oder – falls es sich nicht um ein natives Protein handelt – zur Ausgangssequenz beträgt bevorzugt 0-30% (bezogen auf die Zahl der Aminosäuren in der Sequenz), besonders bevorzugt 0-15%, ganz besonders bevorzugt 0-5%.

Nukleinsäuresequenzen und Aminosäuresequenzen können als Volllänge-Sequenzen oder als Additions- oder Deletionsprodukte dieser Volllängesequenzen zur Durchführung der Erfindung eingesetzt werden. Bei den Aminosäuresequenzen umfassen die Additionsprodukte auch Fusionsproteine, außerdem Aminosäuresequenzen, die durch Addition von 1-100, bevorzugt 1-30, ganz besonders bevorzugt 1-10 Aminosäuren entstehen. Die addierten Aminosäuren können dabei einzeln oder in zusammenhängenden Abschnitten von 2 oder mehr miteinander verknüpften Aminosäuren ein- oder angefügt werden. Die Addition kann am N- oder C-Terminus oder innerhalb der ursprünglichen Sequenz stattfinden. Es sind mehrere Additionen in einer Sequenz zulässig, wobei eine einzelne Addition bevorzugt ist, besonders bevorzugt eine Addition am C- oder N-Terminus.

Die Deletionsprodukte der Volllängen-Aminosäuresequenzen entstehen – falls nicht für spezielle Sequenzen anders angegeben - durch Deletion von 1-100, bevorzugt 1-20, ganz besonders bevorzugt 1-10 Aminosäuren. Die deletierten Aminosäuren können dabei einzeln oder in zusammenhängenden Abschnitten von 2 oder mehr miteinander verknüpften Aminosäuren entfernt werden. Die Deletion kann am N- oder C-Terminus oder innerhalb der ursprünglichen Sequenz stattfinden. Es sind mehrere Deletionen in einer Sequenz zulässig, wobei eine einzelne Deletion bevorzugt ist, besonders bevorzugt eine Deletion am C- oder N-Terminus.

Die zulässigen Deletionen und Additionen in den erfindungsgemäßen Nukleinsäuresequenzen haben den Umfang und die Ausprägung, welche der zulässigen Aminosäuredeletionen bzw.- additionen entsprechen. Über die Deletion und Addition ganzer Codons hinaus ist auch die Addition oder Deletion von einzelnen oder paarweisen Basen möglich.

Ein Fragment einer Nukleinsäure oder eines Proteins ist ein Teil von dessen Sequenz, das kürzer als Volllänge ist, jedoch noch einen minimal zur Hybridisierung bzw. spezifischen Bindung erforderlichen Sequenzabschnitt enthält. Im Falle einer Nukleinsäure ist dieser Sequenzabschnitt noch in der Lage, mit der nativen Nukleinsäure unter stringenten Bedingungen zu hybridisieren und umfasst vorzugsweise mindestens 15 Nukleotide, besonders bevorzugt mindestens 25 Nukleotide. Im Falle eines Peptids ist dieser Sequenzabschnitt ausreichend, um eine Bindung eines für einen Abschnitt des nativen Proteins spezifischen Antikörpers oder einer Zelle, welche an TN-R oder ein TN-R-Fragment bindet, zu ermöglichen. Die Peptidlänge beträgt vorzugsweise wenigstens 5 Aminosäuren, besonders bevorzugt wenigstens 10 Aminosäuren, ganz besonders bevorzugt wenigstens 20 Aminosäuren.

Ein "Fusionsprotein" im Kontext der vorliegenden Erfindung umfasst mindestens eine erfindungsgemäße Tenascin-R-Verbindung, die mit mindestens einem zweiten Protein oder Peptid verknüpft ist. Dieses zweite Protein oder Peptid ist bevorzugt ein Selektions- oder Markerprotein, ein Protein, welches der Bindung des Fusionsproteins an eine Oberfläche dient, oder eine Tenascin-R-Verbindung. Bevorzugt sind Fusionsproteine aus nativem Tenascin-R und weiteren funktionellen Proteinen und Peptiden, und Fusionsproteine aus zwei oder mehr, besonders bevorzugt zwei oder drei Tenascin-R-Fragmenten. Die Nukleinsäuresequenzen, die in einem Vektor oder einem transformierten Wirtsorganismus für die einzelnen Teile des Fusionsproteins kodieren, sind in einer Weise miteinander verknüpft, welche die Expression unter der Kontrolle eines einzigen Promoters erlaubt. Die Aminosäuresequenzen der einzelnen funktionalen Teile des Fusionsproteins sind dabei entweder direkt oder mit einem Linker verknüpft. Der Linker ist 1-30 Aminosäuren lang, bevorzugt 10-20 Aminosäuren.

"Neurodegenerative Erkrankungen" sind Erkrankungen des Nervensystems, die mit dem Absterben von neuronalen und/oder makroglialen Zellen aufgrund von Beeinträchtigungen ihrer funktionellen Integrität assoziiert sind. Solche Zellschädigungen und -verluste führen zu Ausfall oder Störung der Funktionen der betroffenen Regionen des Nervensystems und/oder der von diesen Regionen gesteuerten Körperteilen.

Die durch das Verfahren nach Ausführungsform (1) und (2) isolierten Zellen sind bevorzugt gliale Zellen, besonders bevorzugt Oligodendrozyten.

Die Tenascin-R-Sonde zur Verwendung in Ausführungsform (1) stammt dabei bevorzugt aus Hirngewebe von Fisch (Hai, Karpfen, Goldfisch, Forelle etc.), Amphibien (Salamander, Frosch, etc.), Reptilien (griechische Landschildkröte, Ringelnatter, etc.), Vögeln (Huhn, Taube etc.) und Säugern (Igel, Kaninchen, Nager, Schwein, Rind, Mensch), besonders von Säugetieren, insbesondere aus Nager, Schwein, Rind oder Mensch, wobei die Fragmente dem vorstehend definierten humanen Fragment entsprechen. Das TN-R-Proteinfragment gemäß der Erfindung wird bevorzugt rekombinant hergestellt und/oder ist ein humanes TN-R-Fragment. Eine bevorzugte Quelle für die entsprechende DNA-Sequenz ist im letztgenannten Fall die humane Neuroblastomzelllinie SH-SY5Y. Die Expression des Fragments erfolgt bevorzugt nach Transformation von humanen Flp-In 293-Zellen (Invitrogen) oder in ausgewählten *E. coli* Stämmen mit den entsprechenden DNA-Sequenzen.

Die TN-R-Sonde kann in Ausführungsform (1) zudem weitere funktionelle Protein- oder Peptidsequenzen enthalten und/oder an einen Träger gekoppelt sein.

Ein bevorzugter Aspekt der Ausführungsform (1) und (2) ist die Tenascin-R-Sonde, ein Tenascin-R-Fragment (a), das dem von Nukleotiden 151-648 der SEQ ID NO:1 kodierten humanen Tenascin-R-Fragment entspricht und ist vorzugsweise ein Fragment mit Aminosäureresten 24 bis 189 von SEQ ID NO:2.

In einem weiteren bevorzugten Aspekt der Ausführungsform (1) und (2) ist die Tenascin-R-Sonde (b) ein Fragment von (a), bei dem bis zu 10, vorzugsweise bis zu 5 Aminosäurereste von N- und/oder C-Terminus abgespaltet sind, und/oder das wenigstens 150 Aminosäurereste aufweist.

In einem weiteren bevorzugten Aspekt der Ausführungsform (1) und (2) ist die Tenascin-R-Sonde (c) eine Substitutions-, Deletions- und/oder Additionsmutante von (a) oder (b).

In einem weiteren bevorzugten Aspekt der Ausführungsform (1) und (2) ist die Tenascin-R-Sonde ein Tenascin-R-Fusionsprotein (d) mit einem wie vorstehend unter (a) bis (c) definiertem Tenascin-R-Fragment und einer funktionelle Komponente, umfassend eines oder mehrere weiterer funktioneller Peptide oder Proteine, oder ein Tenascin-R-Fusionsprotein, das aus zwei oder mehreren, bevorzugt zwei oder drei der wie vorstehend unter (a) bis (c) definierten funktionellen Tenascin-R-Fragmenten zusammengesetzt ist.

Die phylogenetisch konservierte Eigenschaft von TN-R Proteinen, als adhäsives Substrat für Oligodendrozyten wirken zu können, wird auf molekularer Ebene durch

eine hohe Konservierung der Aminosäuresequenz zwischen verschiedenen Vertebratenspezies reflektiert: die humane TN-R Sequenz weist Homologien von 93% (zu Ratte), 75% (zu Huhn) und 60% (zu Zebrafisch) auf (Fig. 4). Diese Eigenschaft macht sich die vorliegende Anmeldung zunutze.

Die Isolierung des TN-R aus natürlichen Quellen erfolgt bevorzugt durch bekannte chromatographische und/oder immunologische Methoden zur Proteinreinigung, insbesondere durch Affinitätschromatographie an TN-R-Antikörper (siehe Beispiel 1 von WO2006/067094). Als Quelle für das TN-R kommen Gewebe und Einzelzellsuspensionen höherer und niederer Vertebraten infrage.

Rekombinante Methoden zur Herstellung der TN-R-Sonde umfassen die bekannten gängigen Methoden zur Transformation von Pro- und Eukaryoten (beschrieben z. B. in G. Schrimpf (Hrsg.), Gentechnische Methoden, 3. Auflage, Spektrum Akademischer Verlag (2002); Smith, C., The Scientist 12(3):18 (1998); Unger, T., The Scientist 11(17):20 (1997)). Geeignete Methoden zur Herstellung rekombinanter Proteine oder Proteinfragmente umfassen Transfektions- oder Transformationsmethoden, die auf verschiedenen Expressionssystemen/-vektoren für prokaryotische (insbesondere *E. coli*) und eukaryotische Zellen (Hefe, Pilze, Insekten- und Säugerzellen) basieren. Um funktionell aktive rekombinante Proteine zu erzeugen (also solche, die nach ihrer Faltung/Konformation und Glykosylierung dem nativen Protein am ähnlichsten sind), werden Säugerzellen als Produzenten bevorzugt. Die verschiedenen Expressionsvektoren für Säugerzellen unterscheiden sich hauptsächlich in Promotertyp (SV40, CMV, human EF1alpha, MMTV-LTR, MSV-LTR, RSV-LTR, etc.), Art der Expression (transient, konstitutiv, induzierbar), Induktionsmechanismus, Selektionsmarker (Antibiotikum- oder Drogenresistenz und/oder Koexpression leicht nachweisbarer Proteine) und Elemente für subzelluläres Targeting des Genprodukts (Mitochondrien, Kern, Sekretion). Als Produzenten rekombinanter Proteine/Proteinfragmente werden pro- und eukaryotische Expressionssysteme, die das Fremdgen konstitutiv exprimieren, bevorzugt.

In einer bevorzugten Durchführungsform von (2) zur erfindungsgemäßen Expression humaner rekombinanter Proteinfragmente werden definierte PCR-Fragmente des humanen TN-R mit Hilfe des TOPO TA Klonierungssystems (Invitrogen) in den pcsecTag/FRT/V5-His-TOPO-Vektor (Invitrogen) kloniert, welcher die konstitutive Expression und Sekretion des gewünschten, mit einem am C-Terminus mit 6xHis-Peptid versehenen Proteinfragments in humanen Flp-In 293

Zellen (Invitrogen) erlaubt. In Flp-In-Zellen ist das Plasmid pFRT/lacZeo (Invitrogen) stabil integriert, die FRT–Region wird spezifisch von der Flp-Rekombinase erkannt. Bei gleichzeitiger Transfektion der Flp-293-Zellen mit dem pOG44-Plasmid, das die Expression der Flp-Rekombinase ermöglicht, und dem die Basensequenz des gewünschten Proteinfragments tragenden pcsecTag/FRT/V5-His-TOPO-Vektor kommt es an der FRT-Region zu einem Einbau der für die Herstellung eines sekretierten Proteinfragments notwendigen Anteile des pcsecTag/FRT/V5-His-TOPO-Vektors. Dies ermöglicht die Sekretion polyHis-tragender Proteinfragmente in den Zellkulturüberstand und ihre Aufreinigung über Nickel-Chelatchromatographie aus gesammelten Zellkulturüberständen.

Ein weiterer Aspekt der Ausführungsform (1) ist die Herstellung der TN-R-Fragmente durch chemische Synthese, durch Fragmentierung von isoliertem TN-R oder rekombinant, bevorzugt rekombinant gemäß Ausführungsform (7). Geeignete rekombinante Methoden umfassen die bekannten gängigen Methoden zur Transformation von Pro- und Eukaryoten (beschrieben z. B. in G. Schrimpf (Hrsg.), Gentechnische Methoden, 3. Auflage, Spektrum Akademischer Verlag (2002); Smith, C., The Scientist 12(3):18 (1998); Unger, T., The Scientist 11(17):20 (1997)). Hierfür kann ein Wirtsorganismus gemäß Ausführungsform (6) verwendet werden, der mit einem Vektor transformiert oder transfiziert ist, der die vorstehend definierten TN-R oder TN-R-Fusionsprotein kodierenden DNA Sequenzen umfasst. Solch ein Vektor kann, neben den genannten DNA Sequenzen noch an den Wirtsorganismus angepasste funktionelle Sequenzen wie Promotoren, Leadersequenzen usw. enthalten. Zur chemischen Herstellung von TN-R-Fragmenten sowie zur Fragmentierung von isoliertem TN-R können einschlägig bekannte Methoden verwendet werden, wie z. B. Festphasen-Peptidsynthese bzw. enzymatische oder mechanische Fragmentierungsmethoden.

Ein weiterer bevorzugter Aspekt der Ausführungsform (1) betrifft ein Fusionsprotein umfassend eine Tenascin-R-Komponente, ausgewählt aus nativem Tenascin-R oder Tenascin-R-Fragmenten und Fusionsproteinen aus zwei der mehr Tenascin-R-Fragmente, und eine funktionelle Komponente, die funktionelle Peptid- oder Proteinsequenzen umfasst. Die Komponenten können direkt oder mittels eines (flexiblen) Linkerpeptides miteinander verknüpft sein. Ein weiterer Aspekt betrifft die Kombination von zwei oder mehreren der vorstehend definierten Tenascin-R-Komponenten, insbesondere Tenascin-R-Fragmenten, in einer Art und Weise, die nicht der nativen Aminosäuresequenz entspricht, zu einer erfindungsgemäßen

Tenascin-R-Sonde. Die Verknüpfung kann ebenfalls direkt oder mittels eines Linkerpeptids erfolgen. Zur Synthese können die oben genannten Vektorsysteme verwendet werden, wobei diejenigen cDNA-Sequenzen von Teilen der TN-R-Sequenz, welche räumlich nicht benachbart sind, über endständige Restriktionsenzym-Schnittstellen nach gängigen technischen verfahren miteinander verknüpft werden.

Die Tenascin-R-Sonde gemäß Ausführungsform (1) und (2) umfasst vorzugsweise die Teilsequenz der humanen TN-R, welche die Aminosäurereste 24 – 189 in SEQ ID NO:2 entspricht. Ein bevorzugter Aspekt von (1) bis (4) ist, dass die Sonde eine der Aminosäuresequenzen dieser Gruppe besitzt oder sich aus 2 oder mehreren der Aminosäuresequenzen dieser Gruppe in einem Fusionsprotein zusammensetzt, wobei auch die Wiederholung einer oder mehrerer der Sequenzen innerhalb des Fusionsproteins möglich ist. Gegenstand der Erfindung sind auch die Nukleinsäuren, die Nukleinsäurefragmente umfassen, welche für derartige Proteine kodieren, bevorzugt DNA-Sequenzen und cDNA.

In einem bevorzugten Aspekt der Ausführungsform (2) ist die Tenascin-R-Sonde ein Fragment von humanem Tenascin-R und entweder durch Präparation aus Zellen von Menschen oder durch rekombinante Herstellung erhältlich. Insbesondere ist es als natives TN-R aus Zellen neuralen Ursprungs, besonders bevorzugt aus SH-SY5Y Neuroblastomzellen erhältlich. Rekombinante Herstellung speziell der TN-R-Fragmente findet bevorzugt in entsprechend transformierten humanen Flp-In 293-Zellen oder ausgewählten *E. coli* Stämmen statt.

Ein bevorzugter Aspekt der Ausführungsform (1) und (2) ist die Durchführung des Verfahrens als Einstufenverfahren und/oder durch selektive Substratadhäsion an die Tenascin-R-Sonde. Hierbei werden durch enzymatische Behandlung des gewünschten zentralnervösen Gewebes gewonnene Einzelzellsuspensionen auf mit TN-R Proteinen oder Proteinfragmenten beschichteten Plastikoberflächen ausgesät. Nach Inkubation, bevorzugt für 8-20 h und bevorzugt in serumfreiem Medium (was eine Vermehrung astrozytärer und mikroglialer Zellen verhindert), finden sich auf den immobilisierten TN-R Substraten reine Oligodendrozytenpopulationen. Andere Zelltypen liegen im Zellkulturüberstand vor und können durch Mediumwechsel vollständig entfernt werden. Da nur ein einziger Selektionsschritt erfolgt und die Selektionsphase kurz ist im Vergleich zur Dauer der bislang üblichen mehrwöchigen Kultivierung gemischter glialer Kulturen und weiterer Selektionsverfahren, ist die resultierende Zellausbeute hoch. Grund dafür ist u.a., dass sämtliche

Oligodendrozyten (verschiedener Differenzierungsstadien) aus einem Primärgewebe auf TN-R-Substraten selektioniert werden können. Im Gegensatz hierzu ist die Isolierung von Oligodendrozyten aus gemischten glialen Kulturen mit einem hohen Verlust an Zellen verbunden (z. B. beim Abschütteln der auf einer Astrozyten-Monoschicht haftenden Oligodendrozyten und Mikroglia und bei weiterer Selektion mikroglialer Zellen).

Das erfindungsgemäße Isolierungsverfahren nach (1) und (2) erlaubt die Isolierung vollständiger Oligodendrozytenpopulationen und ist damit auch vorteilhaft gegenüber immunologischen Selektionsverfahren wie z. B. FACS, biomagnetic cell sorting oder Antikörper-Panning. Diese erlauben nur die Anreicherung distinkter Oligodendrozytenpopulationen; oligodendrogliale Zellen, die von den Antikörpern nicht erkannt werden, gehen verloren. Insbesondere hat die in dem Verfahren nach (1) und (2) verwendete Sonde die Eigenschaft, dass sie das Überleben und Transdifferenzierung adulter humaner mesenchymaler Stammzellen in neuronale oder oligodendrogliale Zellen, insbesondere unter definierten serumfreien Kulturbedingungen unterstützt

Das erfindungsgemäße Verfahren von (1) und (2) ermöglich somit die Isolierung von oftmals für weitere Experimente ausreichenden Oligodendrozytenpopulationen aus einem einzigen Vertebraten, insbesondere einem einzigen Nager. Dies ist insbesondere von Vorteil, wenn bestimmte Effekte an Mäusen untersucht werden, die z. B. in transgenen Mäusen, Knockout-Mäusen oder mit Testsubstanzen behandelten Mäusen auftreten.

Die als Startmaterial der Ausführungsform (1) und (2) verwendeten Primärgewebe können aus unterschiedlichen ZNS-Bereichen sowie aus unterschiedlichen Entwicklungsstadien stammen. Bevorzugte ZNS-Bereiche sind das Gehirn und einzelne Gehirnregionen (insbesondere Vorderhirn, Kleinhirn, Hippocampus, Hirnstamm), der optische Nerv und das Rückenmark. Die geeigneten Entwicklungsstadien umfassen embryonale, fötale, früh-/spätpostnatale und adulte Gewebe, bevorzugt frühpostnatale und adulte Gewebe.

Wird im Verfahren nach (1) bis (2) eine Einzelzellsuspension verwendet, so enthält diese Zellen einer oder mehrerer Differenzierungsstufen, bevorzugt einer einzigen Differenzierungsstufe.

Die neuralen Primärgewebe, die zur Durchführung des Verfahrens nach (1) und (2) verwendet werden, stammen aus niederen und höheren Vertebraten, einschließlich Fischen, Amphibien, Reptilien, Vögeln und Säugetieren, besonders bevorzugt aus

Hai, Karpfen, Huhn, Nagern einschließlich Maus und Ratte, Rind, Schwein und Mensch, ganz besonders bevorzugt aus Nagern und Mensch.

Die TN-R-Sonde zur Verwendung in (1) und (2) stammt vorzugsweise aus TN-R höherer und niederer Vertebraten. Bevorzugt ist sie das native TN-R oder ein Fragment des nativen TN-R.

Die Gewinnung von Einzelzellsuspensionen aus Primärgewebe zum Einsatz im Verfahren gemäß Ausführungsform (1) oder (2) erfolgt nach in der Fachwelt üblichen Methoden. So kann das Gewebe in einem oder mehreren Schritten mechanisch und/oder enzymatisch in Gewebefragmente und/oder einzelne Zellen überführt werden. Geeignete Methoden werden in "Zell- und Gewebekultur" (T. Lindl, Spektrum Akademischer Verlag, 2002) und "Current Protocols in Neuroscience" (John Wiley & Sons, Inc., 2004, Hrsg. J Crawley et al.) beschrieben. Die so gewonnenen Zellen werden in serumfreiem Medium resuspendiert und dann mit der TN-R-Sonde in Kontakt gebracht. Nach einer zur vollständigen Adsorption der selektierten Zellen ausreichenden Inkubationszeit (1-48 h, bevorzugt 8-20 h) unter geeigneten Bedingungen werden die nicht adhärierten Zellen entfernt. Die adhärierten Zellen können für eine weitere Verwendung entweder adhärent bleiben oder enzymatisch, bevorzugt durch Behandlung mit Trypsin bzw. Trypsin-EDTA, Collagenase, Dispase, Pronase, Accutase® oder anderen geeigneten Proteinasen, insbesondere mit Accutase®, vom Adsorbens abgelöst werden. Ihre Weiterverwendung umfasst die Kultivierung – auch auf anderen Substraten oder Plastikoberflächen bzw. in anderen definierten Medien - zur Gewinnung von beispielsweise unreifen Vorläufer-Oligodendrozyten oder myelinkompetenten Oligodendrozyten.

Das Verfahren nach (1) und (2) kann unabhängig davon eingesetzt werden, ob die TN-R-Sonde und das neurale Primärgewebe aus Organismen derselben Spezies stammen. So ist eine Isolierung von Oligodendrozyten über Speziesgrenzen hinweg möglich. TN-R aus verschiedenen Vertebraten können zur Selektion von Oligodendrozyten aus Einzelzellkulturen anderer Spezies verwendet werden. Unter anderem umfasst dies die Selektion von Oligodendrozyten aus Mensch, Schwein, Rind, Huhn, Maus, Ratte, Frosch und anderen höheren Vertebraten auf TN-R aus einer anderen Spezies (umfassend Fisch, Huhn, Maus, Ratte, Rind, Schwein, Mensch etc.).

Das Verfahren nach (1) und (2) kann des Weiteren unabhängig davon eingesetzt werden, in welcher Differenzierungsstufe (z. B. Vorläufer – unreife – reife

Oligodendrozyten) die selektierten Zellen vorliegen. Es werden allen Zellen einer Zellart selektiert, unabhängig von ihrem Entwicklungsstadium.

Die Selektion von definierten Zellpopulationen aus Einzelzellsuspensionen gemäß (1) und (2) erfolgt in einem Aspekt dadurch, dass die an die TN-R-Sonde gebundenen Zellen isoliert werden und zur weiteren Verwendung vorgesehen sind. In einem anderen Aspekt dagegen ist es der Überstand, der durch die spezifische Adsorption von Zellen an die TN-R-Sonde von diesen Zellen befreit wird und zur weiteren Verwendung als definierte Zellpopulation vorgesehen ist. In wieder einem anderen Aspekt wird als TN-R-Sonde ein modifiziertes TN-R oder ein TN-R-Fragment eingesetzt, dass für andere Zellen als das Ausgangsprotein (natives TN-R) selektiv ist.

In einem Aspekt der Ausführungsform (1) oder (2) ist die Tenascin-R-Sonde durch geeignete Methoden zur Immobilisierung an ein Trägermaterial gekoppelt. Die Immobilisierung kann kovalent oder nichtkovalent erfolgen. Derartige geeignete Immobilisierungsmethoden umfassen adäquate Kupplungstechniken, welche die Spezifität der Tenascin-R-Sonde nicht verändern, wie z. B. die kovalente Vernetzung des Proteins mit dem Trägermaterial oder die Immobilisierung durch Wechselwirkung mit einem geeigneten Antikörper. Bevorzugt erfolgt die Kupplung nichtkovalent, über einen Antikörper oder durch kovalente Vernetzung.

In einer bevorzugten Ausprägung dieses Aspekts der Ausführungsform (1) oder (2) werden zur Isolierung von Zellen aus Primärgewebe neuralen Ursprungs Trägermaterialien wie z. B. Zellkulturplatten mit TN-R bzw. mit rekombinant hergestellten TN-R-Fragmenten beschichtet, indem das Trägermaterial, bevorzugt eine Plastikoberfläche, mit einer Lösung der TN-R-Sonde inkubiert und anschließend gewaschen wird. Durch selektive Substratadhäsion erfolgt dann die Isolierung reinster Zellpopulationen aus Zellsuspensionen. Unter Verwendung von TN-R konnten aus frühpostnatalen Nagerhirnen 100% reine Oligodendrozyten-präparationen gewonnen werden: $2x10^6$ Oligodendrozyten aus einem P0-P2 Nagervorderhirn, $4\text{-}6x10^6$ Oligodendrozyten aus einem P5 Nagervorderhirn, $2x10^6$ Oligodendrozyten aus einem P7-P8 Nagerkleinhirn. Ähnliche Ergebnisse sind mit rekombinant hergestellten Tenascin-R-Fragmenten möglich.

In einer weiteren Ausprägung dieses Aspekts wird die TN-R-Sonde auf einer Plastikoberfläche immobilisiert. Dies ermöglicht ebenfalls die selektive Adhäsion und Isolation von definierten Zellpopulationen, insbesondere von Oligodendrozyten,

jedoch nicht von anderen neuralen Zellen (wie Astrozyten, Mikroglia oder Neuronen), aus den als Startmaterial verwendeten gemischten Zellpopulationen.

Die Immobilisierung erfolgt bevorzugt durch direkten Kontakt der TN-R-Sonde mit der Trägeroberfläche. Nach ausreichender Inkubationszeit (1-4 h) wird das nicht gebundene Protein abgewaschen. Die nicht besetzten Bindungsstellen auf der Oberfläche werden anschließend blockiert, z. B. durch Inkubation mit einem BSA-haltigen Blockierungspuffer. Die so beschichteten Oberflächen können bis zu ihrer Verwendung feucht gehalten oder nach Eintrocknen verwendet werden.

Als bevorzugte TN-R-Sonde werden in Ausführungsform (2) ein N-terminales Fragment des nativen TN-R verwendet. Auch die Verwendung einer Mischung aus mehr als einer TN-R-Sonde zur Beschichtung des Trägermaterials ist möglich.

Das Verfahren nach Ausführungsform (1) bis (2) ist zur Gewinnung von neuralen Zellen, insbesondere von Oligodendrozyten, für die Anzucht differenzierter Zellen, insbesondere neuraler Zellen, in neurobiologischen und zellphysiologischen Untersuchungen, in der biologischen und klinischen Forschung und für diagnostische und therapeutische Verfahren *in vitro* und *in vivo*, insbesondere für die Herstellung eines Medikaments zur Zelltherapie und zur Therapie von neurodegenerativen Krankheiten geeignet. Des Weiteren ist es zum Nachweis von neurodegenerativen Krankheiten nutzbar.

Ausführungsform (8) betrifft Antikörper, welche spezifisch an das N-terminale Ende von TN-R, insbesondere an das N-terminale Ende von TNR in wenigstens zwei Spezies, vorzugsweise zwei Vertebraten binden.

Die Kreuzaktivität mit verschiedenen Spezies ist bedingt durch das Herstellverfahren, nämlich dass ein geeigneter Wirtsorganismus mit Tenascin-R von wenigstens zwei unterschiedlichen Spezies, vorzugsweise von zwei unterschiedlichen Vertebraten durch übliche Verfahren immunisiert wird und nachfolgenden Screening- und Reinigungsschritten isoliert wird. Geeignete Wirtsorganismen für die Immunisierung sind insbesondere nicht-humane Säuger wie Nager (Mäuse, Ratten usw.), Kaninchen, Meerschweinchen, Ziege usw.

Die Antikörper nach Ausführungsform (8) sind in verschiedenen auf Nachweis und/oder Bindung von TN-R basierenden immunochemischen Verfahren anwendbar, insbesondere in ELISAs, Westernblots, histologischen und zytologischen Untersuchungen und Immunpräzipitationen. Auch in *in vitro*-Assays sind sie von Bedeutung, da ihre Anwesenheit die inhibitorische Wirkung des TN-R Proteins auf die neuronale Zelladhäsion und das Axonwachstum neutralisieren kann. Die

Antikörper reagieren spezifisch mit TN-R in Hirn-Extrakten oder gereinigtem TN-R und zeigen keine Kreuzreaktivität mit anderen TN-Proteinen. Letzteres läßt sich daraus schließen, dass keine Reaktion mit Herz oder Niere (in Maus enthaltend TN-W, Scherbich, A. et al., J. Cell. Sci. 117:571-581 (2004)), neonataler Haut oder Hautfibroblasten-konditionertem Medium (enthaltend TN-X, Zweers, M.C. et al., Cell Tissue Res. 319:279-287 (2005)) und TN-C-Präparationen aus Maushirn stattfindet. Die Antikörper sind dabei insbesondere zur selektiven Blockierung des erfindungsgemäßen TN-R-Fragments (1) und (2) geeignet.

Die monoklonalen Antikörper gemäß Ausführungsform (8) können dabei durch Kultivieren der Zelllinie gemäß Ausführungsform (9) hergestellt werden. Die Zelllinien Ausführungsform (9) sind insbesondere sogenannte Hybridomzelllinien. Diese sind z. B. durch Immunisierung eines geeigneten Wirtsorganismus mit TN-R von wenigstens zwei verschiedenen Spezies, wie vorstehend beschrieben, Isolation von Milzzellen des Wirtsorganismus und nachfolgendes Verschmelzen mit geeigneten primären Zellen, z. B. Myelomzellen, erhältlich. In Abhängigkeit vom Wirtsorganismus und vom Ursprung der primären Zellen handelt es sich um Homo- oder Heterohybridomzellen, wobei das Erstere bevorzugt ist.

Die Antikörper der Ausführungsform (8) der Erfindung sind nicht nur zum immunochemischen Nachweis von TN-R geeignet, sondern auch zur Hemmung der Wirkung von TN-R *in vivo* und *in vitro*.

Aufgrund ihrer Wechselwirkung mit TN-R in Bezug auf die neuronale Zelladhäsion und das Axonwachstum sind die Antikörper nach Ausführungsform (8) zur gezielten Beeinflussung der Neuralentwicklung *in vivo* und *in vitro*, zur Therapie und Prophylaxe von traumatischen Nervenläsionen und zur Herstellung von Medikamenten zur gezielten Beeinflussung der Neuralentwicklung und zur Therapie und Prophylaxe von traumatischen Nervenläsionen einsetzbar. Traumatische Nervenläsionen entstehen z. B. nach mechanischer Nervenschädigung. Die Regeneration der Nervenfasern nach solchen Läsionen wird durch TN-R negativ beeinflusst (Probstmeier, R. et al., J. Neurosci. Res. 60:21-36 (2000); Zhang, Y. et al., Mol. Cell. Neurosci. 17:444-459 (2001); Becker, C.C. et al., Mol. Cell. Neurosci. 26:376-389 (2004); Xu, G. et al., J. Neurochem. 91:1018-1023 (2004)).

Die Erfindung betrifft daher in Ausführungsform (14) ebenfalls ein Verfahren zur Therapie und Prophylaxe von traumatischen Nervenläsionen und zur gezielten Beeinflussung der Neuralentwicklung umfassend das Verabreichen einer geeigneten Menge an Antikörper nach Ausführungsform (8) an einen Patienten, der einer

solchen Behandlung bedarf. Die verabreichte Antikörpermenge und die notwendige Dosierung wird vom behandelnden Arzt von Fall zu Fall festzulegen sein. Sie hängt dabei unter anderem einerseits vom Alter, Körpergewicht und der Konstitution des Patienten, andererseits von der Art und Schwere der zu behandelnden Krankheit ab.

Der Kit gemäß Ausführungsform (10) enthält bevorzugt das in Ausführungsform (3) definierten Protein oder eine Stammkultur der Zelllinie zur Produktion dieses Proteins. Besonders bevorzugt enthält dieser Kit humanes Tenascin-R oder dessen erfindungsgemäße Fragmente und/oder eine Stammkultur von Zellen, die zur rekombinanten Produktion dieser Proteine geeignet sind.

Ein bevorzugter Aspekt der Ausführungsform (10) ist ein Kit, in dem die Tenascin-R-Sonde durch eine adäquate Kupplungstechnik an ein Trägermaterial gebunden ist, und/oder in dem weiterhin TN-R-Antikörper (z. B. zur Überprüfung der Immobilisierungseffizienz der TN-R-Sonde), eine oder mehrere enzymatische Lösung(en) zur Zelldissoziierung, ggf. Mittel zur Detektion der Bindung von Zellen an die Tenascin-R-Sonde, Puffer und/oder Kulturmedien enthalten sind. Zu den Puffern und Medien zählen insbesondere Blockierungspuffer und definierte serumfreie Kulturmedien. Im Kit enthaltene Antikörper sind bevorzugt Antikörper der Ausführungsform (8).

In Ausführungsform (11) ist die Verwendung eines TN-R-Fragments oder eines TN-R-Fusionsproteins wie in Ausführungsform (3) definiert, bevorzugt.

Eine bevorzugte Verwendung der erfindungsgemäßen TN-R-Sonde ist der Einsatz der Tenascin-R-Sonde zur Gewinnung von Oligodendrozyten gemäß Ausführungsform (11). Ein damit verknüpfter Aspekt der Ausführungsform (11) ist die Anzucht differenzierter Zellen aus den so gewonnenen Zellpopulationen. Die differenzierungsfördernde Wirkung des nativen TN-R wurde bereits beschrieben (Pesheva, P. et al., J. Neurosci. 17:4642-51 (1997)).

Die Diagnoseverfahren gemäß der Ausführungsform (11) können *in vivo* und *in vitro* durchgeführt werden, bevorzugt jedoch *in vitro*. Bevorzugt verwendet wird für die Verwendung gemäß Ausführungsform (11) eine Tenascin-R-Sonde gemäß Ausführungsform (4), insbesondere humanes Tenascin-R oder dessen erfindungsgemäße Fragmente. Die Tenascin-R-Sonde kann dabei aus Quellen gereinigt worden sein, in denen sie natürlich vorkommt, oder rekombinant hergestellt worden sein. Bevorzugt wird eine rekombinante Tenascin-R-Sonde verwendet.

Neurodegenerative Erkrankungen, die mit einem Verlust von Oligodendrozyten (durch Zelltod) oder Myelin assoziiert sind, wie z. B. Multiple Sklerose (MS), zeichnen sich dadurch aus, dass in den betroffenen Regionen Remyelinisierung nicht oder nur im geringen Umfang stattfinden kann. Das liegt zum Großteil daran, dass die vorhandenen "traumatischen" (also als Folge der Wirkung pathologischer Stimuli veränderten) Vorläufer- und unreifen Oligodendrozyten nicht in der Lage sind zu differenzieren/remyelinisieren. Die Erfindung bietet hier Ansätze für neue diagnostische und/oder therapeutische Verfahren:

Zur Diagnose von MS ist besonders die schnelle (innerhalb von 1-2 Tagen) Selektion "traumatischer" Zellen auf TN-R-Sonden geeignet, bevorzugt aus einem Tiermodell oder aus Biopsie-Proben von Patienten. Dies ermöglicht die Durchführung von direkten Untersuchungen ihres molekularen Profils und/oder die Entwicklung diagnostischer Marker. Für die Entwicklung eines Medikaments zur Zelltherapie können "traumatische" Oligodendrozyten mit verschiedenen Wirkstoffkandidaten behandelt werden, um den Einfluss der letzteren auf die "Genesung traumatischer Zellen", bzw. die Remyelinisierungspotenz solcher Zellen zu bestimmen.

Die erfindungsgemäße Methode ist auch geeignet zur Selektion "normaler" adulter Oligodendrozyten, welche vor der Kultivierung unter traumatischen Bedingungen *in vitro* (durch Zugabe relevanter Cytokine oder Liquorproben von Patienten/erkrankten Tieren) selektioniert und anschließend mit Wirkstoffkandidaten behandelt werden. Solch ein *in vitro*-System erlaubt Untersuchungen zu den stattfindenden traumatischen Veränderungen in Oligodendrozyten, die Rückschlüsse auf solche Veränderungen *in vivo* ermöglichen.

Des Weiteren können derartig kultivierte Oligodendrozyten zur Entwicklung diagnostischer Marker dienen, wobei auch verschiedene Stadien der traumatischen Veränderungen festgestellt werden können. Die so gewonnenen Oligodendrozyten sind auch geeignet zum Screening auf Wirkstoffkandidaten, die den Zelltod und/oder eine fehlende Myelinisierungskompetenz von Oligodendrozyten unter traumatischen Bedingungen aufheben, bzw. als Medikament zur Zelltherapie *in vivo* eingesetzt werden können.

Ein bevorzugter Aspekt der Ausführungsform (11) ist somit die Verwendung der Tenascin-R-Sonde zur Diagnose von Multipler Sklerose (MS) und zur Herstellung eines Medikaments gegen MS.

Ein weiterer bevorzugter Aspekt der Ausführungsform (11) ist somit die Verwendung der Tenascin-R-Sonde zur Herstellung eines Medikaments zur Zelltherapie und zur Therapie von neurodegenerativen Krankheiten, die mit einem Verlust von Oligodendrozyten oder Myelin einhergehen, insbesondere Multipler Sklerose und periventrikulärer Leukomalazie (PVL).

Ausführungsform (13) betrifft ein Verfahren zur Zelltherapie und zur Therapie von neurodegenerativen Krankheiten, die mit einem Verlust von Oligodendrozyten oder Myelin einhergehen, insbesondere Multipler Sklerose und periventrikulärer Leukomalazie (PVL), umfassend das Verabreichen einer pharmakologisch geeigneten Menge der TN-R-Sonde an einen Patienten, der einer solchen Behandlung bedarf. Die verabreichte Menge und die notwendige Dosierung wird vom behandelnden Arzt von Fall zu Fall festzulegen sein. Sie hängt dabei unter anderem einerseits vom Alter, Körpergewicht und der Konstitution des Patienten, andererseits von der Art und Schwere der zu behandelnden Krankheit ab.

Das Verfahren (12) zur Herstellung von Oligodendrozyten aus isolierten Stammzellen kann mit neuralen oder nicht-neuralen Stammzellen durchgeführt werden. Besonders bevorzugte isolierte Stammzellen sind Vorläuferzellen neuralen oder hämatopoetischen Ursprungs. So können humane neurale Stammzellen in Gegenwart von TN-R selektiv zu reifen Oligodendrozyten differenziert werden.

Bevorzugt wird das Verfahren (12) mit TN-R höherer Vertebraten, besonders bevorzugt mit einer erfindungsgemäßen TN-R-Sonde, ganz besonders bevorzugt mit nativem TN-R oder einem TN-R-Fragment oder -Fusionsprotein der Ausführungsform (4) durchgeführt.

Die Hybridomzelllinien tn-R4 (Produzent des Antikörpers R4) und tn-R6 (Produzent des Antikörpers R6) wurden am 02. Dezember 2005 unter den Hinterlegungsnummern DSM ACC2754 bzw. DSM ACC2753 bei der DSMZ, Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH, Mascheroder Weg 1b, 38124 Braunschweig, Deutschland, hinterlegt.

Die Erfindung wird anhand der nachfolgenden Beispiele näher erläutert. Diese schränken den Schutzbereich der Erfindung jedoch nicht ein.

Beispiele

Verwendete Lösungen/Medien

1. HBSS (Hank's Balanced Salt Solution) (Sigma)
2. Enzymatische Lösungen für Zelldissoziierung:

1% (w/v) Trypsinlösung: 1% (w/v) Trypsin (Zellkultur getestet); 0,1% (w/v) DNase I; 1 mM EDTA; 0,8 mM $MgSO_4$; 10 mM HEPES in HBSS (Ca/Mg-frei).

DNaselösung: 0,05% (w/v) DNase I; 10 mM HEPES in BME (Basal Medium Eagle).

3. Support Medium: DMEM (Sigma) supplementiert mit 10% (v/v) FCS (fötales Kälberserum), Penicillin (100 units/ml) und Streptomycin (0,1 mg/ml).

4. Definiertes serumfreies Wachstumsmedium: DMEM (Sigma) supplementiert mit Insulin (10 µg/ml), Progesteron (0,06 µg/ml), Putrescin (16 µg/ml), Natriumselenit (0,22 µM), Transferrin (0,1 mg/ml), HEPES (25 mM), Gentamycin (25 µg/ml), Penicillin (100 units/ml) und Streptomycin (0,1 mg/ml), sowie den Wachstumsfaktoren FGF-B (human recombinant basic FGF, Peprotech: 50 ng/ml) und PDGF-BB (human recombinant PDGF, Peprotech: 10 ng/ml) (unterstützen die Proliferation von Oligodendrozyten-Vorläuferzellen).

5. Serumfreies gliales Differenzierungsmedium: serumfreies Wachstumsmedium ohne Wachstumsfaktoren (FGF-B und PDGF-BB).

6. Trypsin/EDTA Lösung für hMSC (Lonza)

7. MSCGM (Mesenchymal Stem Cell Growth Medium) für hMSC (Lonza)

8. Accutase® Lösung (Sigma)

9. Definiertes serumfreies Neuromedium: DMEM/Ham´s F-12 (Sigma, mit L-Glutamin und 15 mM HEPES) supplementiert mit EGF (human recombinant epidermal growth factor, 20 ng/ml) und FGF-B (basic fibroblast growth factor, 20 ng/ml).

10. Serumfreies neuronales Differenzierungsmedium: Neurobasal Medium (Invitrogen) supplementiert mit 1% Glutamax (Invitrogen), 1% N2 Supplement (Invitrogen), B-27 Supplement 1:50 (Invitrogen), Gentamycin (25 µg/ml), Penicillin (100 units/ml) und Streptomycin (0,1 mg/ml), sowie dem Wachstumsfaktor BDNF (human recombinant brain-derived neurotrophic factor, 10 ng/ml).

Verwendete Antikörper

Die R4- und R6-Antikörper sind erhältlich aus der Hybridomzelllinie tn-R4 und tn-R6, die am 02.12.05 unter den Hinterlegungsnummern DSM ACC2754 bzw. DSM ACC2753 bei der DSMZ (Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH) hinterlegt sind (siehe auch WO 2006/067094).

V-5-Antikörper (Sigma, Cat. No. V8012), O4-Antikörper (Sigma, Cat. No. O7139)

Beispiel 1: Herstellung eines humanen TNR-Cys (H-TNR-Cys) Fragments

Für die Herstellung eines rekombinanten eukaryotisch exprimierten H-TNR-Cys Fragments wird folgender Sequenzbereich ausgewählt:

H-TNR-Cys: bp 151-648 (von SEQ ID NO:1 Cystein-reiche Region)
Produktlänge: 498 bp

Zur Gewinnung humaner TN-R-spezifischer mRNA wird die menschliche Neuroblastomzellinie SH-SY5Y verwendet (Woodworth et al., 2004). Gesamt-RNA wird aus diesen Zellen unter Verwendung von Trizol-Reagenz (Invitrogen) gereinigt. Die cDNA–Synthese aus diesen RNA-Präparationen erfolgt unter Verwendung von „Random hexamer"-Primern mit Hilfe des SuperScript II Systems (Invitrogen). Zur Herstellung von H-TNR-Cys-spezifischem cDNA-Fragment werden folgende Primer verwendet.

H-TNR-Cys-UP (SEQ ID NO:3): bp 151-173: TCCATGATCAAGCCTTCAGAGTG
H-TNR-Cys-DO (SEQ ID NO:4): bp 627-648: GATGCAGCCACAGGACTCAAAG

Das gewonnene PCR-Fragment wird mit Hilfe des TOPO/TA Klonierungssystems (Invitrogen), das sich die überstehenden A-Reste der PCR-Produkte bei Verwendung von Taq-Polymerase zunutze macht, in den pcsecTag/FRT/V5-His-TOPO-Vektor (Invitrogen) kloniert. Dieser Vektor erlaubt nach stabiler Integration in eukaryontische FlpIn-Zellinien (siehe unten) die Sekretion des gewünschten, mit einem am C-Terminus mit einem 6xHis-Peptid versehenen Fragments in den Zellkulturüberstand. PolyHis-tragende Fragmente werden über Nickel-Chelatchromatographie aus gesammelten Zellkulturüberständen aufgereinigt.

Als Produzenten des H-TNR-Cys Fragments werden FlpIn 293 Zellen (Invitrogen) verwendet, die sich von der menschlichen Nierenzellinie HEK 293 ableiten. In FlpIn-Zellen ist das Plasmid pFRT/lacZEo (Invitrogen) stabil integriert. Dieser Vektor enthält eine für die Flp-Rekombinase spezifisch erkannte FRT–Region. Bei gleichzeitiger Transfektion der Flp-293-Zellen mit dem pOG44-Plasmid, das die Expression der Flp-Rekombinase ermöglicht und dem die Basensequenz des H-TNR-Cys Fragments tragenden pcsecTag/FRT/V5-His-TOPO-Vektor kommt es an der FRT-Region zu einem Einbau des pcsecTag/FRT/V5-His-TOPO-Vektors.

Zur bakteriellen Expression kann Cys-Fragment in einen prokaryotischen Expressionsvektor, z.B. dem Vektor pIN-III-ompA2 (SEQ ID NO:5; Adresse PubMed Nucleotide: NM_013045) kloniert. Das zellfrei synthetisierte Fremdgen (Cys-Region + His-Tag) verfügt über flankierende EcoRI-bzw. BamHI-spezifische Schnittstellen, die den Einbau des Fremdgens in die EcoRI-bzw. BamHI-Klonierungsstelle des pIN-III-ompA2-Vektor nach entsprechendem Verdau mit Restriktionsenzymen ermöglichen.

Die Expression des Proteins erfolgt im E.Coli-Stamm JA221 nach Vektortransformation. Die Selection von Transformanten geschieht durch Kultivierung in Ampicillin-haltigen Kulturmedien. Das Protein wird in den periplasmatischen Raum der E.Coli-Zelle sekretiert, dieser durch osmotischen Schock eröffnet und das Protein über einen C-terminalen His-Tag affinitätschromatographisch gereinigt.

Das über das FlpIn-Expressionssystem hergestellte H-TNR-Cys Fragment weist in SDS-PAGE ein Molekulargewicht von 34 kD auf und wird in Westernblot-Analysen von Tag-spezifischen (V5) und TN-R-spezifischen (R4) monoklonalen Antikörpern erkannt (Fig. 1A). Westernblot- und Funktionsanalysen rekombinanter H-TNR-Cys und H-TNR-S1-bis-5-Fragmente (S1 = 24 bis 328, S2 = 324 bis 1134, S3 = 1120 bis 1358, S4 = 24 bis 506, S5 = 498 bis 955, S6 = 949 bis 1358 von SEQ ID NO:2, siehe auch WO 06/067094) weisen nach, dass der R4 Antikörper (1) ein Epitop in der Cys-Region (H-TNR-Cys Fragment) und der FNG-Domäne (H-TNR-S3 Fragment) von TN-R erkennt (Fig. 1A), (2) die Sulfatid-vermittelte Zelladhäsion auf TN-R/TN-R Fragmente blockiert (Fig. 1B) und an die Sulfatid-Bindungsstellen von TN-R bindet bzw. H-TNR-Cys und H-TNR-S3 Fragmente Sulfatide binden (Fig. 1C).

Beispiel 2: Selektive Aufreinigung von Oligodendrozyten aus ZNS-Gewebe von Säugern mit Hilfe von rekombinanten H-TNR Fragmenten

Als Ausgangsmaterial wurden postnatale Mausgehirne (entweder das Gesamtgehirn oder isolierte Vorderhirnbereiche bzw. Präparationen des optischen Nervs) der Altersstufen Postnataltag 1 (P1) bis 4 (P4) verwendet. Isolierte Gehirnbereiche wurden nach mechanischer Zerkleinerung entsprechend der Herkunft bzw. des Alters mit 0,5 bis 1%iger (w/v) Trypsinlösung behandelt (P1 bis P2 Gehirne mit 0,5% (w/v) Trypsinlösung für 10 min bei Raumtemperatur (RT), P4 Gehirne mit 0,5% (w/v) Trypsinlösung für 15 min bei RT. Die Gewebeteile wurden nach Zugabe eines größeren Volumens HBSS bei 600 g für 5 Minuten bei 4°C pelletiert.

Zur Gewinnung von Einzelzellen wurden die pelletierten Gewebestücke in DNase-Lösung aufgenommen und in einer Pasteurpipette mit verengtem Spitzendurchmesser mehrmals auf- und abpipettiert. Die erhaltene grobe Zellsuspension wurde in einem 5-10fachem Volumen an Support Medium verdünnt und 5 Minuten auf Eis inkubiert. Der die Einzelzellsuspension enthaltende Überstand wurde bei 600 g für 5 min bei 4°C zentrifugiert und die pelletierten Einzelzellen in serumfreiem Wachstumsmedium resuspendiert. Die so gewonnenen Einzelzellsuspensionen enthielten alle in den entsprechenden Gehirnen/Gehirnbereichen vorhandenen

Zelltypen (Neurone, Astrozyten, Oligodendrozyten, Mikroglia, meningiale und endotheliale Zellen).

Zur Gewinnung reiner Oligodendrozytenpopulationen wurden die im letzten Abschnitt vorgestellten Einzelzellsuspensionen (1-2 x 10^6 Zellen/ml in serumfreiem Medium) auf mit H-TNR Fragmenten beschichteten Zellkulturschalen (siehe unten) ausplattiert und für 8-20 Stunden in einem CO_2-Inkubator (5% CO_2) kultiviert. Nicht adhärente Zellen wurden mit HBSS weggespült und adhärente Zellen in serumfreiem Wachstumsmedium weiter kultiviert. Anschließend wurden die auf H-TNR Fragmenten adhärenten Zellen mit einem Sulfatid-spezifischen monoklonalen Maus-Antikörper (O4; Bansal, R. et al., J. Neurosci. Res. 24:548-557 (1989)) inkubiert (30 min bei RT). Nach Fixierung der Zellen mit 4 % (v/v) Formaldehyd in PBS für 10 min bei RT wurde die Bindung des O4-Antikörpers auf die Zellen durch Inkubation mit Cyanin3- oder FITC-gekoppelten anti-Maus-Ig-Antikörpern (20 min bei RT) fluoreszenzmikroskopisch nachgewiesen. Auf dem Substrat verblieben 99+/-1% O4-färbbare Zellen, also nur Oligodendrozyten (Fig. 2).

Die durch dieses Einstufenverfahren gewonnenen Zellen konnten für weitere Verwendungszwecke durch Behandlung mit Accutase® (Sigma) vom Substrat abgelöst und auf anderen Substraten/Plastikoberflachen bzw. in anderen definierten Medien zur Gewinnung von beispielsweise unreifen oder reifen, myelinkompetenten Oligodendrozyten weiter kultiviert werden.

Für die Herstellung von Substraten aus H-TNR Fragmenten wurden Plastikoberflächen (Zellkulturschalen, -platten, etc.) mit H-TNR-Cys oder H-TNR-S3 Fragmenten (10 µg/ml in 0,1 M $NaHCO_3$) für 2 h bei RT inkubiert, mit PBS (2-3 mal) gewaschen und anschließend als Substrat für die Oligodendrozyten-Selektion verwendet. Die aus H-TNR Fragmenten hergestellten Substrate können nach Beschichtung auch eingetrocknet und bei -20°C steril gelagert werden, ohne dass die spezifischen adhäsiven Eigenschaften der Fragmente für Oligodendrozyten hierdurch verloren gingen.

Beispiel 3: Differenzierungsverfahren für Gliazellen aus adulten humanen mesenchymalen Stammzellen (hMSC) mit Hilfe von rekombinanten H-TNR Fragmenten

Als Ausgangsmaterial wurden adulte humane mesenchymale Stammzellen (hMSC) aus dem Knochenmark (Lonza; CD105-, CD166-, CD29- und CD44-positiv) verwendet. Die aus normalem humanem Knochenmark isolierten Zellen wurden für

3 bis 4 Passagen in MSCGM vermehrt. Zur Gewinnung von Einzelzellen wurden die als Monolayer wachsenden Zellen mit Trypsin/EDTA Lösung dissoziiert, die Einzelzellsuspension nach Zugabe eines größeren Volumens MSCGM bei 600 g für 5 Minuten bei 4°C pelletiert und die pelletierten Einzelzellen in serumfreiem Wachstumsmedium resuspendiert. Zur Gewinnung glialer Zellpopulationen wurden Einzelzellsuspensionen (1-2 x 10^6 Zellen/ml) auf unbeschichtete Schalen ausplattiert und für 6 bis 9 Tage in serumfreiem Wachstumsmedium in einem CO_2-Inkubator (5% CO_2) kultiviert. Das Zellkulturmedium wurde alle 2-3 Tage gewechselt. Anschließend wurden adhärente Zellen trypsinisiert, Einzelzellsuspensionen (1 x 10^6 Zellen/ml) auf mit Laminin (Kontrollsubstrat) oder H-TNR Fragmenten beschichteten Schalen (wie oben beschrieben) ausplattiert und für weitere 2 bis 5 Tage in serumfreiem Wachstumsmedium kultiviert (Fig. 3A). Danach wurde das Wachstumsmedium durch gliales Differenzierungsmedium ersetzt und die Zellen wurden darin für 3 Tage weiter kultiviert. Anschließend wurden die auf den Substraten adhärenten Zellen mit 4 % (v/v) Formaldehyd und 5% (w/v) Sucrose in PBS für 30 min bei RT fixiert und mit Hilfe indirekter Immunfluoreszenz mit Neuron- (βIII tubulin) und Glia-spezifischen Antikörpern (gegen Nestin, Sulfatid, Galactocerebrosid (GalC) und GFAP) für 30 min bei RT (für Sulfatid und GalC) angefärbt. Für den Nachweis von βIII Tubulin, Nestin und GFAP wurden fixierte Zellen zuerst mit einer 0,25%igen Triton X-100-Lösung in PBS permeabilisiert (20 min bei RT) und anschließend mit Molekül-spezifischen Antikörpern (abcam) über Nacht bei 4°C inkubiert. Die Bindung der entsprechenden Antikörper wurde durch Inkubation (30 min bei RT) mit Cyanin 3- oder ALEXA 488-gekoppelten sekundären Antikörpern fluoreszenzmikroskopisch visualisiert. Auf den H-TNR-S3 und H-TNR-Cys Substraten wurden 60% (auf H-TNR-S3) bis 90% (auf H-TNR-Cys) Sulfatid/GalC-positive Zellen, also überwiegend Oligodendrozyten nachgewiesen, wobei die Überlebensrate oligodendroglial differenzierter Zellen auf H-TNR-Cys (60% der Ausgangszellzahl) 3fach höher als diese auf H-TNR-S3 war (Fig. 3B, 3D).

Beispiel 4: Differenzierungsverfahren für neuronale Zellen aus adulten humanen mesenchymalen Stammzellen (hMSC) mit Hilfe von rekombinanten H-TNR Fragmenten

Als Ausgangsmaterial wurden adulte humane mesenchymale Stammzellen (hMSC) aus dem Knochenmark (Lonza; CD105-, CD166-, CD29- und CD44-positiv) verwendet. Die aus normalem humanem Knochenmark isolierten Zellen wurden für

3 Passagen in MSCGM vermehrt. Zellen von Monolayern wurden mit Trypsin/EDTA Lösung dissoziiert, die Einzelzellsuspension nach Zugabe eines größeren Volumens MSCGM bei 600 g für 5 Minuten bei 4°C pelletiert und die pelletierten Einzelzellen in serumfreiem Neuromedium resuspendiert. Zur Gewinnung neuronaler Zellpopulationen wurden Einzelzellsuspensionen (1-2 x 10^5 Zellen/cm^2) auf mit 0.8% (w/v) Agarose Typ VII (Sigma) beschichtete Schalen (5 ml/95 mm Schale) ausplattiert und für 3 bis 5 Tage bis zur Ausbildung von Neurosphären in Neuromedium in einem CO_2-Inkubator (5% CO_2) kultiviert. Das Zellkulturmedium wurde alle 2-3 Tage gewechselt. Anschließend wurden Neurosphären durch Zentrifugation pelletiert, mit Accutase® (Sigma) für 15 min bei RT dissoziiert und in neuronales Differenzierungsmedium resuspendiert. Einzelzellsuspensionen (0.5 x 10^6 Zellen/ml) wurden auf mit Laminin oder poly-D-Lysin (PDL, Kontrollsubstrate) und H-TNR Fragmenten beschichteten Schalen (wie oben beschrieben) ausplattiert und für 5 bis 10 Tage in neuronalem Differenzierungsmedium kultiviert. Das Zellkulturmedium wurde alle 2-3 Tage gewechselt. Anschließend wurden die auf den Substraten adhärenten Zellen mit 4 % (v/v) Formaldehyd in PBS für 30 min bei RT fixiert und mit Hilfe indirekter Immunfluoreszenzfärbung mit Neuron- und Glia-spezifischen Antikörpern (wie oben beschrieben) analysiert. Während auf H-TNR-S3 Substraten fast keine Stammzellen im neuronalen Differenzierungsmedium überlebten, konnten 80% der Zellen mit langen Axon-ähnlichen Fortsetzten auf H-TNR-Cys Substraten als ßIII Tubulin-positiv und somit als Neurone/neuronale Vorläufer identifiziert werden. Hierbei betrug die Überlebensrate transdifferenzierter Zellen über 80% der aus Neurosphären stammender Ausgangszellzahl (Fig. 3C, 3D).

PCT

Ausdruck (Original in electronischem Format)
(Dieses Blatt zählt nicht als Blatt der internationalen Anmeldung und ist nicht Teil derselben)

0-1	**Formular PCT/RO/134 (SAFE) Angaben zu einem hinterlegten Mikroorganismus und/oder anderem hinterlegten biologischen Material**	
0-1-1	erstellt mit	PCT Online Filing Version 3.5.000.204 MT/FOP 20020701/0.20.5.9
0-2	**Internationales Aktenzeichen**	
0-3	**Aktenzeichen des Anmelders oder Anwalts**	092185woJHml

1	**Die nachstehenden Angaben betreffen den Mikroorganismus und/oder anderes biologisches Material, der/das in der Beschreibung genannt ist**	
1-1	**Seite**	27
1-2	**Zeile**	(3H////) 26-31 * * RO/EP
1-3	**Angaben betr. Hinterlegung**	
1-3-1	Name der Hinterlegungsstelle	DSMZ DSMZ-Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH
1-3-2	Anschrift der Hinterlegungsstelle	Inhoffenstr. 7B, D-38124 Braunschweig, Germany
1-3-3	Datum der Hinterlegung	14. Dezember 2005 (14.12.2005)
1-3-4	Eingangsnummer	DSMZ ACC2753
1-5	**Bestimmungsstaaten, für die besondere Angaben gemacht werden**	alle Bestimmungsstaaten
2	**Die nachstehenden Angaben betreffen den Mikroorganismus und/oder anderes biologisches Material, der/das in der Beschreibung genannt ist**	
2-1	**Seite**	27
2-2	**Zeile**	(3H////) 26-31 * * RO/EP
2-3	**Angaben betr. Hinterlegung**	
2-3-1	Name der Hinterlegungsstelle	DSMZ DSMZ-Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH
2-3-2	Anschrift der Hinterlegungsstelle	Inhoffenstr. 7B, D-38124 Braunschweig, Germany
2-3-3	Datum der Hinterlegung	14. Dezember 2005 (14.12.2005)
2-3-4	Eingangsnummer	DSMZ ACC2754
2-5	**Bestimmungsstaaten, für die besondere Angaben gemacht werden**	alle Bestimmungsstaaten

VOM ANMELDEAMT AUSZUFÜLLEN

0-4	**Dieses Formular ist mit der internationalen Anmeldung eingegangen** (ja oder nein)	ja
0-4-1	Bevollmächtigter Bediensteter	Gärtner, Sabine

K-FEE SYSTEM GMBH, EX2009, page 3142
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

PCT

Ausdruck (Original in electronischem Format)
(Dieses Blatt zählt nicht als Blatt der internationalen Anmeldung und ist nicht Teil derselben)

VOM INTERNATIONALEN BÜRO AUSZUFÜLLEN

0-5	**Dieses Formular ist an folgendem Datum beim internationalen Büro eingegangen**	
0-5-1	Bevollmächtigter Bediensteter	

K-FEE SYSTEM GMBH, EX2009, page 3143
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Patentansprüche

1. Verfahren zur Isolierung und Reinigung von neuralen Zellen aus neuralem Primärgewebe von Vertebraten, umfassend die Selektion der Zellen aus einer Einzelzellsuspension mittels einer Tenascin-R-haltigen Sonde ("Tenascin-R-Sonde"), welche ausgewählt ist aus (a) dem N-terminalen Fragment von nativem Tenascin-R (TN-R), das dem von Nukleotiden 151-648 der SEQ ID NO:1 kodierten humanen Tenascin-R-Fragment entspricht, (b) Homologen und Fragmenten von (a), und (c) Fusionsproteine umfassend eine Domäne mit (a) oder (b).

2. Verfahren nach Anspruch 1, wobei das N-terminale Tenascin-R-Fragment (a) ein Tenascin-R-Fragment ist, das ein Fragment mit Aminosäureresten 24 bis 189 von SEQ ID NO:2 ist.

3. Verfahren nach Anspruch 1 oder 2, wobei das Fragment (b)
(i) ein Fragment von (a) ist, bei dem bis zu 10, vorzugsweise bis zu 5 Aminosäureresten von N- und/oder C-Terminus abgespalten sind und/oder das wenigstens 150 Aminosäurereste aufweist, und/oder
(ii) eine Substitutions-, Deletions- und/oder Additionsmutante von (a) oder (b) ist.

4. Verfahren nach einem oder mehreren der Ansprüche 1 bis 3, wobei das Tenascin-R-Fusionsprotein (c)
(i) wenigstens eine Domäne mit einem Tenascin-R-Fragment (a) oder (b) und eine funktionelle Domäne, umfassend eines oder mehrere weiterer funktioneller Peptide oder Proteine, aufweist oder
(ii) aus zwei oder mehreren, bevorzugt zwei oder drei der funktionellen Tenascin-R-Fragmente (a) oder (b) zusammengesetzt ist.

5. Verfahren nach einem oder mehreren der Ansprüche 1 bis 4, wobei
(i) das TN-R-Fragment aus Vertebraten, bevorzugt aus Fischen, Reptilien, Amphibien, Vögeln und Säugetieren, besonders bevorzugt aus Hai, Karpfen, Huhn, Nagern einschließlich Maus und Ratte, Rind, Schwein und Mensch, ganz besonders bevorzugt aus Nagern und Mensch stammt; und/oder
(ii) die Tenascin-R-Sonde weitere funktionelle Peptid- oder Proteinsequenzen enthält und/oder an einen Träger gekoppelt ist; und/oder
(iii) das Tenascin–R-Fragment ein Peptid mit der Sequenz der Aminosäurereste 24 bis 189 von SEQ ID NO:2 ist.

6. Verfahren nach einem oder mehreren der Ansprüche 1 bis 5, wobei

(i) das Verfahren zur Isolierung und Reinigung von glialen Zellen, bevorzugt von Oligodendrozyten, geeignet ist; und/oder

(ii) das Verfahren zur Transdifferenzierung adulter humaner mesenchymaler Stammzellen in neuronale oder oligodendrogliale Zellen geeignet ist; und/oder

(ii) das Vertebraten-Primärgewebe aus niederen oder höheren Vertebraten einschließlich Fischen, Amphibien, Vögeln und Säugetieren, besonders bevorzugt aus Hai, Karpfen, Huhn, Nagern einschließlich Maus und Ratte, Rind, Schwein und Mensch, ganz besonders bevorzugt aus Nagern und Mensch stammt; und/oder

(iii) die Isolierung der Zellen durch selektive Substratadhäsion an die Tenascin-R-Sonde und/oder in einem einzigen Reinigungsschritt erfolgt.

7. Verfahren nach einem oder mehreren der Ansprüche 1 bis 6, wobei die Einzelzellsuspension

(i) aus embryonalem, fötalem, früh- oder spätpostnatalem und/oder adultem Gewebe hergestellt wird; und/oder

(ii) aus Gewebe aus verschiedenen Bereichen des Nervensystems, bevorzugt aus Nervengewebe oder Gehirn, besonders bevorzugt aus Gehirn, Rückenmark oder optischem Nerv hergestellt wird; und/oder

(iii) Zellen einer oder mehrerer Differenzierungsstufen, bevorzugt einer einzigen Differenzierungsstufe, enthält.

8. Verfahren nach einem oder mehreren der Ansprüche 1 bis 7, wobei

(i) die Tenascin-R-Sonde durch nichtkovalente Wechselwirkungen, einschließlich Wechselwirkung mit TN-R-spezifischen Antikörpern usw., oder durch eine andere adäquate Kopplungstechnik, welche die Spezifität der Tenascin-R-Sonde nicht verändert, einschließlich kovalente Vernetzung usw., an ein Trägermaterial gebunden ist; und/oder

(ii) die Einzelzellsuspension mit der Tenascin-R-Sonde in Kontakt gebracht wird, so dass in der Einzelzellsuspension vorhandene Tenascin-R-bindende Zellen an die Sonde gebunden werden; und/oder

(iii) durch spezifische Bindung neuraler Stammzellen aus der Einzelzellsuspension an die Tenascin-R-Sonde eine Isolierung dieser Zellen aus der Zellkultur erfolgt, die nicht gebundenen Zellen entfernt werden und optional anschließend die über die Tenascin-R-Sonde an das Trägermaterial gebundenen Zellen durch Trypsinierung, Inkubation mit Accutase® oder ein anderes adäquates Verfahren vom Trägermaterial abgelöst werden; und/oder

(iv) die gebundenen Zellen durch immunologische Methoden nachgewiesen werden; und/oder

(v) das Verfahren *in vitro* erfolgt.

9. Verfahren nach einem oder mehreren der Ansprüche 1 bis 8, das

(i) zur Gewinnung von neuralen Zellen, insbesondere von Oligodendrozyten, für die Anzucht differenzierter Zellen, insbesondere neuraler Zellen, in neurobiologischen und zellphysiologischen Untersuchungen, in der biologischen und klinischen Forschung und für diagnostische und therapeutische Verfahren *in vitro* und *in vivo*, insbesondere für die Herstellung eines Medikaments zur Zelltherapie und zur Therapie von neurodegenerativen Krankheiten; und/oder

(ii) zum Nachweis von neurodegenerativen Krankheiten

geeignet ist.

10. Tenascin-R-Fragment oder Tenascin-R-Fusionsprotein wie in Anspruch 1 bis 5 definiert.

11. DNA, die für ein Tenascin-R-Fragment oder Tenascin-R-Fusionsprotein nach Anspruch 10 kodiert.

12. Vektor, der eine DNA nach Anspruch 11 umfasst.

13. Wirtsorganismus, der mit einem Vektor nach Anspruch 12 transformiert/transfiziert ist und/oder eine DNA nach Anspruch 11 aufweist.

14. Verfahren zur Herstellung eines Tenascin-R-Fragments oder Tenascin-R-Fusionsproteins nach Anspruch 10, umfassend das Kultivieren des Wirtsorganismus nach Anspruch 13.

15. Antikörper, der durch Immunisierung eines geeigneten Wirtsorganismus mit einem Tenascin-R-Fragment nach Anspruch 10 erhältlich ist.

16. Antikörper nach Anspruch 15,

(i) der spezifisch ist für das Tenascin-R-Fragment nach Anspruch 10; und/oder

(ii) durch Immunisierung mit Tenascin-R-Fragmenten nach Anspruch 9 von wenigstens zwei unterschiedlichen Spezies, insbesondere mit solchen Tenascin-R-Fragmenten von wenigstens zwei unterschiedlichen Vertebraten erhältlich ist und/oder welcher an das N-terminales Tenascin-R von wenigstens zwei unterschiedlichen Spezies, insbesondere von wenigstens zwei unterschiedlichen Vertebraten bindet; und/oder

(iii) der monoklonal ist.

17. Zelllinie oder Hybridomzelllinie, die einen monoklonalen Antikörper nach Anspruch 14 produziert.

18. Verwendung des Antikörpers nach Anspruch 15 oder 16
(i) zum immunochemischen Nachweis von TN-R;
(ii) zur Hemmung der Wirkung von TN-R;
(iii) zur Beeinflussung der Neuralentwicklung und
(iv) zur Herstellung von Medikamenten zur Therapie und Prophylaxe traumatischer Nervenläsionen und von Medikamenten zur gezielten Beeinflussung der Neuralentwicklung.

19. Kit zur Isolierung und Reinigung von neuralen Zellen, insbesondere von Oligodendrozyten, nach einem oder mehreren der Verfahren der Ansprüche 1 bis 10, insbesondere enthaltend
(i) eine wie in Ansprüchen 1 bis 5 definierte Tenascin-R-Sonde, und/oder
(ii) einen Vektor, der für die in (i) definierte Tenascin-R-Sonde kodiert, und/oder
(iii) eine Stammkultur einer Zelllinie, die dazu geeignet ist, die wie in Ansprüchen 1 bis 5 definierte Tenascin-R-Sonde zu exprimieren.

20. Kit nach Anspruch 19, wobei
(i) die Sonde an ein Trägermaterial gebunden ist; und/oder
(ii) der Kit weiterhin Tenascin-R-Antikörper, insbesondere einen wie in Ansprüchen 15 bis 16 definierten Antikörper umfasst; und/oder
(iii) der Kit weiterhin enzymatische Lösungen zur Zelldissoziierung, Puffer und/oder Kulturmedien umfasst.

21. Verwendung eines Tenascin-R-Fragments oder eines Tenascin-R-Fusionsproteins wie in Anspruch 10 definiert, zur Gewinnung von neuralen Zellen, insbesondere von Oligodendrozyten, für die Anzucht differenzierter Zellen, insbesondere neuraler Zellen, in neurobiologischen und zellphysiologischen Untersuchungen, in der biologischen und klinischen Forschung und für diagnostische und therapeutische Verfahren *in vitro* und *in vivo*, insbesondere für die Herstellung eines Medikaments zur Zelltherapie und zur Therapie von neurodegenerativen Krankheiten, die mit einem Verlust von Oligodendrozyten oder Myelin einhergehen, insbesondere Multipler Sklerose und periventrikulärer Leukomalazie (PVL).

22. Verfahren zur Herstellung von Oligodendrozyten aus isolierten Stammzellen *in vitro* durch Inkubation der Stammzellen in Anwesenheit eines Tenascin-R-Fragments oder eines Tenascin-R-Fusionsproteins wie in Anspruch 10 definiert.

23. Verfahren nach Anspruch 22, wobei die isolierten Stammzellen neurale oder nicht-neurale Stammzellen sind, welche das Potential zur Sulfatid-Expression besitzen.

24. Verfahren zur Zelltherapie oder zur Therapie von neurodegenerativen Krankheiten, die mit einem Verlust von Oligodendrozyten oder Myelin einhergehen, insbesondere von Multipler Sklerose und periventrikulärer Leukomalazie (PVL), umfassend die Gabe eines Tenascin-R-Fragments oder eines Tenascin-R-Fusionsproteins wie in Anspruch 10 definiert, an einen menschlichen oder tierischen Patienten.

25. Verfahren zur Therapie und Prophylaxe traumatischer Nervenläsionen oder zur gezielten Beeinflussung der Neuralentwicklung, umfassend die Verabreichung einer pharmakologisch ausreichenden Menge des Antikörpers nach Anspruch 15 oder 16 an einen menschlichen oder tierischen Patienten, der einer solchen Behandlung bedarf.

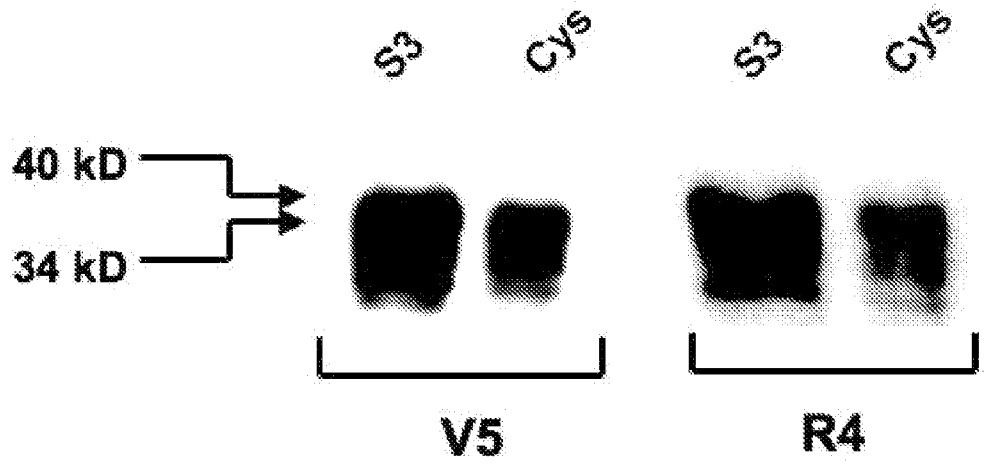

S3
Cys
S3
Cys
40 kD
34 kD
V5
R4

Fig.1A

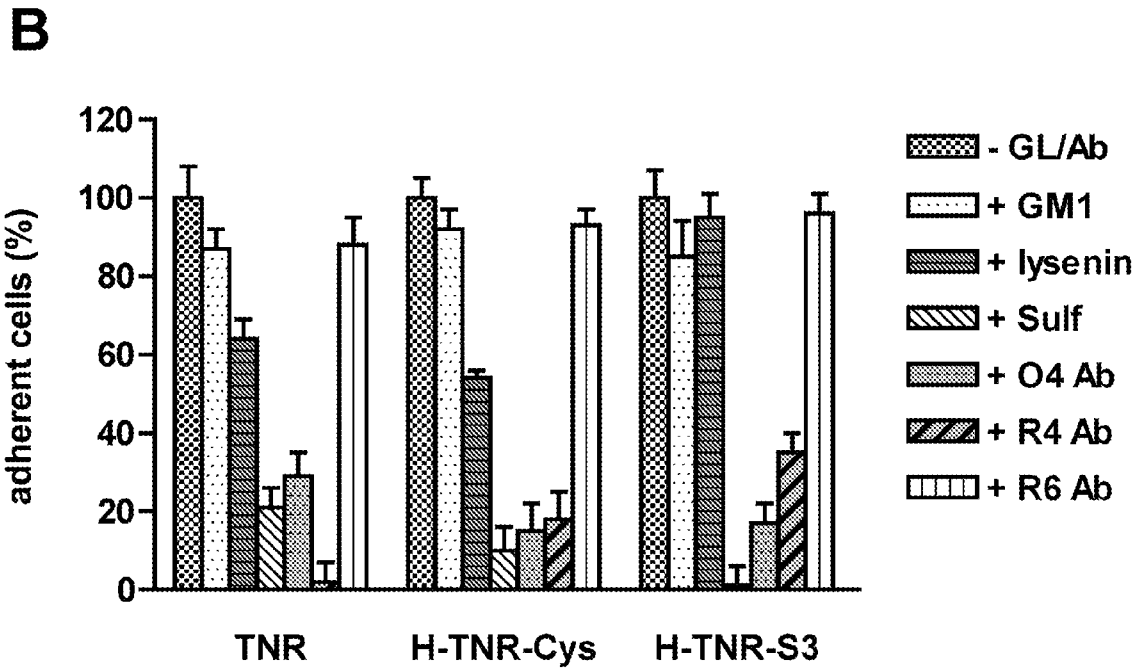

B
adherent cells (%)
120
100
80
60
40
20
0
TNR
H-TNR-Cys
H-TNR-S3
- GL/Ab
+ GM1
+ lysenin
+ Sulf
+ O4 Ab
+ R4 Ab
+ R6 Ab

Fig.1B

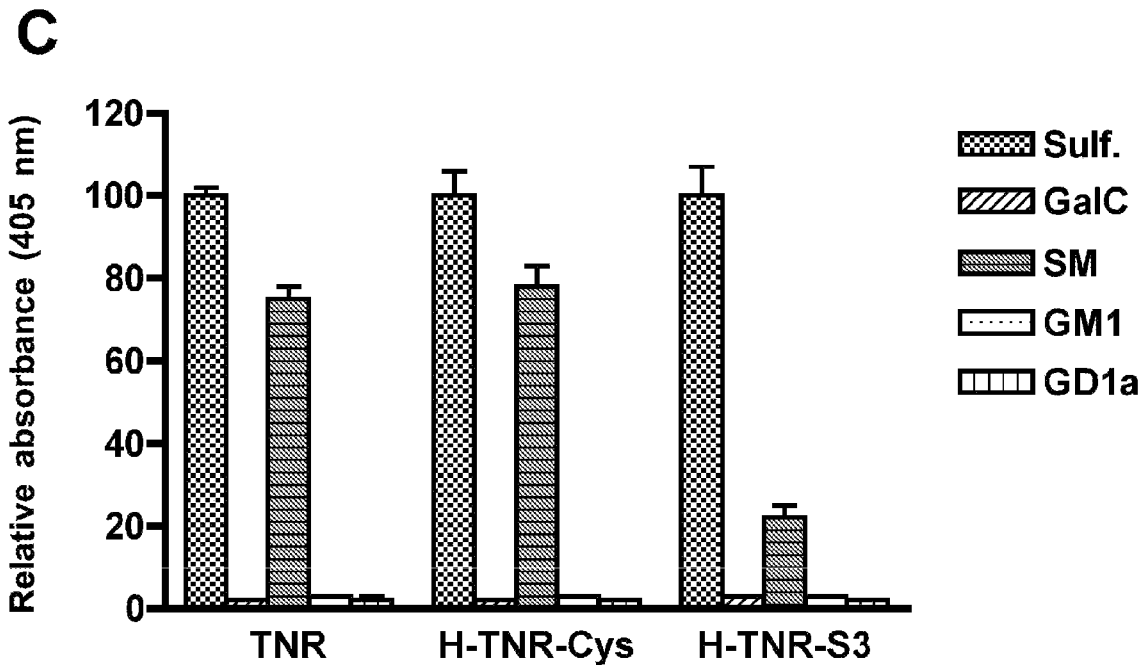

C
Relative absorbance (405 nm)
120
100
80
60
40
20
0
TNR
H-TNR-Cys
H-TNR-S3
Sulf.
GalC
SM
GM1
GD1a

Fig.1C

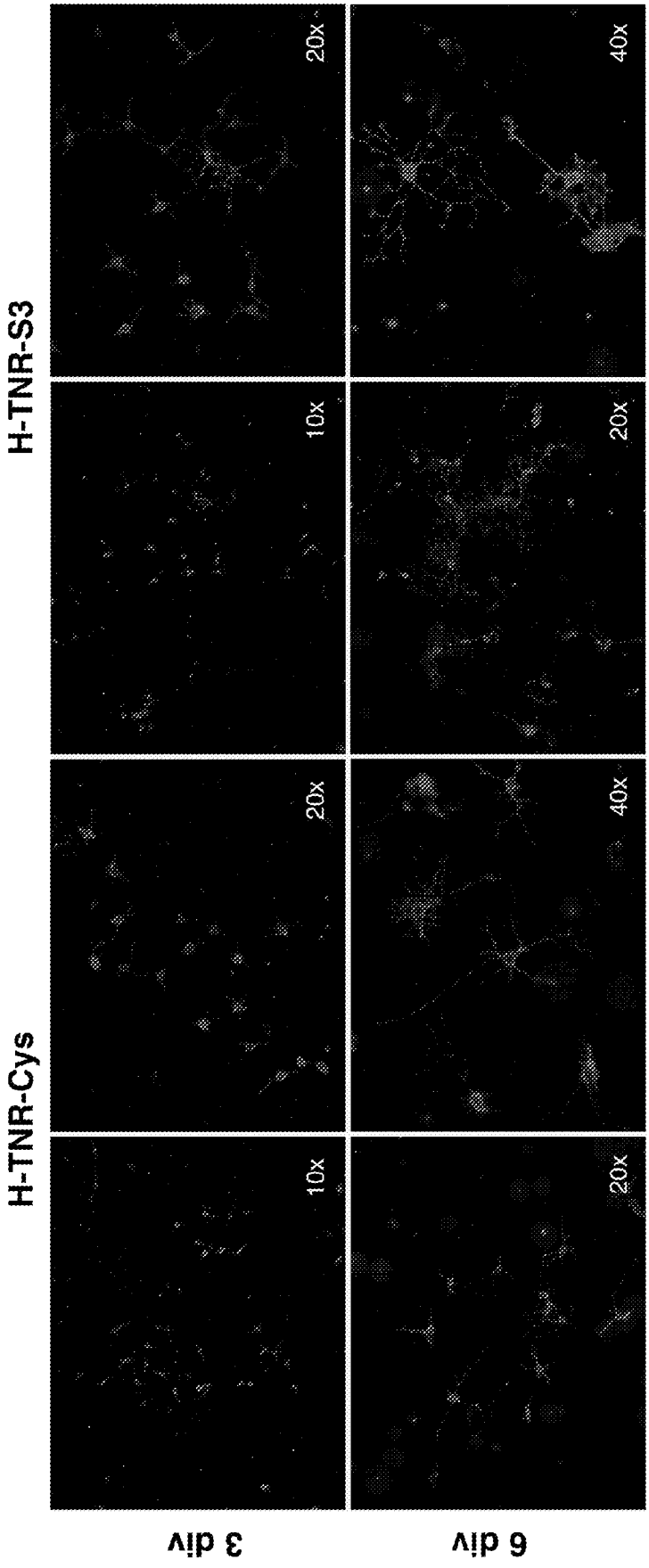


Fig.2

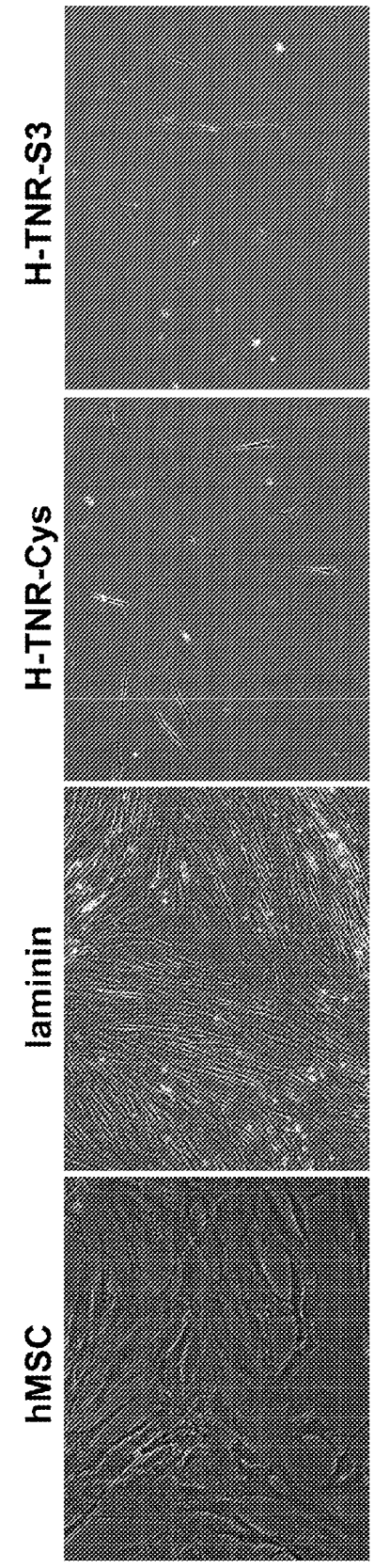


Fig.3A

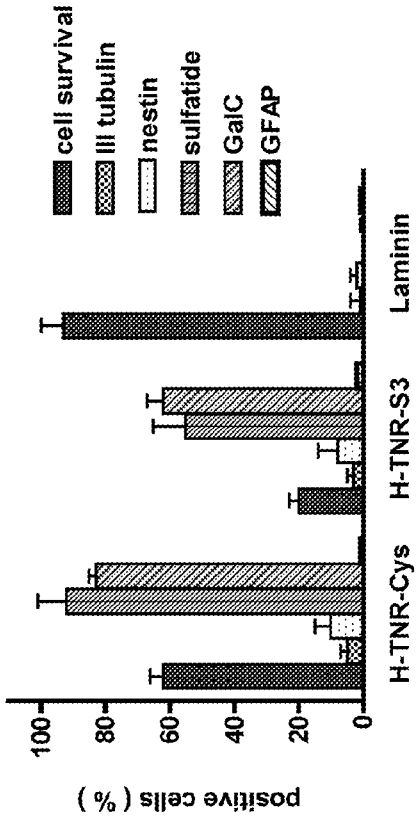


Fig.3B

K-FEE SYSTEM GMBH, EX2009, page 3152
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

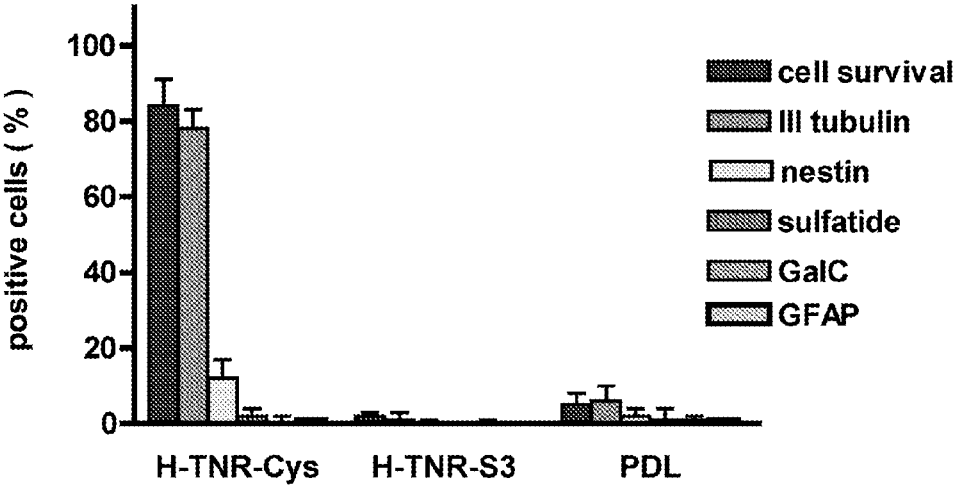

positive cells (%)
100
80
60
40
20
0
H-TNR-Cys
H-TNR-S3
PDL
cell survival
III tubulin
nestin
sulfatide
GalC
GFAP

Fig.3C

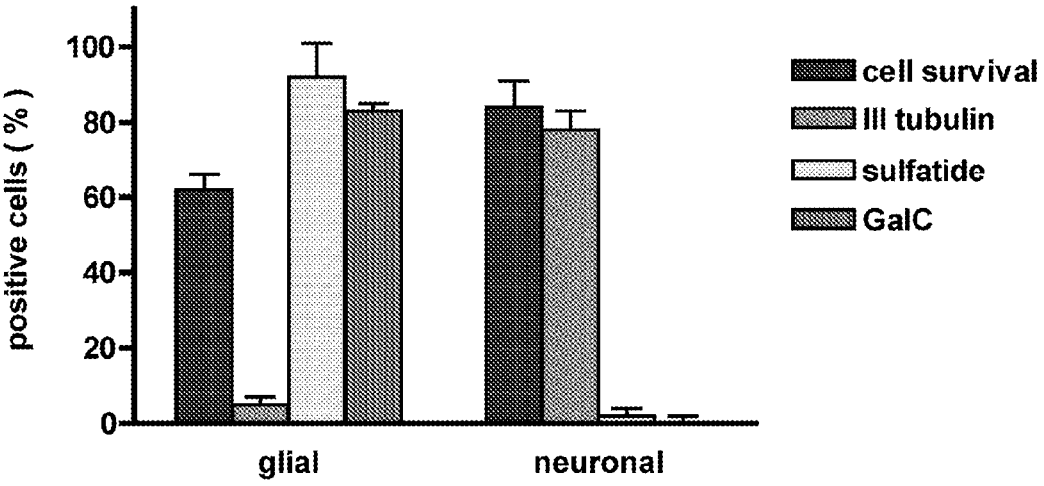

positive cells (%)
100
80
60
40
20
0
glial
neuronal
cell survival
III tubulin
sulfatide
GalC

Fig.3D

TN-R multiple sequence alignment

```
gi|29789028|ref|NP_071707.1|      Mus musculus
gi|6981668|ref|NP_037177.1|       Rattus norvegicus
gi|5730098|ref|NP_003276.2|       Homo sapiens
gi|45384054|ref|NP_990607.1|      Gallus gallus
gi|35902868|ref|NP_919364.1|      Danio rerio

gi|29789028|ref|NP_071707.1|      MGIDGETVVLKNMLIGVNLILLGSMLKPSECRLEVTTERAQRQTVEEEGG 50
gi|6981668|ref|NP_037177.1|       MGIEGETVVLKNMLIGVNLILLGSMLKPSECRLEVTTERVQRQTVEEEGG 50
gi|5730098|ref|NP_003276.2|       MGADGETVVLKNMLIGVNLILLGSMLKPSECQLEVTTERVQRQSVEEEGG 50
gi|45384054|ref|NP_990607.1|      MGTDSENPVLRVVLISFNLLLGAVLKPFECRLFVTTEPAERPAVDEEGG 50
gi|35902868|ref|NP_919364.1|      --MWGCTMAIQGSVVSLALLFFGIQAVPSPTSKLVRTTRVRR-QVPEGGD 47
                                      . . .::. ::.. *:::*    *      * *  ..*  * * *.

gi|29789028|ref|NP_071707.1|      ASSHNTSSKEQPMVFNHVYNINVPLESLCSSGLEASAEQDMSAE----DD 96
gi|6981668|ref|NP_037177.1|       ASSYNTSSKEQPMVFNHVYNINVPLESLCSSGLEASAEQDVSAE----DD 96
gi|5730098|ref|NP_003276.2|       IANYNTSSKEQPVVFNHVYNINVPLDNLCSSGLEASAEQEVSAE----DE 96
gi|45384054|ref|NP_990607.1|      LANCSPPVKEQPMVFHHIYNINVPVDSCCSSMLRSSAE-EVSSE----DD 95
gi|35902868|ref|NP_919364.1|      PADN----QMQPMVFNHVYNINVPVESLCSVDLDAVTGPETNKTASGSDK 93
                                   :.     : **:**:*:******::. **  * : :  : .      *.

gi|29789028|ref|NP_071707.1|      TLAEYIGQTSDHESQVTFTHKINLPKKACPCASSSQVLQELLSRIEMLER 146
gi|6981668|ref|NP_037177.1|       TLAEYTGQTSDHESQVTFTHKINLPKKACPCASSAQVLQELLSRIEMLER 146
gi|5730098|ref|NP_003276.2|       TLAEYMGQTSDHESQVTFTHRINFPKKACPCASSAQVLQELLSRIEMLER 146
gi|45384054|ref|NP_990607.1|      RLAEYTEQTSDSESQVTFTHRINLPKQACKCSTSLPSLQELLSRIEMLER 145
gi|35902868|ref|NP_919364.1|      MPTEYTEETVDSDSQVTFTHRINIPKQACACP-SATTIEQLASRIEMLER 142
                                    :**  :* * :*******:**:**:** *. *   :::* ********

gi|29789028|ref|NP_071707.1|      EVSLLRDQCNTNCCQESAATGQLDYVPHCSGHGNFSFESCGCICNEGWFG 196
gi|6981668|ref|NP_037177.1|       EVSVLRDQCNTNCCQESAATGQLDYVPHCSGHGNFSFESCGCICNEGWFG 196
gi|5730098|ref|NP_003276.2|       EVSVLRDQCNANCCQESAATGQLDYIPHCSGHGNFSFESCGCICNEGWFG 196
gi|45384054|ref|NP_990607.1|      EVSMLRDQCNSNCCQENAATGRLDYTLPCSGHGNFSLESCRCICSEGWAG 195
gi|35902868|ref|NP_919364.1|      EVSLLRTQCSSSCCGESSVMGRLDFVPQCG-IGTFSMEVCGCVCEEGWIG 191
                                  ***:** **.:.** *.:. *:**:   *. **.**:* * *:*.*** *

gi|29789028|ref|NP_071707.1|      KNCSEPYCPLGCSSRGVCVDGQCICDSEYSGDDCSELRCPTDCSSRGLCV 246
gi|6981668|ref|NP_037177.1|       KNCSEPYCPLGCSSRGVCVDGQCICDSEYSGDDCSELRCPTDCSSRGLCV 246
gi|5730098|ref|NP_003276.2|       KNCSEPYCPLGCSSRGVCVDGQCICDSEYSGDDCSELRCPTDCSSRGLCV 246
gi|45384054|ref|NP_990607.1|      SNCSEPRCPRGCSSRGVCLEGQCVCDNDYGGEDCSQLRCPAGCGSRGLCV 245
gi|35902868|ref|NP_919364.1|      KNCTEPRCPDDCSGQGICIEGDCVCDRNFGGENCSEPRCPSDCSDRGLCI 241
                                  .**:** ** .**.:*:*:::*:*:** ::.*::**: ***:.*..****:

gi|29789028|ref|NP_071707.1|      DGECVCEEPYTGEDCRELRCPGDCSGKGQCANGTCLCQEGYAGEDCSQRR 296
gi|6981668|ref|NP_037177.1|       DGECVCEEPYTGEDCRELRCPGDCSGKGQCANGTCLCQEGYAGEDCSQRR 296
gi|5730098|ref|NP_003276.2|       DGECVCEEPYTGEDCRELRCPGDCSGKGRCANGTCLCEEGYVGEDCGQRQ 296
gi|45384054|ref|NP_990607.1|      DGECICEEGFGGEDCSQPRCPRDCSGRGHCDNGTCVCAEGYAGEDCGWLR 295
gi|35902868|ref|NP_919364.1|      DGECVCEEAFAGEDCSLGRCTNDCSDQGACVNGSCQCRSGFTGEDCSLTF 291
                                  ****:*** : ****   **  ***.:* * **:* * .*: ****.

gi|29789028|ref|NP_071707.1|      CLNACSGRGHCQEGLCICEEGYQGPDCSAVAPPEDLRVAGISDRSIELEW 346
gi|6981668|ref|NP_037177.1|       CLNACSGRGHCQEGLCICEEGYQGPDCSAVTPPEDLRVAGISDRSIELEW 346
gi|5730098|ref|NP_003276.2|       CLNACSGRGQCREGLCVCEEGYQGPDCSAVAPPEDLRVAGTSDRSIELEW 346
gi|45384054|ref|NP_990607.1|      CPNACSGRGVCQDGLCICEDGYGGQDCSAVAPPENLRVTGISDGSIELAW 345
gi|35902868|ref|NP_919364.1|      CANNCSQRGVCKEGFCVCQEGYTGDDCTSVLPPMNLRVRGVSENTIDLQW 341
                                  * * ** ** *::*:*:*::** * **::* ** :*** *:*: :*:* *

gi|29789028|ref|NP_071707.1|      DGPMAVTEYVISYQPTALGGLQLQQRVPGDWSGVTIMELEPGLTYNISVY 396
gi|6981668|ref|NP_037177.1|       DGPMAVTEYVISYQP-SLGGLQLQQRVPGDWSGVTITELEPGLTYNISVY 395
gi|5730098|ref|NP_003276.2|       DGPMAVTEYVISYQPTALGGLQLQQRVPGDWSGVTITELEPGLTYNISVY 396
gi|45384054|ref|NP_990607.1|      DSLGAATEYVVSYQPAGPGGSQLQQRVPGDWSTITITELEPGVAYNVSIY 395
gi|35902868|ref|NP_919364.1|      EGPAILTDYLITYEPTTPGGVQLEMRVPGNVTNITIKGLNPGLEYNVNVY 391
                                  :.    *:*:::*:*   ** **: ****: : :**  *:**: **:.:*

gi|29789028|ref|NP_071707.1|      AVISNILSLPITAKVATHLSTPQGLQFKTITETTVEVQWEPFSFSFDGWE 446
gi|6981668|ref|NP_037177.1|       AVISNILSLPITAKVATHLSTPQGLQFKTITETTVEVQWEPFSFSFDGWE 445
gi|5730098|ref|NP_003276.2|       AVISNILSLPITAKVATHLSTPQCLQFKTITETTVEVQWEPFSFSFDGWE 446
gi|45384054|ref|NP_990607.1|      AVISDVLSSPVTTKVTTNLATPQGLKFKTITETTVEVQWEPFSFPFDGWE 445
gi|35902868|ref|NP_919364.1|      AVIDNIISSPMNTLVSTYLSNPDGLLFKSIMETSVEVQWQPLDYLFDGWE 441
                                  ***.:::* *:.: *:* *:.*:** **:* **:*****:*:.: *****
```

```
gi|29789028|ref|NP_071707.1|      ISFIPKNNEGGVIAQLPSDVTSFNQTGLKPGEEYIVNVVALKEQARSPPT 496
gi|6981663|ref|NP_037177.1|       ISFTPKNNEGGVIAQLPSDVTSFNQTGLKPGEEYIVNVVALKEQARGPPT 495
gi|5730093|ref|NP_003276.2|       ISFIPKNNEGGVIAQVPSDVTSFNQTGLKPGEEYIVNVVALKEQARSPPT 496
gi|45384054|ref|NP_990607.1|      ISFIPKNNEGGVIAQLPSTVTTFNQTGLKPGEEYTVTVVALKDQARSPPA 495
gi|35902868|ref|NP_919364.1|      ISFTPKDNDGGMTAQLPSTITSFHQTGLKPGEEYTVNLVALKDQGRSLPV 491
                                  *** **:*:**: **:** :*:*:********** *.:****:*.*. *.

gi|29789028|ref|NP_071707.1|      SASVSTVIDGPTQILVRDVSDTVAFVEWTPPRAKVDFILLKYGLVGGEGG 546
gi|6981663|ref|NP_037177.1|       SASVSTVIDGPTQILVRDVSDTVAFVEWTPPRAKVDFILLKYGLVGGEGG 545
gi|5730093|ref|NP_003276.2|       SASVSTVIDGPTQILVRDVSDTVAFVEWIPPRAKVDFILLKYGLVGGEGG 546
gi|45384054|ref|NP_990607.1|      SDSISTLIDGPTQILVRDVSDTVAFVEWTPPRARVDAILLKYGLADGEGG 545
gi|35902868|ref|NP_919364.1|      TATVTTLIDGPIQLIVRDISDTVAFVEWSPPKAKVDQIILRYGLVGVEGP 541
                                  : :::*:**** *::***:********* **:*:** *:*:***.. **

gi|29789028|ref|NP_071707.1|      KTTFRLQPPLSQYSVQALRPGSRYEVSISAVRGTNESEASSTQFTTEIDA 596
gi|6981663|ref|NP_037177.1|       KTTFRLQPPLSQYSVQALRPGSRYEVSISAVRGTNESDASSTQFTTEIDA 595
gi|5730093|ref|NP_003276.2|       RTTFRLQPPLSQYSVQALRPGSRYEVSVSAVRGTNESDSATTQFTTEIDA 596
gi|45384054|ref|NP_990607.1|      RTTFRLQPPLSQYSLQALRPGARYHLAVSALRGANESQPALAQFTTEIDA 595
gi|35902868|ref|NP_919364.1|      KTTFRLQPTLSQYSLQVLRPGSTYEVSVSGVRNGTESGVISTEFTTEIDA 591
                                  :*******.*****:*.****: *.:::*.:*. .**    ::*******

gi|29789028|ref|NP_071707.1|      PKNLRVGSRTATSLDLEWDNSEAEAQEYKVVYSTLAGEQYHEVLVPKGIG 646
gi|6981663|ref|NP_037177.1|       PKNLRVGSRTATSLDLEWDNSEAEAQEYKVVYSTLAGEQYHEVLVPKGIG 645
gi|5730093|ref|NP_003276.2|       PKNLRVGSRTATSLDLEWDNSEAEVQEYKVVYSTLAGEQYHEVLVPRGIG 646
gi|45384054|ref|NP_990607.1|      PKNLRVGSRTPASLELTWDNSEAEAHSYRVVYSTLAGEHYHEVLVPRDTG 645
gi|35902868|ref|NP_919364.1|      PKNLRVLSKTSISLELEWDNSEADVEGYSVVYSTLAGDQYDKVIVPRNDG 641
                                  ****** *:*. **:* ******:.. * ********::*.:*:**:. *

gi|29789028|ref|NP_071707.1|      PTTKTTLTDLVPGTEYGVGISAVMNSKQSIPATMNARTELDSPRDLMVTA 696
gi|6981663|ref|NP_037177.1|       PTTKTTLTDLVPGTEYGVGISAVMNSKQSIPATMNARTELDSPRDLMVTA 695
gi|5730093|ref|NP_003276.2|       PTTRATLTDLVPGTEYGVGISAVMNSQQSVPATMNARTELDSPRDLMVTA 696
gi|45384054|ref|NP_990607.1|      PTTRATLADLVPGTEYGIGISAVMDSQQSVPATMNARTELDSPRDLLVTA 695
gi|35902868|ref|NP_919364.1|      PSTKTTLNELMPGTEYGIGISAVLGANQSTPATMNARTGLDVPLDLTVTA 691
                                  *:*::** :*:******:*****:.::** ******** ** * ** ***

gi|29789028|ref|NP_071707.1|      SSETSISLIWTKASGPIDHYRITFTPSSGISSEVTVPRDRTSYTLTDLEP 746
gi|6981663|ref|NP_037177.1|       SSETSISLIWTKASGPIDHYRITFTPSSGISSEVTVPRDRTSYTLTDLEP 745
gi|5730093|ref|NP_003276.2|       SSETSISLIWTKASGPIDHYRITFTPSSGIASEVTVPKDRTSYTLTDLEP 746
gi|45384054|ref|NP_990607.1|      STETSISLSWTKAMGPIDHYRVTFTPASGMASEVTVSRNESCLTLSELEP 745
gi|35902868|ref|NP_919364.1|      STDNTITLLWGTVQGPIDHYRVTYTSSSGVTCRLTVPKDVTTTTLTSTQP 741
                                  *::.:*:* * .. *******:*:*.:**:::*:**.:: :  **:.*:*

gi|29789028|ref|NP_071707.1|      GAEYIISITAERGRQQSLESTVDAFTGFRPISHLHFSHVTSSSVNITWSD 796
gi|6981663|ref|NP_037177.1|       GAEYIISITAERGRQQSLESTVDAFTGFRPISHLHFSHVTSSSVNITWSD 795
gi|5730093|ref|NP_003276.2|       GAEYIISVTAERGRQQSLESTVDAFTGFRPISHLHFSHVTSSSVNITWSD 796
gi|45384054|ref|NP_990607.1|      GTEYTISIIAERGRQQSLEATVDAFTGVRPIQLHFSQLTSSSVNITWSD 795
gi|35902868|ref|NP_919364.1|      GTEYTITVAAQRGRQQSTAATIDAFTGFRPIQLFFSEVSSDSLTVAWSS 791
                                  *:** *:: *:******  :*:*****.***::*.**.::*.*:.::**.

gi|29789028|ref|NP_071707.1|      PSPPADRLILNYSPRDKEEDMLEVLLDATKRHAVLMGLQPATEYTVNLVA 846
gi|6981663|ref|NP_037177.1|       PSPPADRLILNYSPRDEEEEMMEVLLDATKRHAVLMGLQPATEYTVNLVA 845
gi|5730093|ref|NP_003276.2|       PSPPADRLILNYSPRDEEEEMMEVSLDATKRHAVLMGLQPATEYTVNLVA 846
gi|45384054|ref|NP_990607.1|      PSPPADRLVLTYSPRD-EEAPQQLALDGTRRHASLIGLRPSTEYLVSLVA 844
gi|35902868|ref|NP_919364.1|      PAPPADAFILNYSAQDSSEDS-EIALDGSKTRITLIGLMPSRRYTATLVT 840
                                  *:**** ::*.**.:* .*   :: **.:: :  * ** *: .* ..**:

gi|29789028|ref|NP_071707.1|      VHGTVTSEPIVGSITTGIDPPKNITISNVTKDSLTVSWSSPVAPFDYYRV 896
gi|6981663|ref|NP_037177.1|       VHGTVTSEPIVGSITTGIDPPKNITISNVTKDSLTVSWSPPVAPFDYYEY 895
gi|5730093|ref|NP_003276.2|       VHGTVTSEPIVGSITTGIDPPKDITISNVTKDSVMVSWSPPVASFDYYRV 896
gi|45384054|ref|NP_990607.1|      VHGAVSSEPVTGSITTGMDAPKDLRVGNITQDSMVIYWSPPVAPFDHYRI 894
gi|35902868|ref|NP_919364.1|      MHGNVTSKPVVGSVNTGMDPPRDITVLYVTEESVTITWIQPLALLDYYRM 890
                                  :** *:*:*:.**:.**:*.*::: :  :*::*: : *  *:* :*:*.

gi|29789028|ref|NP_071707.1|      SYRPTQVGRLDSSVVPNTVTEFAITRLYPATEYEISLNSVRGREESERIC 946
gi|6981663|ref|NP_037177.1|       PID-HPSGRLDSSVVPNTVTEFTITRLYPASQYEISLNSVRGREESERIC 944
gi|5730093|ref|NP_003276.2|       SYRPTQVGRLDSSVVPNTVTEFTITRLNPATEYEISLNSVRGREESERIC 946
gi|45384054|ref|NP_990607.1|      SYR-AAEGRIDSTAIGNDATEYIMRLLQPATKYEIGVKSVRGREESEVAS 943
gi|35902868|ref|NP_919364.1|      SYQ-SSKGRMDSVVIDSDINNYILTSLHPATEYEIKLNAVRGSQESKVIT 939
                                  .      ** ** .: .  .:: :  * **::*** :::*** :**:

gi|29789028|ref|NP_071707.1|      TLVETAMDSPMDLIATNITPTEALLQWKAPMGEVENYVIVLTHFAIAGET 996
gi|6981663|ref|NP_037177.1|       TLVETAMDSPMDLIATNITPTEALLQWKAPMGEVENYVIVLTHFAMAGET 994
gi|5730093|ref|NP_003276.2|       TLVETAMDNPVDLIATNITPTEALLQWKAPVGEVENYVIVLTHFAVAGET 996
gi|45384054|ref|NP_990607.1|      ITTYTAMDAPLGVTATNITPTEALLQWNPPLMDVESYVLVLTR--HTGET 991
```

```
gi|35902868|ref|NP_919364.1|      TTVFTAIDMPAELTALNVTPQGALLRWNPPASSVDNYVLTVTRNQVTADT 989
                                    ..**:* *  : * *:**  ***:*:.*  .*:.**:.:*:   :.:*
gi|29789028|ref|NP_071707.1|      TLVDGVSEEFQLVDLLPSTHYTVTMYATSGPLMSGTTATNFSTLLDPPDN 1046
gi|6981663|ref|NP_037177.1|       ILVDGVSEEFQLVDLLPRTHYTVTMYATSGPLVSGTIATNFSTLLDPPAN 1044
gi|5730093|ref|NP_003276.2|       ILVDGVSEEFRLVDLLPSTHYTATMYATNGPLTSGTISTNFSTLLDPPAN 1046
gi|45384054|ref|NP_990607.1|      ILVDGINQEYQLTNLQPSTTYTVAMYATNGPLTSQTISTNFTTLLDPPTN 1041
gi|35902868|ref|NP_919364.1|      FLVEGNKQEYQLSQLIPSTTYSVALYAIKGPLTSGTVISNFVTPMDAPQN 1039
                                  :**:* .:*::* :* * * *:.::***.*** * *: :** * :*.* *

gi|29789028|ref|NP_071707.1|      LTASEVTRQSALISWQPPRAAIENYVLTYKSTDGSRKELIVDAEDTWIRL 1096
gi|6981663|ref|NP_037177.1|       LTASEVTRQSALISWQPPRAAIENYVLTYKSTDGSRKELIVDAEDTWIRL 1094
gi|5730093|ref|NP_003276.2|       LTASEVTRQSALISWQPPRAEIENYVLTYKSTDGSRKELIVDAEDTWIRL 1096
gi|45384054|ref|NP_990607.1|      LTASEVTRRSALLSWVPPVGDIENYILTYRSTDGSRKELIVDAEDTWIRL 1091
gi|35902868|ref|NP_919364.1|      LTASEINHRSALISWQPPIADIDNYMLTYKAADGSRKELILDAEDTWIRL 1089
                                  *****:.::***:** ** . *:**:***:::********:*********

gi|29789028|ref|NP_071707.1|      EGLSENTDYTVLLQAAQEATRSSLTSTVFTTGGRVFSHPQDCAQHLMNGD 1146
gi|6981663|ref|NP_037177.1|       EGLSENTDYTVLLQAAQEATRSSLTSTIFTTGGRVFSHPQDCAQHLMNGD 1144
gi|5730093|ref|NP_003276.2|       EGLLENTDYTVLLQAAQDTTWSSITSTAFTTGGRVFPHPQDCAQHLMNGD 1146
gi|45384054|ref|NP_990607.1|      EGLSETTQYTVRLQAAQNAMRSGFISTIFTTGGRVFANPQDCAQHLMNGD 1141
gi|35902868|ref|NP_919364.1|      EGLAETTEYTVRLQVARGLETSVIVSTSFTTGNRLFPTPQNCAQHLLNGE 1139
                                  *** *.*:*** **.*:    * : ** ****.*:*. **:*****:**:

gi|29789028|ref|NP_071707.1|      TLSGVYTIFLNGELSHKLQVYCDMTTDGGGWLVFQRRQNGQTDFFRKWAD 1196
gi|6981663|ref|NP_037177.1|       TLSGVYTIFLNGELSHKLQVYCDMTTDGGGWLVFQRRQNGQTDFFRKWAD 1194
gi|5730093|ref|NP_003276.2|       TLSGVYPIFLNGELSQKLQVYCDMTTDGGGWLVFQRRQNGQTDFFRKWAD 1196
gi|45384054|ref|NP_990607.1|      TLSGVYTISINGDLSQRVQVFCDMSTDGGGWLVFQRRQNGLTDFFRKWAD 1191
gi|35902868|ref|NP_919364.1|      TLGGIYTIYVNRDLSQGVQVYCDMTTDGGGWLVFQRRQNGLTDFSRKWID 1189
                                  **.*:*.* :* :**: :**:***:*************** *** ***:*

gi|29789028|ref|NP_071707.1|      YRVGFGNLEDEFWLGLDNIHRITAQGRYELRVDMRDGQEAVFAYYDKFAV 1246
gi|6981663|ref|NP_037177.1|       YRVGFGNLEDEFWLGLDNYHRITAQGRYELRVDMRDGQEAVFAYYDKFAV 1244
gi|5730093|ref|NP_003276.2|       YRVGFGNVEDEFWLGLDNIHRITSQGRYELRVDMRDGQEAAFASYDRFSV 1246
gi|45384054|ref|NP_990607.1|      YRVGFGNLEDEFWLGLDNIHKITSQGRYELRLDMRDGQEAAYAYYDKFSV 1241
gi|35902868|ref|NP_919364.1|      YKIGFGSLEDEFWLGLDNIHKIAAQGRYELRLDMKDGQESVYANYDRFSI 1239
                                  *::***.:********** *:*::*******:**:****:.:* **:*::

gi|29789028|ref|NP_071707.1|      EDSRSLYKIRIGSYNGTAGDSLSYHQGRPFSCEDRDNDVAVTNCAMSYKG 1296
gi|6981663|ref|NP_037177.1|       EDSRSLYKLRIGGYNGTAGDSLSYHQGRPFSCEDRDNDVAVTNCAMSYKG 1294
gi|5730093|ref|NP_003276.2|       EDSRNLYKLRIGSYNGTAGDSLSYHQGRPFSCEDRDNDVAVTNCAMSYKG 1296
gi|45384054|ref|NP_990607.1|      GDSRSLYKLRIGDYNGTSGDSLTYHQGRPFSCKDRDNDVAVTNCAMSYKG 1291
gi|35902868|ref|NP_919364.1|      GDSKSLYKLRIGEYSGTAGDSLSYHQSRPFSCKDKDNDIAVTNCALSYKG 1289
                                   **:.***:*** *.**:****:***.*****:*:***:******:****

gi|29789028|ref|NP_071707.1|      AWWYKNCHRTNLNGKYGESRHSQGINWYHWKGHEFSIPFVEMKMRPYIHR 1346
gi|6981663|ref|NP_037177.1|       AWWYKNCHRTNLNGKYGESRHSQGINWYHWKGHEFSIPFVEMKMRPYIHR 1344
gi|5730093|ref|NP_003276.2|       AWWYKNCHRTNLNGKYGESRHSQGINWYHWKGHEFSIPFVEMKMRPYNHR 1346
gi|45384054|ref|NP_990607.1|      AWWYKNCHRTNLNGKYGESRHSQGINWYHWKGHEFSIPFVEMKMRPYNHR 1341
gi|35902868|ref|NP_919364.1|      AWWYKNCHRANLNGKYGESRHSQGINWYHWKGHEFSIPFVEMKMRPYNYR 1339
                                  *********:**********************************: :*

gi|29789028|ref|NP_071707.1|      LTAGRKRRALKF 1358
gi|6981663|ref|NP_037177.1|       LTAGRKRRALKF 1356
gi|5730093|ref|NP_003276.2|       LMAGRKRQSLQF 1358
gi|45384054|ref|NP_990607.1|      NISGRKRRSLQL 1353
gi|35902868|ref|NP_919364.1|      SISCKRRRSAH- 1350
                                    :*::*:: :
```

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/062024

A. CLASSIFICATION OF SUBJECT MATTER
INV. C07K14/435

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C07K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, BIOSIS, EMBASE, Sequence Search

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2006/067094 A (UNIV BONN [DE]; PESHEVA PENKA [DE]) 29 June 2006 (2006-06-29) cited in the application * H-TNR-S1 * page 32 - page 33	1-25
Y	XIAO ZHI-CHENG ET AL: "Distinct effects of recombinant tenascin-R domains in neuronal cell functions and identification of the domain interacting with the neuronal recognition molecule F3/11" EUROPEAN JOURNAL OF NEUROSCIENCE, OXFORD UNIVERSITY PRESS, GB, vol. 8, no. 4, 1 January 1996 (1996-01-01), pages 766-782, XP002378375 ISSN: 0953-816X page 767 - page 768	1-25

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 Oktober 2009	10/11/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Hillenbrand, Guenter

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	XIAO ZHI-CHENG ET AL: "Tenascin-R is a functional modulator of sodium channel beta subunits" JOURNAL OF BIOLOGICAL CHEMISTRY, vol. 274, no. 37, 10 September 1999 (1999-09-10), pages 26511-26517, XP002541748 ISSN: 0021-9258 figure 3	1-25
Y	XIAO ZHI-CHENG ET AL: "Signaling events following the interaction of the neuronal adhesion molecule F3 with the N-terminal domain of tenascin-R" JOURNAL OF NEUROSCIENCE RESEARCH, vol. 49, no. 6, 1997, pages 698-709, XP002541749 ISSN: 0360-4012 the whole document	1-25
Y	LIAO HONG ET AL: "Tenascin-R plays a role in neuroprotection via its distinct domains that coordinate to modulate the microglia function" JOURNAL OF BIOLOGICAL CHEMISTRY, AMERICAN SOCIETY OF BIOLOCHEMICAL BIOLOGISTS, BIRMINGHAM, US, vol. 280, no. 9, 22 December 2004 (2004-12-22), pages 8316-8323, XP002378376 ISSN: 0021-9258 the whole document	1-25
A	WO 2004/052922 A (SINGAPORE GENERAL HOSPITAL PTE [SG]; XIAO ZHI-CHENG [SG]; DENISON CHRI) 24 June 2004 (2004-06-24) * 100% identity in 65 aa overlap of SEQ ID NO: 2 (24-189) with SEQ ID NO: 9 (125-329 - 205 aa) and 100% identity in 375 nt overlap of SEQ ID NO: 1 (151-648) with SEQ ID NO: 14 (454-1068 - 615 nt) *	10-20

K-FEE SYSTEM GMBH, EX2009, page 3158
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2009/062024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2006067094 A	29-06-2006	DE 102004062420 A1	06-07-2006
		EP 1828238 A1	05-09-2007
WO 2004052922 A	24-06-2004	AU 2003288434 A1	30-06-2004
		CA 2508847 A1	24-06-2004
		CN 1745094 A	08-03-2006
		EP 1567545 A2	31-08-2005
		JP 2006526382 T	24-11-2006
		KR 20050092366 A	21-09-2005

K-FEE SYSTEM GMBH, EX2009, page 3159
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP2009/062024

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
INV. C07K14/435

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
C07K

Recherchierte, aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)
EPO-Internal, BIOSIS, EMBASE, Sequence Search

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
Y	WO 2006/067094 A (UNIV BONN [DE]; PESHEVA PENKA [DE]) 29. Juni 2006 (2006-06-29) in der Anmeldung erwähnt * H-TNR-S1 * Seite 32 - Seite 33	1-25
Y	XIAO ZHI-CHENG ET AL: "Distinct effects of recombinant tenascin-R domains in neuronal cell functions and identification of the domain interacting with the neuronal recognition molecule F3/11" EUROPEAN JOURNAL OF NEUROSCIENCE, OXFORD UNIVERSITY PRESS, GB, Bd. 8, Nr. 4, 1. Januar 1996 (1996-01-01), Seiten 766-782, XP002378375 ISSN: 0953-816X Seite 767 - Seite 768	1-25

-/--

[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen [X] Siehe Anhang Patentfamilie

* Besondere Kategorien von angegebenen Veröffentlichungen :
"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist
"E" älteres Dokument, das jedoch erst am oder nach dem internationalen Anmeldedatum veröffentlicht worden ist
"L" Veröffentlichung, die geeignet ist, einen Prioritätsanspruch zweifelhaft erscheinen zu lassen, oder durch die das Veröffentlichungsdatum einer anderen im Recherchenbericht genannten Veröffentlichung belegt werden soll oder die aus einem anderen besonderen Grund angegeben ist (wie ausgeführt)
"O" Veröffentlichung, die sich auf eine mündliche Offenbarung, eine Benutzung, eine Ausstellung oder andere Maßnahmen bezieht
"P" Veröffentlichung, die vor dem internationalen Anmeldedatum, aber nach dem beanspruchten Prioritätsdatum veröffentlicht worden ist
"T" Spätere Veröffentlichung, die nach dem internationalen Anmeldedatum oder dem Prioritätsdatum veröffentlicht worden ist und mit der Anmeldung nicht kollidiert, sondern nur zum Verständnis des der Erfindung zugrundeliegenden Prinzips oder der ihr zugrundeliegenden Theorie angegeben ist
"X" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann allein aufgrund dieser Veröffentlichung nicht als neu oder auf erfinderischer Tätigkeit beruhend betrachtet werden
"Y" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als auf erfinderischer Tätigkeit beruhend betrachtet werden, wenn die Veröffentlichung mit einer oder mehreren anderen Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese Verbindung für einen Fachmann naheliegend ist
"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
29. Oktober 2009	10/11/2009

Name und Postanschrift der Internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Hillenbrand, Guenter

Formblatt PCT/ISA/210 (Blatt 2) (April 2005)

C. (Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
Y	XIAO ZHI-CHENG ET AL: "Tenascin-R is a functional modulator of sodium channel beta subunits" JOURNAL OF BIOLOGICAL CHEMISTRY, Bd. 274, Nr. 37, 10. September 1999 (1999-09-10), Seiten 26511-26517, XP002541748 ISSN: 0021-9258 Abbildung 3	1-25
Y	XIAO ZHI-CHENG ET AL: "Signaling events following the interaction of the neuronal adhesion molecule F3 with the N-terminal domain of tenascin-R" JOURNAL OF NEUROSCIENCE RESEARCH, Bd. 49, Nr. 6, 1997, Seiten 698-709, XP002541749 ISSN: 0360-4012 das ganze Dokument	1-25
Y	LIAO HONG ET AL: "Tenascin-R plays a role in neuroprotection via its distinct domains that coordinate to modulate the microglia function" JOURNAL OF BIOLOGICAL CHEMISTRY, AMERICAN SOCIETY OF BIOLOCHEMICAL BIOLOGISTS, BIRMINGHAM, US, Bd. 280, Nr. 9, 22. Dezember 2004 (2004-12-22), Seiten 8316-8323, XP002378376 ISSN: 0021-9258 das ganze Dokument	1-25
A	WO 2004/052922 A (SINGAPORE GENERAL HOSPITAL PTE [SG]; XIAO ZHI-CHENG [SG]; DENISON CHRI) 24. Juni 2004 (2004-06-24) * 100% identity in 65 aa overlap of SEQ ID NO: 2 (24-189) with SEQ ID NO: 9 (125-329 - 205 aa) and 100% identity in 375 nt overlap of SEQ ID NO: 1 (151-648) with SEQ ID NO: 14 (454-1068 - 615 nt) *	10-20

K-FEE SYSTEM GMBH, EX2009, page 3161
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationales Aktenzeichen
PCT/EP2009/062024

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
WO 2006067094 A	29-06-2006	DE 102004062420 A1	06-07-2006
		EP 1828238 A1	05-09-2007
WO 2004052922 A	24-06-2004	AU 2003288434 A1	30-06-2004
		CA 2508847 A1	24-06-2004
		CN 1745094 A	08-03-2006
		EP 1567545 A2	31-08-2005
		JP 2006526382 T	24-11-2006
		KR 20050092366 A	21-09-2005

K-FEE SYSTEM GMBH, EX2009, page 3162
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

APPENDIX G

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 December 2001 (27.12.2001)

PCT

(10) International Publication Number
WO 01/99047 A1

(51) International Patent Classification[7]: G06K 19/06

(21) International Application Number: PCT/GB01/02720

(22) International Filing Date: 20 June 2001 (20.06.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0015222.3 21 June 2000 (21.06.2000) GB

(71) Applicant *(for all designated States except US)*: **MONEY CONTROLS PLC** [GB/GB]; Coin House, New Coin Street, Royton, Oldham OL2 6JZ (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **D'HAENS, Joseph, Paul, Mariette** [BE/BE]; Liersesteenweg 100, B-2520 Ranst-Emblem (BE). **JANSEN, Jan** [BE/BE]; No. 38, B-2200 Noorderwijk (BE). **BELL, Malcolm, Reginald, Hallas** [GB/GB]; 9 Foxhill Green, Westwood, Leeds LS16 5PQ (GB).

(74) Agents: **GEARY, Stuart, Lloyd** et al.; Venner, Shipley & Co., 20 Little Britain, London EC1A 7DH (GB).

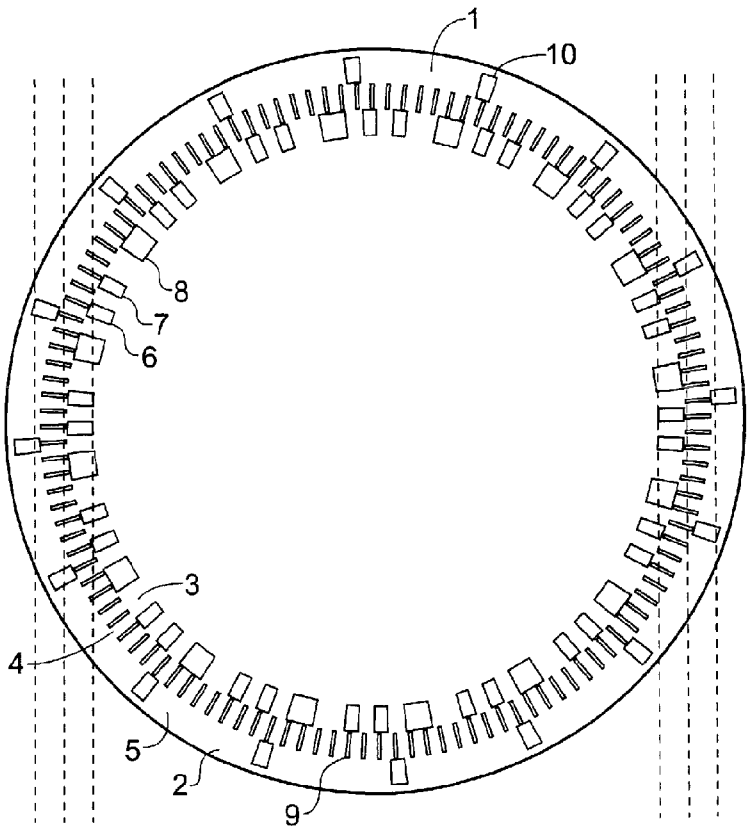
(81) Designated States *(national)*: AU, JP, US, ZA.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: BAR CODE SYSTEM



(57) Abstract: A bar code comprises a data track (3; 104; 205; 304) and a clock track (4; 103; 204; 303). The separate clock track (4; 103; 204; 303) means that the sampling of the data track (3; 104; 205; 304) can be synchronised with the movement of the bar code. The addition of a reference track (5; 105; 206) enables the forming of the bar code into a ring containing a plurality of repetitions of the encoded data. The bar codes may form a continuous ring themselves or be discrete blocks arranged in a ring. Consequently, a coin-like object (1; 101; 201), such as a coin or a token, can be marked with the bar code and the bar code can be read as the coin-like object (1; 101; 201) falls past an optical sensing station (26, 27; 226, 227) with sensors for reading respectively the clock data and reference tracks.

WO 01/99047 A1

K-FEE SYSTEM GMBH, EX2009, page 3164
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Bar Code System

Field of the Invention

The present invention relates to a method of bar coding an object comprising forming a data pattern on an object, and forming a clock pattern on the object, the clock pattern being aligned with the data pattern for providing a data pattern sampling signal and to a bar-coded object, e.g. a sheet or a coin-like object, having a data pattern and a clock pattern formed as concentric rings, the clock pattern being aligned with the data pattern for providing a data pattern sampling reference.

Background to the Invention

Bar codes are well known and are widely used for marking objects with machine-readable information. Everyone is familiar with the bar codes found on groceries for instance.

Conventional 1-dimensional bar codes suffer from the problem that the object carrying the bar code must be oriented correctly for a bar code scanner to be able to read the bar code. Consequently, bar codes have not been successfully used on objects that can have an arbitrary orientation during handling, for example tokens or coins in an acceptor, CDs and CD-ROMs, without special means being provided to put the object into the correct orientation for reading of the bar code. However, the provision of such special means is itself undesirable and a disincentive to the use of bar codes on arbitrarily orientable objects because of the mechanical complexity that would be introduced into the object handling apparatus.

A circular barcode including an inner data patter and an outer clock pattern is described in GB-A-1218349. However, the described bar code cannot be read at arbitrary orientations while moving linearly. Instead, the code must be rotated through 360°.

Summary of the Invention

A bar-coded object according to the present invention is characterised in that the data pattern comprises a plurality of repetitions of the same information arranged in a ring such

that a complete instance of said information can be obtained from a single chordal scan through the data pattern without limitation on the direction of said scan.

A bar-coded object according to the present invention is characterised in that the data pattern comprises a plurality of repetitions of the same information arranged in a ring such that a complete instance of said information can be obtained from a single chordal scan through the data pattern without limitation on the direction of said scan.

Thus, since the clock pattern moves with the data pattern, it can be used to trigger sampling of the data pattern. Consequently, the process of reading of the data is not affected by variations in the speed of the object. Furthermore, the barcode can read regardless of the orientation of the object about the axis passing perpendicularly through the centre of the bar code rings.

The patterns are preferably optically readable. However, the patterns may be, for example, magnetically readable.

The data pattern elements are preferably binary in nature. However, a multilevel code could be used.

The clock pattern and the or each data pattern may be formed as concentric rings. In this case, the data pattern is preferably located inwards of the clock pattern and a substantially circular reference pattern is optionally formed concentric with the clock pattern, the reference pattern identifying the start of each repetition of said information. An alternative to the use of a reference pattern is the use of a characteristic "start" code at the beginning of each repetition of the data pattern. If a reference pattern is used, the data pattern is preferably located within the clock pattern and the clock pattern is preferably located inwards of the reference pattern. Alternatively, the clock pattern may be located within the data pattern and the data pattern is located inwards of the reference pattern.

The presence of some form of "start" making means that, as long as all of the elements required for one instance of the information are read, even if the end part is read before the beginning, the start of the information can be found when reading the data pattern and the

information recovered.

The patterns need not themselves be ring-shaped. Instead, the each repetition of the information may lie on a chord of a ring, preferably parallel to and alongside the clock pattern. Advantageously, the start of each repetition is marked.

According to the present invention, there is provided a method of forming a coin-like object, e.g. a coin or a token, including bar coding the object by a method according to the present invention.

According to the present invention, there is provided a method of reading a bar-coded object according to the present invention, the method comprising scanning said patterns simultaneously and determining the values of data pattern elements at times defined by said clock pattern.

For coin-like or substantially disc-shaped objects, the reading method preferably comprises simultaneously scanning said patterns chordally and determining the values of the data pattern elements at times defined by said clock pattern.

According to the present invention, there is provided a bar code reading apparatus for reading a bar code on an object according to the present invention, the apparatus comprising scanning means for simultaneously scanning said patterns chordally and means for determining the values of data pattern elements at times defined by said clock pattern.

Processing means may be included for re-ordering said pattern element values to recover said information. In this case, the processing means is preferably configured for identifying a start position and, if necessary, moving one or more bits from before the start position to a position after the start position.

Preferably, another part of each of the patterns is simultaneously scanning chordally also, the values of the data elements obtained in each scanning of the data pattern are compared and an error condition is signalled if there is a mismatch between information represented by the values obtained from said scans of the data pattern.

The or each scanning may be performed by guiding a bar-coded object past a fixed sensor station.

Preferably, a first sensor is used for sensing the data pattern, a second sensor is used for sensing the clock pattern and a third sensor is used for sensing a start position reference.

Processing means may be configured such that a representation of said information is built from the output of the first sensor and cleared in dependence on the output of the third sensor. Preferably, the processing means counts pattern elements during said building and resets the pattern element count in dependence on the output of the third sensor. More preferably, the processing means is configured to produce an output if said reference meets a predetermined criterion when the pattern element count is at a threshold value.

A bar code reading apparatus according to the present invention may be used in a validator for coin-like objects.

Brief Description of the Drawings

Figure 1 shows a first bar-coded object according to the present invention in a first orientation;

Figure 2 shows the first bar-coded object of Figure 1 in a second orientation;

Figure 3 is an exaggerated, partial sectional view of the object of Figure 1;

Figure 4 is a side sectional view of part of the coin path of a coin validator according to the present invention with a coin-like object present;

Figure 5 is a side sectional view of part of the coin path of a coin validator according to the present invention without a coin-like object being present;

Figure 6 is a partially cut away front view of the coin validator of Figure 4;

Figure 7 is a block diagram of the optical signal processing circuitry of the coin validator of Figure 4;

Figure 8 is a set of flowcharts illustrating the operation of the bar code processing of the validator of Figure 4;

Figure 9 is a waveform diagram illustrating the operation of the circuit of Figure 7 with the object as shown in Figure 1;

Figure 10 is a waveform diagram illustrating the operation of the circuit of Figure 7 with the object as shown in Figure 2;

Figure 11 shows a second bar-coded object according to the present invention;

Figure 12 is a waveform diagram illustrating the signals obtained by optically sensing the object of Figure 11;

Figure 13 shown a third bar-coded object according to the present invention in a first orientation;

Figure 14 shows the third bar-coded object of Figure 13 in a second orientation;

Figure 15 is a side sectional view of part of the coin path of a coin validator according to the present invention with a coin-like object present;

Figure 16 is a side sectional view of part of the coin path of the coin validator of Figure 15 without a coin-like object being present;

Figure 17 is a partially cut away front view of the coin validator of Figure 15;

Figure 18 is a block diagram of the optical signal processing circuitry of the coin validator of Figure 15;

Figure 19 is a set of flowcharts illustrating the operation of the bar code processing of the validator of Figure 18;

Figure 20 is a waveform diagram illustrating the operation of the circuit of Figure 18 with the third object as shown in Figure 13; and

Figure 21 is a waveform diagram illustrating the operation of the circuit of Figure 18 with the third object as shown in Figure 14.

Detailed Description of Preferred Embodiments

Embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings.

Referring to Figures 1 and 2, a bar-coded token 1 according to the present invention comprises a disc-shaped substrate 2. Three rings of "light" and "dark" markings 3, 4, 5 are formed concentrically on the substrate 2. The inner ring 3 comprises a repeating pattern of dark markings 6, 7, 8 on a light background. The circumferential extent of each of the dark markings 6, 7, 8 is defined by a pair of radii of the inner ring 3 so that they taper towards its middle. In the present example, the inner ring 3 comprises sixteen repetitions of the binary code for "83".

The middle ring 4 comprises 128 equispaced, dark radial bars 9 on a light background. The dark radial bars 9 are all the same size and significantly narrower than the widest part of the 1-bit dark markings 6, 7 in the inner ring 3. The purpose of the middle ring 4 is to provide a "clock" signal for the sampling of the bits of the inner and outer ring patterns 3, 5.

The outer ring 5 comprises 16 equispaced bars 10 which are broadened radial extensions of respective bars 8 of the middle ring 4. The purpose of the bars 10 in the outer ring 5 is to mark the start of each pattern repetition in the inner ring 3.

Referring to Figure 3, the "dark" markings (an outer ring marking 10 is shown) comprise depressions in the substrate 2, which in this example is metallic and therefore inherently reflective. These depressions are prism-shaped with their axes extending radially with respect to the substrate 2. The angles α, β, γ at the edges of the prism-shaped depressions are chosen so as to avoid retroreflection. In the example shown, angles α and γ are 30° and angle β is 120°. Consequently, a sensor positioned beside the source of a beam 11 incident perpendicularly on the substrate 2 will be avoided by the reflected beams 12, 13 from a depression.

Referring to Figures 4, 5 and 6, a validator for coin-like objects 1 has a vertical coin path 21 defined by front and back walls 22, 23 and first and second side walls 24, 25. Left and right sensor stations 26, 27 are mounted to the front wall 22. The left sensor station 26 is located at the left side of the front wall 22 and comprises three light emitting diode units 28a, 28b, 28c alternating with three photo-sensors 29a, 29b, 29c. The right sensor station 17 is located at the right side of the front wall and is similarly constructed with three light emitting diode units 30a, 30b, 30c and three photo-sensors 31a, 31b, 31c. It is preferred that at least the middle light emitting diode unit 28b, 30b of each sensor station 26, 27 emits a beam which is narrower than the circumferential width of the "dark" markings 9 of the middle ring 4. A laser diode may be usefully employed for this purpose, and indeed for the other light emitting diode units 28a, 28c, 30a, 30c. The narrower beam produces sharper transitions in the output signals of the corresponding photo-sensor. Sharp transitions are particularly desirable in the case of the clock markings in the middle

ring because, as will be seen, it is the light-to-dark transitions of the clock ring 4 that trigger sampling of the photo-sensor signals for the inner and outer rings 3, 5.

A strip 32 of retroreflective material is affixed across the back wall 23 to reflect light from the light emitting diode units 28a, 28b, 28c, 30a, 30b, 30c back to the photo-sensor 29a, 29b, 29c, 31a, 31b, 31c in the absence of a coin-like object 1.

An infrared light-emitting diode (LED) 33 is mounted in the first side wall 24 and an infrared light sensor 34 is mounted in the second side wall 25 directly opposite the LED 33. The LED 33 and the light sensor 34 are for detecting the passage of a coin-like object 1 and are located above the sensor stations 26, 27 such that the beam 35 from the LED 33 to the light sensor 34 ceases to be broken by a coin-like object 1 when the sensor stations 26, 27 can no longer properly detect the rings 3, 4, 5 on the coin-like object 1.

The coin path 21 is dimensioned so that it is just wide and thick enough for the coin-like object 1 to fall freely therein.

Referring again to Figures 1 and 2, the dashed lines indicate the "tracks" of the photo-sensors 29a, 29b, 29c, 31a, 31b, 31c as the coin-like object 1 falls past the sensor stations 26, 27.

Referring to Figure 7, the optical signal processing circuit of the validator comprises a microcontroller 41, seven signal conditioning circuits 42, ..., 48, four latches 49, 50, 51, 52 and an inverter 61. The microcontroller 41 has at least first to fourth 1-bit inputs 53, 54, 55, 56 and at least first to fourth rising edge triggered interrupt ports 57, 58, 59, 60.

The first signal conditioning circuit 42 is connected between the light sensor 34 and the first interrupt port 57. The output of the first signal conditioning circuit 42 is also connected to the input of the inverter 61. The output of the inverter 61 is connected to the fourth interrupt port 60. The first signal conditioning circuit 42 squares and inverts the output of the light sensor 34. A delay may need to be

interposed between the inverter 61 and the fourth interrupt port 60 to ensure that processing is not terminated while the bar code patterns are still being sensed by the left and right sensor stations 26, 27.

The second signal conditioning circuit 43 is connected between the first photo-sensor 29a of the left sensor station 26 and the data input of the first latch 49. The output of the first latch 49 is connected to the first 1-bit input 53. The second signal conditioning circuit 43 squares and inverts the output of the first photo-sensor 29a of the left sensor station 26.

The third signal conditioning circuit 44 is connected between the second photo-sensor 29b of the left sensor station 26 and the second interrupt port 58. The output of the third signal conditioning circuit 44 is also connected to the clock inputs of the first and second latches 49, 50. The third signal conditioning circuit 44 squares and inverts the output of the second photo-sensor 29b of the left sensor station 26 before applying it to the second interrupt port 58.

The fourth signal conditioning circuit 45 is connected between the third photo-sensor 29c of the left sensor station 26 and the data input of the second latch 50. The output of the second latch 50 is connected to the second 1-bit input 54. The fourth signal conditioning circuit 45 squares and inverts the output of the third photo-sensor 29c of the left sensor station 26.

The fifth signal conditioning circuit 46 is connected between the first photo-sensor 31a of the right sensor station 27 and the data input of the third latch 51. The output of the third latch 51 is connected to the third 1-bit input 55. The fifth signal conditioning circuit 46 squares and inverts the output of the first photo-sensor 31a of the right sensor station 27.

The sixth signal conditioning circuit 47 is connected between the second photo-sensor 31b of the right sensor station 27 and the third interrupt port 59. The output of the signal conditioning circuit 47 is also connected to the clock inputs of the third and fourth latches 51, 52. The sixth signal conditioning circuit 47 squares

the output of the second photo-sensor 31b of the right sensor station 27 before applying it to the third interrupt port 59.

The seventh signal conditioning circuit 48 is connected between the third photo-sensor 31c of the right sensor station 27 and the data input of the fourth latch 52. The output of the fourth latch 52 is connected to the fourth 1-bit input 56. The seventh signal conditioning circuit 48 squares and inverts the output of the third photo-sensor 31c of the right sensor station 27.

The microcontroller 41 also has a control output to an accept gate (not shown) of the validator.

The operation of the validator with the coin-like object 1 will now be described.

Figures 9(a) and 10(a) show the output of the first signal conditioning circuit 42 as the object 1 passes. Figures 9(b) and 10(b) show the output of the third signal conditioning circuit 44 as the object 1 passes, oriented as shown in Figures 1 and 2 respectively. Figures 9(c) and 10(c) show the output of the second signal conditioning circuit 43 as the object 1 passes, oriented as shown in Figures 1 and 2 respectively. Figures 9(d) and 10(d) show the output of the fourth signal conditioning circuit 45 as the object 1 passes, oriented as shown in Figures 1 and 2 respectively. Figures 9(e) and 10(e) show the data read in by the microcontroller 41 with the object 1 oriented as shown in Figures 1 and 2 respectively.

Referring to Figures 9 and 10, the microcontroller 41 is alerted to the coin-like object 1 being in the coin path 11 by the output of the first signal conditioning circuit 42 going high (see Figures 9(a) and 10(a)). The microcontroller 41 responds by performing a first interrupt routine (see Figure 8(a)). The first interrupt routine includes setting left and right counts to zero (steps s1 and s2) and setting left and right start and stop bit positions to a default value (99 in this case) (steps s3 and s4).

As the coin-like object 1 progresses down the coin path 11, it encounters the beams from the laser diode units 28a, 28b, 28c, 30a, 30b, 30c and reflects them to the

respective photo-sensors 29a, 29b, 29c, 31a, 31b, 31c. Thus, reflections from the coin-like object 1 replace reflections from the retroreflective strip 32 (Figures 4 and 5).

Until the output of the first signal conditioning circuit 42 changes state again, the operation of the circuit of Figure 7 is controlled by the outputs (Figures 9(b) and 10(b)) of the middle photo-sensors 29b, 31b of the left and right sensor stations 26, 27.

Considering the case of the left sensor station 26, each time the output of the second photo-sensor 29b goes low, the output of the third signal conditioning circuit 44 goes high. This causes the outputs of the second and fourth signal (Figures 9(c) and (d) and 10(c) and (d)) conditioning circuits 43, 45 to be loaded into the first and second latches 49, 50. The second interrupt port 58 detects the rising edge as the output of the third signal conditioning circuit 44 goes high and initiates a second interrupt routine (Figure 8(b)). Latching the outputs (Figures 9(e) and 10(e)) of the second and fourth signal conditioning circuits 43, 45 ensures that the desired photo-sensor output values is maintained until the first interrupt routine has been able to read the first and second 1-bit ports 53, 54, irrespective of any actual changes in the photo-sensor outputs.

In the second interrupt routine, the microcontroller 41 first reads (step s11) and stores (step s12) the values (1 or 0) at the first and second 1-bit ports 43, 44. The first and second 1-bit ports 43, 44 may be elements of a single 8-bit port, in which case reading these ports is a single operation.

After reading the first and second 1-bit ports 43, 44, the microcontroller 41 increments the left count (step s13). If the first 1-bit port's value was 1 (step s14) and the left start bit position (LeftStart) value is 99 (step s15), the microcontroller 41 assigns the left count value to the left start bit position (step s16). Otherwise, the first 1-bit port's value is assigned to the left stop bit position (LeftStop) (step s17). The second 1-bit port's value is stored in the elements of an array indexed by the left count value (step s18).

Considering now the case of the right sensor station 27, each time the output of the second photo-sensor 31b goes high, the output of the sixth signal conditioning circuit 47 goes high. This causes the outputs of the fifth and seventh signal conditioning circuits 46, 48 to be loaded into the third and fourth latches 51, 52. The third interrupt port 59 detects the rising edge as the output of the sixth signal conditioning circuit 47 goes high and initiates a third interrupt routine (Figure 8(c)).

In the third interrupt routine, the microcontroller 41 first reads (step s21) and stores the values (1 or 0) at the third and fourth 1-bit ports 55, 56 (step s22).

After reading the third and fourth 1-bit ports 55, 56, the microcontroller 41 increments the right count (step s23). If the fourth 1-bit port's value was 1 (step s24) and the right stop bit position value is 99 (step s25), the microcontroller 41 assigns the right count value to the right stop bit position (RightStop) (step s26). Otherwise, the third 1-bit port's value is assigned to the right start bit position (RightStart) (step s27). The fourth 1-bit port's value is stored in the elements of another array indexed by the right count value (step s28).

When the coin-like object 1 completes its passage through the light beam 35, the light sensor 34 is again illuminated and the output of the first signal conditioning circuit 42 goes low, causing the output of the inverter 61 to go high. This triggers a fourth interrupt routine (Figure 8(d)).

In the fourth interrupt routine, the microcontroller 41 processes the signals from the sensor stations 26, 27.

Starting with the left sensor station 26, the microcontroller 41 determines whether a stop bit was detected by determining whether the stop bit value equals 99 (step s41). If not, i.e. a stop bit was found, as would be the case with the object shown in Figure 1, the microcontroller 41 enters a loop (steps s42, s43 and s44) in which the data is reassembled thus: -

(pseudocode)

```
for i := 0 to NumberOfDataBits - 1 do
begin
        for j := 0 to i do
                LeftResult := leftshift(DataArray[i])
end
```

Otherwise, for instance in the case of the object as shown in Figure 2, the microcontroller 41 enters another loop (steps s45, s46 and s47) in which the data is reassembled thus:-

(pseudocode)

```
for i := 0 to NumberOfDataBits - 1 do
begin
        for j := 0 to i do
                LeftResult := leftshift(DataArray[LeftStart – 4 + i])
end
```

After the data (LeftResult) from the left sensor station 26 has been reassembled, the microcontroller 41 reassembles the data (RightResult) from right sensor station 27. The microcontroller 41 determines whether a start bit was detected by determining whether the start bit value equals 99 (step s48). If not, i.e. a start bit was found, the microcontroller 41 enters a loop (steps s49, s50 and s51) in which the data is reassembled thus: -

(pseudocode)

```
for i := 0 to NumberOfDataBits - 1 do
begin
        for j := 0 to i do
                RightResult := leftshift(DataArray[NumberOfDataBits - 1 - i])
end
```

Otherwise, the microcontroller 41 enters another loop (steps s52, s53 and s54) in which the data is reassembled thus:-

(pseudocode)

```
for i := 0 to NumberOfDataBits - 1 do
```

```
begin
    for j := 0 to i do
        RightResult := leftshift(DataArray[RightStop - 4 -
            (NumberOfDataBits - 1 – i)])
end
```

When the data (LeftResult and RightResult) from the left and right sensor stations 26, 27 has been recovered, the microcontroller 41 compares them (step s55) and, if they do not match, the microcontroller 41 logs a rejection (step s56) and exits the fourth interrupt routine. However, if they do match, the microcontroller 41 compares the recovered data with a reference value, "83" in this case, (step s57). If the recovered value does not match the reference value, the microcontroller 41 logs a rejection (step s58) and exits the fourth interrupt routine. However, if they do match, the microcontroller 41 sends a signal to open the accept gate of the validator (step s59) and exits the fourth interrupt routine.

It is to be understood that the signal for opening the accept gate may be produced subject to the coin-like object passing additional tests using, for example, electromagnetic sensors, as are well-known in the art.

A second embodiment of the present invention will now be described.

Referring to Figure 11, a bar-coded object 101 is substantially the same as that shown in Figure 1 save that the inner ring 103 holds the "clock" pattern and the middle ring 104 holds the data.

The validator shown in Figures 4, 5 and 6 can be used with the token of Figure 11 by the simple expedient of swapping the positions of the second and third photo-sensors 29b, 29c, 31b, 31c within each sensor station 26, 27. It will be appreciated that no changes are required to the circuit of Figure 7 if these sensors are swapped as described.

Figure 12(a) shows the output of the first signal conditioning circuit 42 as the object 101 passes. Figure 12(b) shows the output of the third signal conditioning circuit 44 as the object 101 passes, oriented as shown. Figure 12(c) shows the output of

the fourth signal conditioning circuit 43 as the object 101 passes, oriented as shown. Figure 12(d) shows the output of the second signal conditioning circuit 45 as the object 101 passes, , oriented as shown. Figure 12(e) shows the data read in by the microcontroller 41 with the object 101 oriented as shown.

Referring to Figures 11 and 12, it can be seen that as the "track" 110 of the third photo-sensor 29b, now the furthest inboard, of the left sensor station 26 crosses the middle ring 104, the output of the third photo-sensor 29b changes, causing the microcontroller 41 to read the data and start bit values from the first and second latches 49, 50. In the example shown, the result is two extra 0s at the beginning of the read data. No unwanted samples are taken at the end because the beam 35 is no longer broken (Figure 12(a)). This is not a problem, because these bits will be ignored when the true data is located using the start bit position. However, care must be taken when designing the bar code to ensure that false clocking by the middle ring 104 does not result in the outer photo-sensors 29a, 31a detecting dark regions and a start or stop bit being falsely identified.

Since, the start bits are crucial in the first and second embodiments for locating the "good" data, the start bits should be in the outer ring to prevent the start bit photo-sensor having the possibility of sensing data in the wrong ring.

A third embodiment of the present invention will now be described.

Referring to Figures 13 and 14, a third bar-coded token 201 according to the present invention comprises a disc-shaped substrate 202. Eighteen barcode blocks 203 are arranged in a ring around the margin of the face of the substrate 202. Each barcode block 203 is aligned along a chord of the substrate and comprises outer, middle and inner tracks 204, 205, 206 comprising alternating light and dark regions. The outer track 204 of each block 203 comprises a clock pattern. The middle track 205 of each block 203 comprises a 5-bit data pattern. The inner track 206 of each block contains a start position marker. In the present example, the middle tracks 204 all comprise the binary code for "13".

Referring to Figures 15, 16 and 17, a validator for coin-like objects 201 has a vertical coin path 221 defined by front and back walls 222, 223 and first and second

side walls 224, 225. Left and right sensor stations 226, 227 are mounted to the front wall 222. The left sensor station 226 is located at the left side of the front wall 222 and comprises three light emitting diode units 228a, 228b, 228c alternating with three photo-sensors 229a, 229b, 229c. The right sensor station 227 is located at the right side of the front wall and is similarly constructed with three light emitting diode units 230a, 230b, 230c and three photo-sensors 231a, 231b, 231c. It is preferred that at least the middle light emitting diode unit 228b, 230b of each sensor station 226, 227 emits a beam which is narrower than the circumferential width of the "dark" markings outer tracks 204. A laser diode may be usefully employed for this purpose, and indeed for the other light emitting diode units 228a, 228c, 230a, 230c. The narrower beam produces sharper transitions in the output signals of the corresponding photo-sensor. Sharp transitions are particularly desirable in the case of the clock patterns in the outer tracks 204 because, as will be seen, it is the light-to-dark transitions of these patterns that trigger sampling of the photo-sensor signals for the inner and middle tracks 205, 206.

The coin path 21 is dimensioned so that it is just wide and thick enough for the coin-like object 201 to fall freely therein.

Referring again to Figures 13 and 14, the dashed lines indicate the "tracks" of the photo-sensors 229a, 229b, 229c, 231a, 231b, 231c as the coin-like object 201 falls past the sensor stations 226, 227.

Referring to Figure 18, the optical signal processing circuit of the validator comprises a microcontroller 241, six signal conditioning circuits 243, ..., 247 and four latches 249, 250, 251, 252. The microcontroller 241 has at least first to fourth 1-bit inputs 253, 254, 255, 256 and at least first and second rising edge triggered interrupt ports 258, 259.

The first signal conditioning circuit 243 is connected between the second photo-sensor 229b of the left sensor station 226 and the data input of the first latch 249. The output of the first latch 249 is connected to the first 1-bit input 253. The first signal conditioning circuit 243 squares and inverts the output of the second photo-

sensor 229b of the left sensor station 226.

The second signal conditioning circuit 244 is connected between the first photo-sensor 229a of the left sensor station 226 and the second interrupt port 258. The output of the second signal conditioning circuit 244 is also connected to the clock inputs of the first and second latches 249, 250. The second signal conditioning circuit 244 squares and inverts the output of the first photo-sensor 229a of the left sensor station 226 before applying it to the second interrupt port 258.

The third signal conditioning circuit 245 is connected between the third photo-sensor 229c of the left sensor station 226 and the data input of the second latch 250. The output of the second latch 250 is connected to the second 1-bit input 254. The third signal conditioning circuit 245 squares and inverts the output of the third photo-sensor 229c of the left sensor station 226.

The fourth signal conditioning circuit 246 is connected between the second photo-sensor 231b of the right sensor station 227 and the data input of the third latch 251. The output of the third latch 251 is connected to the third 1-bit input 255. The fourth signal conditioning circuit 246 squares and inverts the output of the second photo-sensor 241a of the right sensor station 227.

The fifth signal conditioning circuit 247 is connected between the first photo-sensor 231a of the right sensor station 227 and the third interrupt port 259. The output of the fifth signal conditioning circuit 247 is also connected to the clock inputs of the third and fourth latches 251, 252. The fifth signal conditioning circuit 247 squares the output of the first photo-sensor 231b of the right sensor station 227 before applying it to the third interrupt port 259.

The sixth signal conditioning circuit 248 is connected between the third photo-sensor 231c of the right sensor station 227 and the data input of the fourth latch 252. The output of the fourth latch 252 is connected to the fourth 1-bit input 256. The sixth signal conditioning circuit 248 squares and inverts the output of the third photo-sensor 231c of the right sensor station 227.

The microcontroller 241 also has a control output to an accept gate (not shown) of the validator.

The operation of the validator shown in Figures 15 to 18 with the coin-like object 201 will now be described.

Figures 20(a) and 21(a) show the output of the second signal conditioning circuit 244 as the object 201 passes, oriented as shown in Figures 13 and 14 respectively. Figures 20(b) and 21(b) show the output of the first signal conditioning circuit 243 as the object 201 passes, oriented as shown in Figures 13 and 14 respectively. Figures 20(c) and 21(c) show the output of the third signal conditioning circuit 245 as the object 201 passes, oriented as shown in Figures 13 and 14 respectively. Figures 20(d) and 21(d) show the data read by the microcontroller 241 with the object 201 oriented as shown in Figures 13 and 14 respectively.

Referring to Figures 20 and 21, as the object 201 falls down the coin path 221, the second photo-sensor 229b of the left sensor station 226 and the the second photo-sensor 230b of the right sensor station 226 eventually detect the outer tracks 204 of barcode blocks 203.

Considering now the case of the left sensor station 226, when the output of the second signal conditioning circuit 244 goes high, the outputs of the first and third signal conditioning circuits 243, 245 are loaded respectively into the first and second latches 249, 250. At the same time, the microcontroller 241 responds to the rising edge on its first interrupt port 258 by performing a first interrupt routine (Figure 19).

In the first interrupt routine, the microcontroller 241 first reads the value at the second 1-bit port 254 (step s201). If this value is 0 (step s202), the microcontroller 241 increments a counter (step s203) and then left-shifts a single-word output data variable (step s204). The microcontroller 241 then adds the value at the first 1-bit port to the output data variable (step s205). At this point, if the value in the

counter is 5, i.e. the number of bits in the code to be read from the object 201, (step s206), the output data variable is compared with a reference value (step s207). If the output data variable and the reference value match (step s207), the microcontroller 241 outputs a signal to open the accept gate (step s208). In either case, the counter is reset to 0 (step s209) and the output data variable is reset to 00000 (step s210).

If the answer at step s206 is no, the interrupt routine terminates.

If the input value is found to be 1 at step s202, the counter is reset to 0 (step s209) and the output data variable is reset to 00000 (step s210).

The processing in response to signals from the right sensor station 227 is performed by a second interrupt routine which is identical to the first except that the 5-least significant bits of the reference value are reversed to reflect the different orders in which the bits are read. For example, if the reference value for the left sensor station 226 is 00001101, the reference for the right sensor station 227 will be 00010110.

A timer may be set in each of the interrupt routines. On expiry the timer triggers a third interrupt routine that resets the counters and output data variables. The timer period is preferably set to be slightly longer that the effective clock period set by the pitch of the outer tracks 204.

A monostable mulitvibrator may be included between the accept gate control output of the microcontroller 241 and the accept gate actuator to prevent the actuator only responds to the first accept gate open signal that the microcontroller 241 produces for the object 201 currently being analysed.

Many modifications may be made to the described embodiments. For instance, the data need not be a single number of character code and may represent a plurality of numbers or character codes.

The discrete optical sensors at each sensor station for sensing the bar code elements may be replaced by a linear CCD optical sensor. If a linear CCD optical sensor is used, some elements may be masked to prevent cros/s-talk between the signals produced by the data, clock and start reference tracks. Also, the alternating emitter/sensor arrangement described above could be replaced by an arrangement wherein the row of emitters at a sensor station is arranged immediately above or below a row of sensors.

Claims

1. A method of bar coding an object comprising:

forming a data pattern (3; 104; 205) on an object (1; 101; 201), and

forming a clock pattern (4; 103; 204) on the object (1; 101; 201), the clock pattern (4; 104; 204) being aligned with the data pattern (3; 103; 205) for providing a data pattern sampling signal,

characterised in that the data pattern (3; 104; 205) comprises a plurality of repetitions of the same information arranged in a ring such that a complete instance of said information can be obtained from a single chordal scan through the data pattern without limitation on the direction of said scan.

2. A method according to claim 1, wherein the clock pattern (4; 103) and the data pattern (3; 104) are formed as concentric rings.

3. A method according to claim 2, wherein the data pattern (3) is located inwards of the clock pattern (4).

4. A method according to claim 2, including forming a substantially circular reference pattern (5; 105) concentric with the clock pattern (4; 103), the reference pattern identifying the start of each repetition of said information.

5. A method according to claim 4, wherein the data pattern (3) is located within the clock pattern (4) and the clock pattern is located inwards of the reference pattern (5).

6. A method according to claim 4, wherein the clock pattern (103) is located within the data pattern (104) and the data pattern (104) is located inwards of the reference pattern (105).

7. A method according to claim 1, wherein the clock pattern (204) comprises a plurality of repetitions of a straight clock pattern segment and each instance of the data pattern (205) is straight and has a clock pattern segment arranged in parallel alongside it.

8. A method according to claim 7, including marking the start of each instance of the data pattern.

9. A method of forming a coin-like object including bar coding the object by a method according to any one of claims 1 to 8.

10. A bar-coded object having a data pattern (3; 104, 205) and a clock pattern (4; 103; 204) formed as concentric rings, the clock pattern (4; 103; 204) being aligned with the data pattern (3; 104; 205) for providing a data pattern sampling reference, **characterised in that** the data pattern (3; 104; 205) comprises a plurality of repetitions of the same information arranged in a ring such that a complete instance of said information can be obtained from a single chordal scan through the data pattern (3; 104; 205) without limitation on the direction of said scan.

11. An object according to claim 10, wherein the data pattern (3; 104; 205) is located inwards of the clock pattern (4; 103; 204).

12. An object according to claim 10, including a substantially circular reference pattern (5; 105) concentric with the clock pattern (4; 103), the reference pattern (5; 105) identifying the start of each repetition of said information.

13. An object according to claim 12, wherein the data pattern (3) is located within the clock pattern (4) and the clock pattern (4) is located inwards of the reference pattern (5).

14. An object according to claim 12, wherein the clock pattern (103) is located within the data pattern (104) and the data pattern (104) is located inwards of the reference pattern (105).

15. An object according to claim 10, wherein the clock pattern (204) comprises a plurality of repetitions of a straight clock pattern segment and each instance of the data pattern information is straight and has a clock pattern segment arranged in parallel alongside it.

16. An object according to claim 15, including a marking (206) at the start of each instance of the data pattern.

17. A coin-like object according to any one of claims 10 to 16.

18. A method of reading a bar-coded object according to claim 10, the method comprising:-

simultaneously scanning said patterns (3, 4, 5; 103, 104, 105; 204, 205, 206) chordally; and

determining the values of data pattern elements at times defined by said clock pattern (4; 103; 204).

19. A method according to claim 18, including re-ordering said pattern element values to recover said information.

20. A method according to claim 19, wherein said re-ordering comprises identifying a start position and moving a bit from before the start position to a position after the start position.

21. A method according to claim 18, including:

simultaneously scanning chordally another part of each of the patterns (3, 4, 5; 103, 104, 105; 204, 205, 206);

comparing the values of the data elements obtained in each scanning of the data pattern; and

signalling an error condition if there is a mismatch between information represented by the values obtained from said scans of the data pattern.

22. A method according to claim 18, wherein the data pattern (3; 104; 205), the clock pattern (4; 103; 204) and a start position reference pattern (5; 105; 206) are sensed by respective sensors (29a, 29b, 29c) along parallel chordal paths.

23. A method according to claim 22, wherein a representation of said information is built from the output of the data pattern sensor (29b; 29c) and cleared in dependence on

the output of the start position reference pattern sensor (29a).

24. A method according to claim 23, including counting each bit as it is added to said representation, performing an action when the bit count reaches a predetermined value and resetting the bit count in dependence on the output of the start position reference pattern sensor.

25. A method according to claim 24, wherein said action is only performed if said representation meets a predetermined criterion.

26. A bar code reading apparatus for reading a bar code on an object according to claim 10, the apparatus comprising:

scanning means (26; 226) for simultaneously scanning said patterns (3, 4, 5; 103, 104, 105; 204, 205, 206) chordally; and

means (41; 241) for determining the values of data pattern elements at times defined by said clock pattern (4; 103; 204).

27. An apparatus according to claim 26, including processing means (41; 241) for re-ordering said pattern element values to recover said information.

28. An apparatus according to claim 27, wherein said re-ordering comprises identifying a start position and moving a bit from before the start position to a position after the start position.

29. An apparatus according to claim 26, including:

means (27; 227) for simultaneously scanning chordally another part of each of the patterns (3, 4, 5; 103, 104, 105; 204, 205, 206);

means (41; 241) for comparing the values of the data elements obtained in each scanning of the data pattern (3; 104; 205); and

means (41; 241) for signalling an error condition if there is a mismatch between information represented by the values obtained from said scans of the data pattern (3; 104; 205).

30. An apparatus according to claim 26, 27 or 28, wherein the sensor means (26; 226) comprises a first sensor (29c; 29b; 229b) for sensing the data pattern (3; 104; 205), a second sensor (29b; 29c; 229a) for sensing the clock pattern (4; 103; 204) and a third sensor (29a; 229c) for sensing the start position reference pattern (5; 205; 206).

31. An apparatus according to claim 30, including processing means (41) configured such that a representation of said information is built from the output of the first sensor (29c; 29b) and cleared in dependence on the output of the third sensor (29a).

32. An apparatus according to claim 31, wherein the processing means (241) counts pattern elements during said building and resets the pattern element count in dependence on the output of the third sensor (229c).

33. An apparatus according to claim 32, wherein the processing means (241) is configured to produce an output if said reference meets a predetermined criterion when the pattern element count is at a threshold value.

34. A validator for coin-like objects including an apparatus according to any one of claims 26 to 33.

35. A method of bar coding an object comprising:

providing an object having a substantially planar surface;

forming a data pattern on said surface, and

forming a clock pattern on said surface, the clock pattern being aligned with the data pattern for providing a data pattern sampling signal,

wherein the data pattern comprises a plurality of repetitions of the same information arranged in a ring such that a complete instance of said information can be obtained from a single chordal scan through the data pattern without limitation on the direction of said scan.

36. A method according to claim 34, wherein the clock pattern and the data pattern are formed as concentric rings.

37. A method according to claim 35, wherein the data pattern is located inwards of the clock pattern.

38. A method according to claim 35, including forming a substantially circular reference pattern concentric with the clock pattern, the reference pattern identifying the start of each repetition of said information.

39. A method according to claim 38, wherein the data pattern is formed within the clock pattern and the clock pattern is formed inwards of the reference pattern.

40. A method according to claim 38, wherein the clock pattern is formed within the data pattern and the data pattern is located inwards of the reference pattern.

41. A method according to claim 35, wherein forming the clock pattern comprises forming a plurality of repetitions of a straight clock pattern segment and forming of each instance of the data pattern comprises forming a straight data pattern such that each data pattern instance has a clock pattern segment arranged in parallel alongside it.

42. A method according to claim 41, including marking the start of each instance of the data pattern.

43. A method according to claim 35, wherein providing said object comprises providing a coin-like object.

44. A bar-coded object having a data pattern and a clock pattern formed as concentric rings, the clock pattern being aligned with the data pattern for providing a data pattern sampling reference, wherein the data pattern comprises a plurality of repetitions of the same information arranged in a ring such that a complete instance of said information can be obtained from a single chordal scan through the data pattern without limitation on the direction of said scan.

45. An object according to claim 44, wherein the data pattern is located inwards of the clock pattern.

46. An object according to claim 44, including a substantially circular reference pattern concentric with the clock pattern, the reference pattern identifying the start of each repetition of said information.

47. An object according to claim 46, wherein the data pattern is located within the clock pattern and the clock pattern is located inwards of the reference pattern.

48. An object according to claim 46, wherein the clock pattern is located within the data pattern and the data pattern is located inwards of the reference pattern.

49. An object according to claim 44, wherein the clock pattern comprises a plurality of repetitions of a straight clock pattern segment and each instance of the data pattern is straight and has a clock pattern segment arranged in parallel alongside it.

50. An object according to claim 49, including a marking at the start of each instance of the data pattern.

51. A bar-coded coin-like object having a data pattern and a clock pattern formed as concentric rings, the clock pattern being aligned with the data pattern for providing a data pattern sampling reference, wherein the data pattern comprises a plurality of repetitions of the same information arranged in a ring such that a complete instance of said information can be obtained from a single chordal scan through the data pattern without limitation on the direction of said scan.

52. An object according to claim 51, wherein the data pattern is located inwards of the clock pattern.

53. An object according to claim 51, including a substantially circular reference pattern concentric with the clock pattern, the reference pattern identifying the start of each repetition of said information.

54. An object according to claim 53, wherein the data pattern is located within the

clock pattern and the clock pattern is located inwards of the reference pattern.

55. An object according to claim 53, wherein the clock pattern is located within the data pattern and the data pattern is located inwards of the reference pattern.

56. An object according to claim 51, wherein the clock pattern comprises a plurality of repetitions of a straight clock pattern segment and each instance of the data pattern is straight and has a clock pattern segment arranged in parallel alongside it.

57. An object according to claim 56, including a marking at the start of each instance of the data pattern.

58. A method of reading a bar-coded object having a data pattern and a clock pattern formed as concentric rings, the clock pattern being aligned with the data pattern for providing a data pattern sampling reference and the data pattern comprises a plurality of repetitions of the same information arranged in a ring such that a complete instance of said information can be obtained from a single chordal scan through the data pattern without limitation on the direction of said scan, the method comprising:-

simultaneously scanning said patterns chordally using sensor means;

determining the values of data pattern elements at times defined by said clock pattern from the output of the sensor means; and

outputting a value in dependence on the determined data pattern element values.

59. A method according to claim 58, including re-ordering said pattern element values to recover said information.

60. A method according to claim 59, wherein said re-ordering comprises identifying a start position and moving a bit from before the start position to a position after the start position.

61. A method according to claim 58, including:

simultaneously scanning chordally another part of each of the patterns using sensor means;

comparing the values of the data elements obtained in each scanning of the data pattern; and

signalling an error condition if there is a mismatch between information represented by the values obtained from said scans of the data pattern.

62. A method according to claim 58, wherein the data pattern, the clock pattern and a start position reference pattern are sensed by respective sensors, comprises in said sensor means, along parallel chordal paths.

63. A method according to claim 62, wherein a representation of said information is built from the output of the data pattern sensor and cleared in dependence on the output of the start position reference pattern sensor.

64. A method according to claim 63, including counting each bit as it is added to said representation, performing an action when the bit count reaches a predetermined value and resetting the bit count in dependence on the output of the start position reference pattern sensor.

65. A method according to claim 64, wherein said action is only performed if said representation meets a predetermined criterion.

66. A bar code reading apparatus for reading a bar code on an object having a data pattern and a clock pattern formed as concentric rings, the clock pattern being aligned with the data pattern for providing a data pattern sampling reference and the data pattern comprises a plurality of repetitions of the same information arranged in a ring such that a complete instance of said information can be obtained from a single chordal scan through the data pattern without limitation on the direction of said scan,, the apparatus comprising:

scanning means for simultaneously scanning said patterns chordally;

means for determining the values of data pattern elements at times defined by said clock pattern in dependence on the output of the scanning means; and

outputting a code value in dependence on said determined data pattern values.

67. An apparatus according to claim 66, including processing means for re-ordering

said pattern element values to recover said information.

68. An apparatus according to claim 67, wherein said processing means is configured such that said re-ordering comprises identifying a start position and moving a bit from before the start position to a position after the start position.

69. An apparatus according to claim 66, including:

means for simultaneously scanning chordally another part of each of the patterns;

means for comparing the values of the data elements obtained in each scanning of the data pattern; and

means for signalling an error condition if there is a mismatch between information represented by the values obtained from said scans of the data pattern.

70. An apparatus according to claim 66, wherein the sensor means comprises a first sensor for sensing the data pattern, a second sensor for sensing the clock pattern and a third sensor for sensing a start position reference pattern.

71. An apparatus according to claim 70, including processing means configured such that a representation of said information is built from the output of the first sensor and cleared in dependence on the output of the third sensor.

72. An apparatus according to claim 71, wherein the processing means counts pattern elements during said building and resets the pattern element count in dependence on the output of the third sensor.

73. An apparatus according to claim 72, wherein the processing means is configured to produce an output if said reference meets a predetermined criterion when the pattern element count is at a threshold value.

74. An apparatus according to claim 67, wherein the sensor means comprises a first sensor for sensing the data pattern, a second sensor for sensing the clock pattern and a third sensor for sensing a start position reference pattern.

75. An apparatus according to claim 74, including processing means configured such that a representation of said information is built from the output of the first sensor and cleared in dependence on the output of the third sensor.

76. An apparatus according to claim 75, wherein the processing means counts pattern elements during said building and resets the pattern element count in dependence on the output of the third sensor.

77. An apparatus according to claim 76, wherein the processing means is configured to produce an output if said reference meets a predetermined criterion when the pattern element count is at a threshold value.

78. An apparatus according to claim 68, wherein the sensor means comprises a first sensor for sensing the data pattern, a second sensor for sensing the clock pattern and a third sensor for sensing a start position reference pattern.

79. An apparatus according to claim 78, including processing means configured such that a representation of said information is built from the output of the first sensor and cleared in dependence on the output of the third sensor.

80. An apparatus according to claim 79, wherein the processing means counts pattern elements during said building and resets the pattern element count in dependence on the output of the third sensor.

81. An apparatus according to claim 80, wherein the processing means is configured to produce an output if said reference meets a predetermined criterion when the pattern element count is at a threshold value.

82. A validator for validating a coin-like object having a data pattern and a clock pattern formed as concentric rings, the clock pattern being aligned with the data pattern for providing a data pattern sampling reference and the data pattern comprises a plurality of repetitions of the same information arranged in a ring such that a complete instance of said information can be obtained from a single chordal scan through the data pattern without

limitation on the direction of said scan, the apparatus comprising:

scanning means for simultaneously scanning said patterns chordally;

means for determining the values of data pattern elements at times defined by said clock pattern in dependence on the output of the scanning means; and

outputting a valid/invalid signal for the coin-like object in dependence on said determined data pattern values.

83. A validator according to claim 82, including processing means for re-ordering said pattern element values to recover said information.

84. A validator according to claim 83, wherein said processing means is configured such that said re-ordering comprises identifying a start position and moving a bit from before the start position to a position after the start position.

85. A validator according to claim 82, including:

means for simultaneously scanning chordally another part of each of the patterns;

means for comparing the values of the data elements obtained in each scanning of the data pattern; and

means for signalling an error condition if there is a mismatch between information represented by the values obtained from said scans of the data pattern.

86. A validator according to claim 82, wherein the sensor means comprises a first sensor for sensing the data pattern, a second sensor for sensing the clock pattern and a third sensor for sensing a start position reference pattern.

87. A validator according to claim 86, including processing means configured such that a representation of said information is built from the output of the first sensor and cleared in dependence on the output of the third sensor.

88. A validator according to claim 87, wherein the processing means counts pattern elements during said building and resets the pattern element count in dependence on the output of the third sensor.

89. A validator according to claim 88, wherein the processing means is configured to produce an output if said reference meets a predetermined criterion when the pattern element count is at a threshold value.

90. A validator according to claim 83, wherein the sensor means comprises a first sensor for sensing the data pattern, a second sensor for sensing the clock pattern and a third sensor for sensing a start position reference pattern.

91. A validator according to claim 90, including processing means configured such that a representation of said information is built from the output of the first sensor and cleared in dependence on the output of the third sensor.

92. A validator according to claim 91, wherein the processing means counts pattern elements during said building and resets the pattern element count in dependence on the output of the third sensor.

93. A validator according to claim 92, wherein the processing means is configured to produce an output if said reference meets a predetermined criterion when the pattern element count is at a threshold value.

94. A validator according to claim 84, wherein the sensor means comprises a first sensor for sensing the data pattern, a second sensor for sensing the clock pattern and a third sensor for sensing a start position reference pattern.

95. A validator according to claim 94, including processing means configured such that a representation of said information is built from the output of the first sensor and cleared in dependence on the output of the third sensor.

96. A validator according to claim 95, wherein the processing means counts pattern elements during said building and resets the pattern element count in dependence on the output of the third sensor.

97. A validator according to claim 96, wherein the processing means is configured to

produce an output if said reference meets a predetermined criterion when the pattern element count is at a threshold value.

K-FEE SYSTEM GMBH, EX2009, page 3197
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

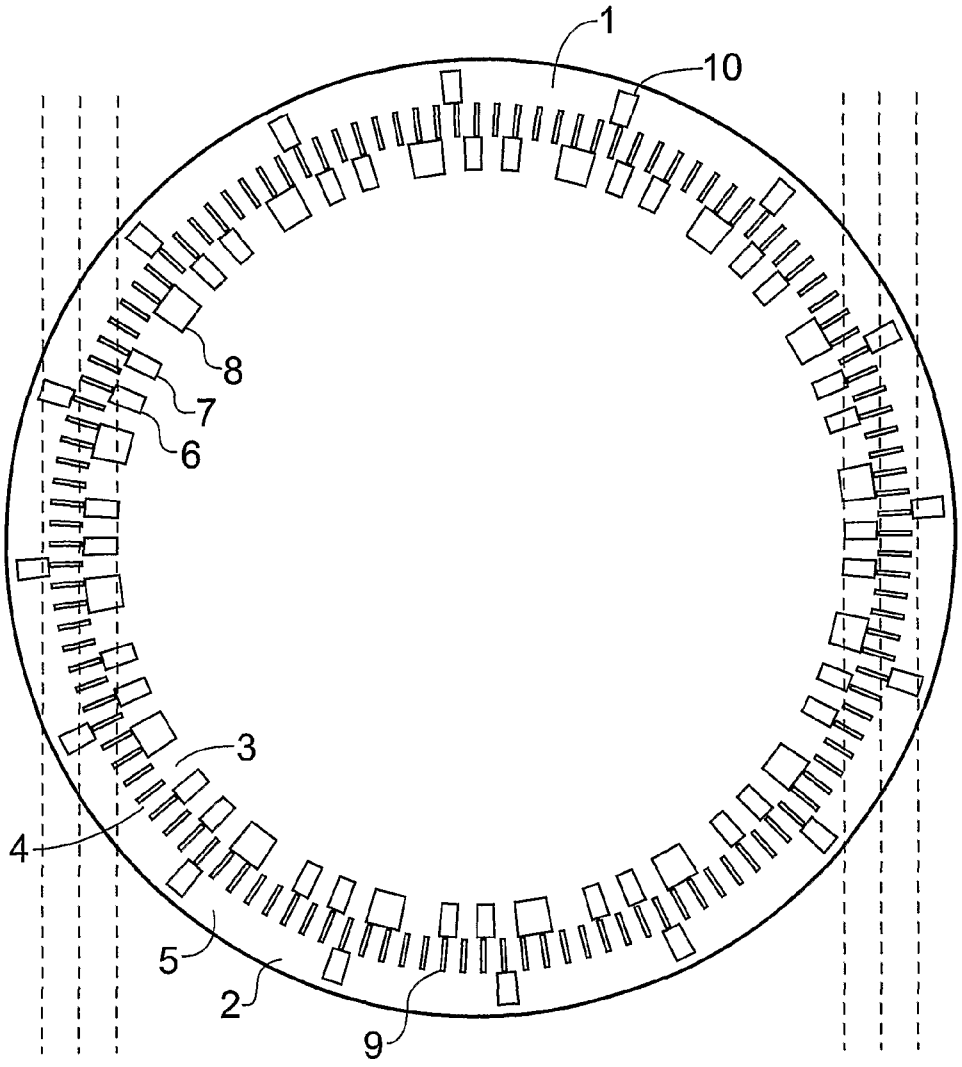


Fig. 1

K-FEE SYSTEM GMBH, EX2009, page 3198
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

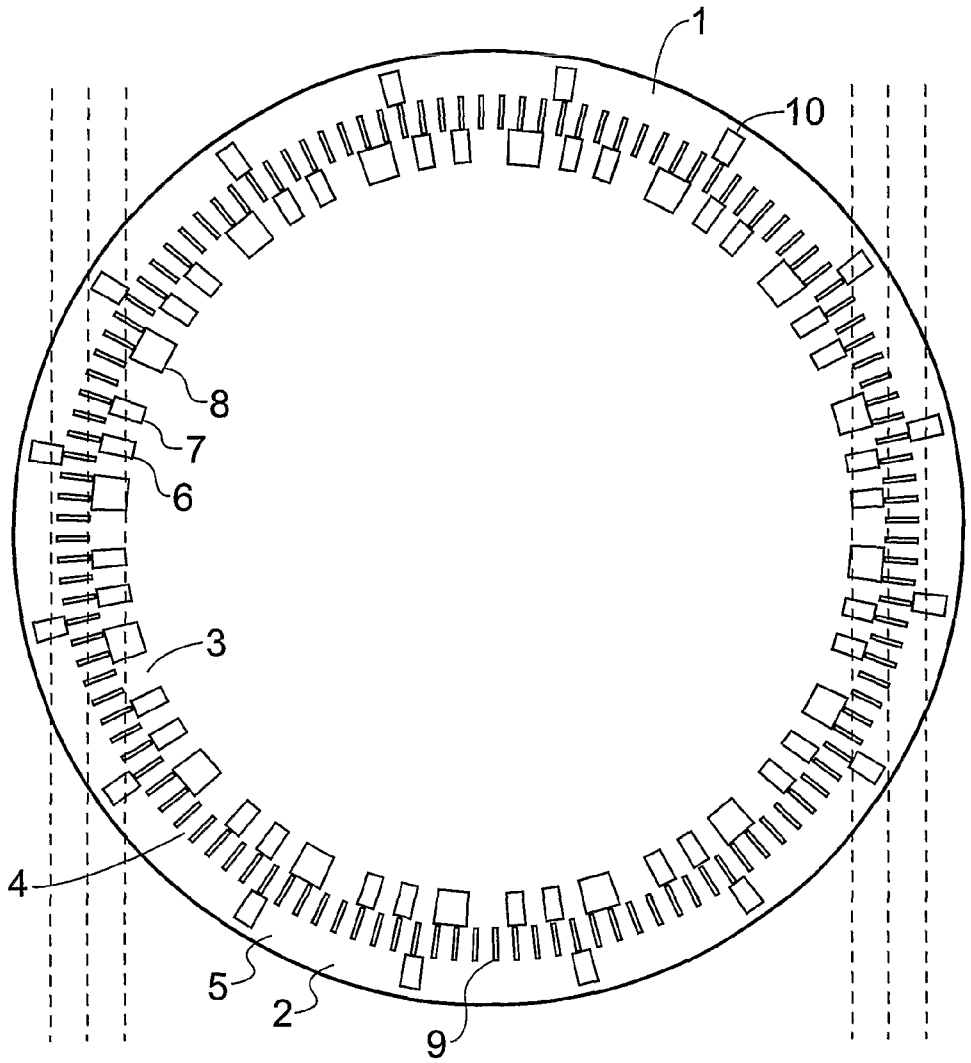


Fig. 2

K-FEE SYSTEM GMBH, EX2009, page 3199
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

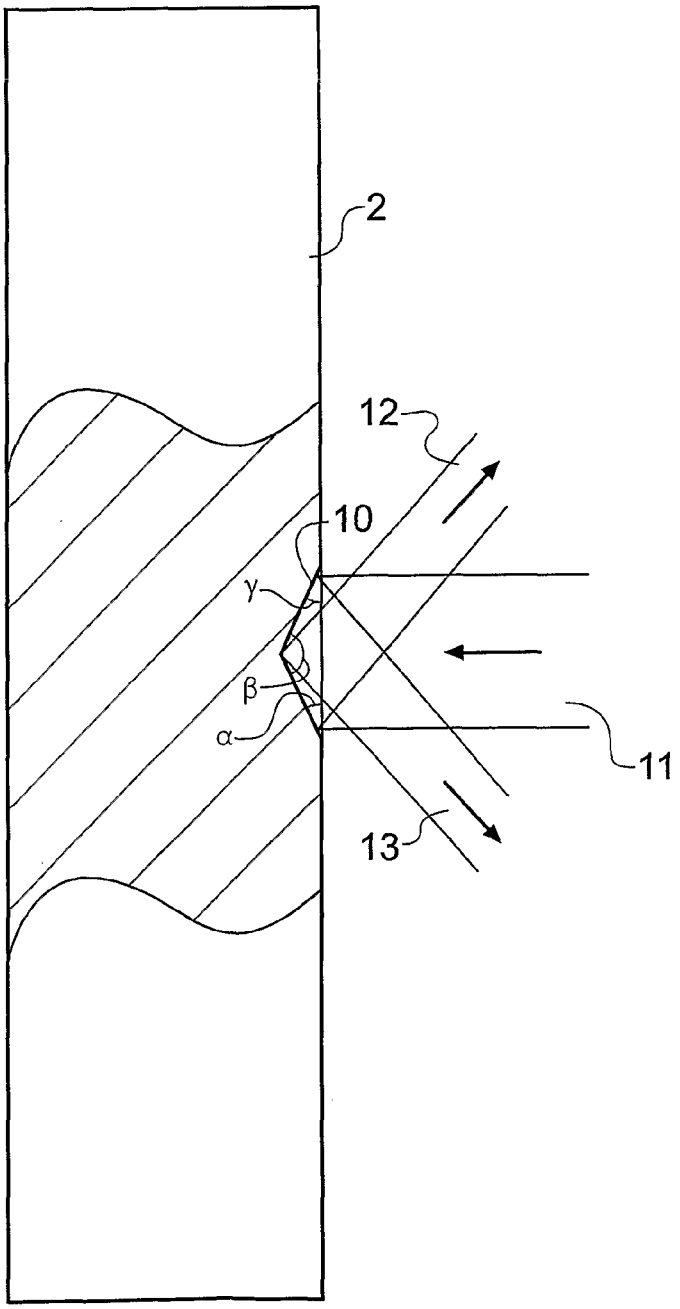


Fig. 3

K-FEE SYSTEM GMBH, EX2009, page 3200
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

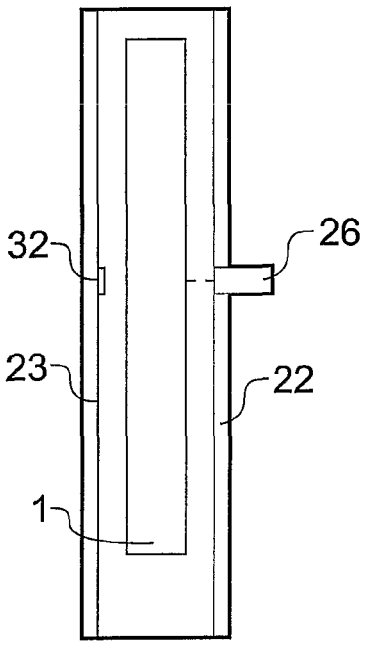


Fig. 4

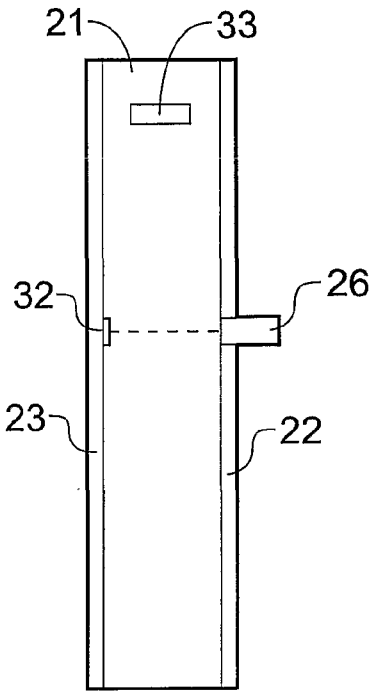


Fig. 5

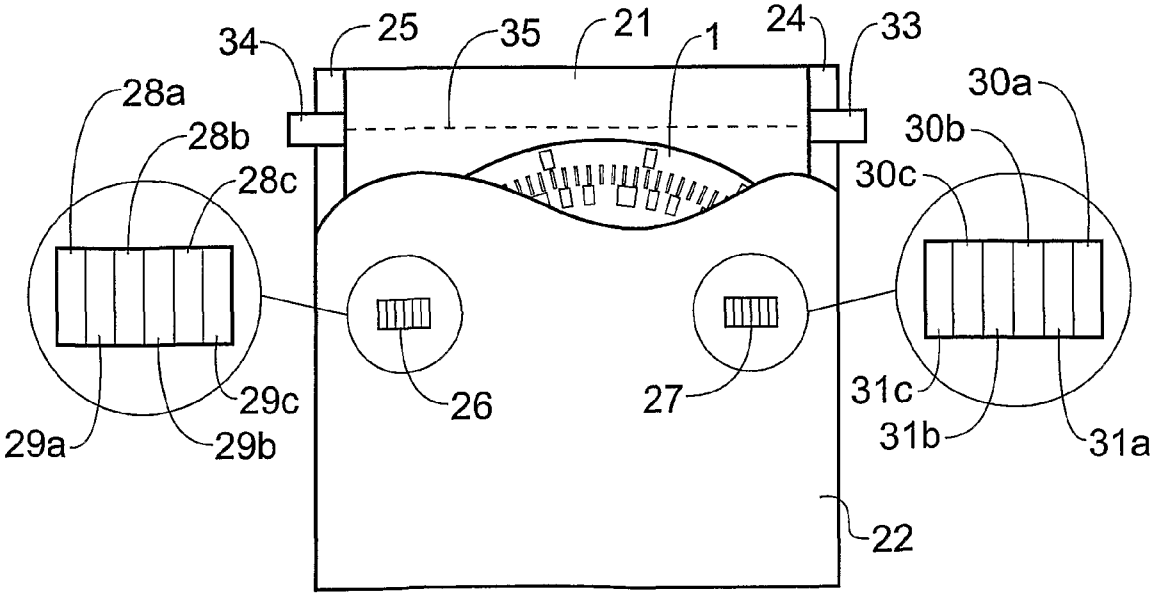


Fig. 6

K-FEE SYSTEM GMBH, EX2009, page 3201
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

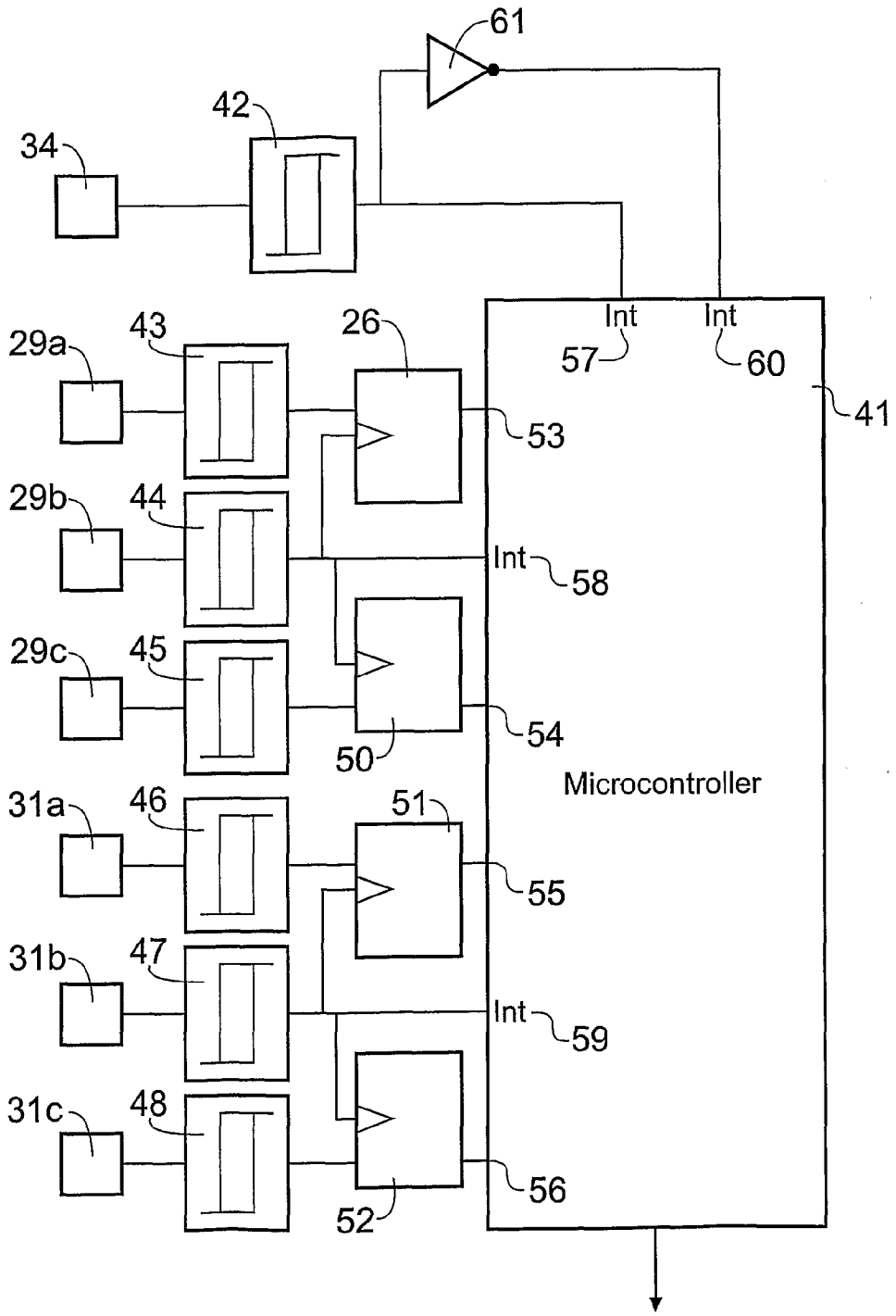


Fig. 7

K-FEE SYSTEM GMBH, EX2009, page 3202
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

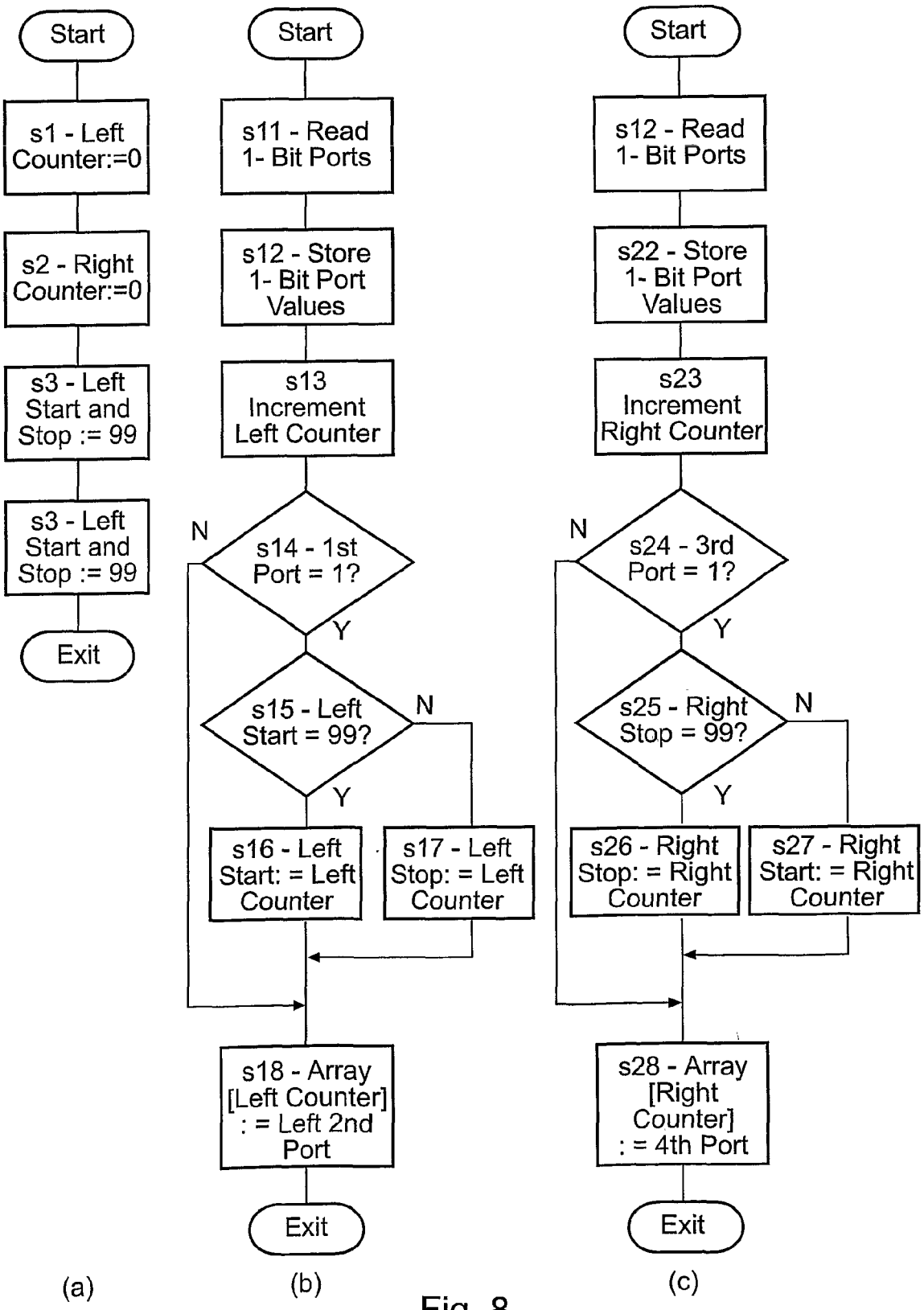
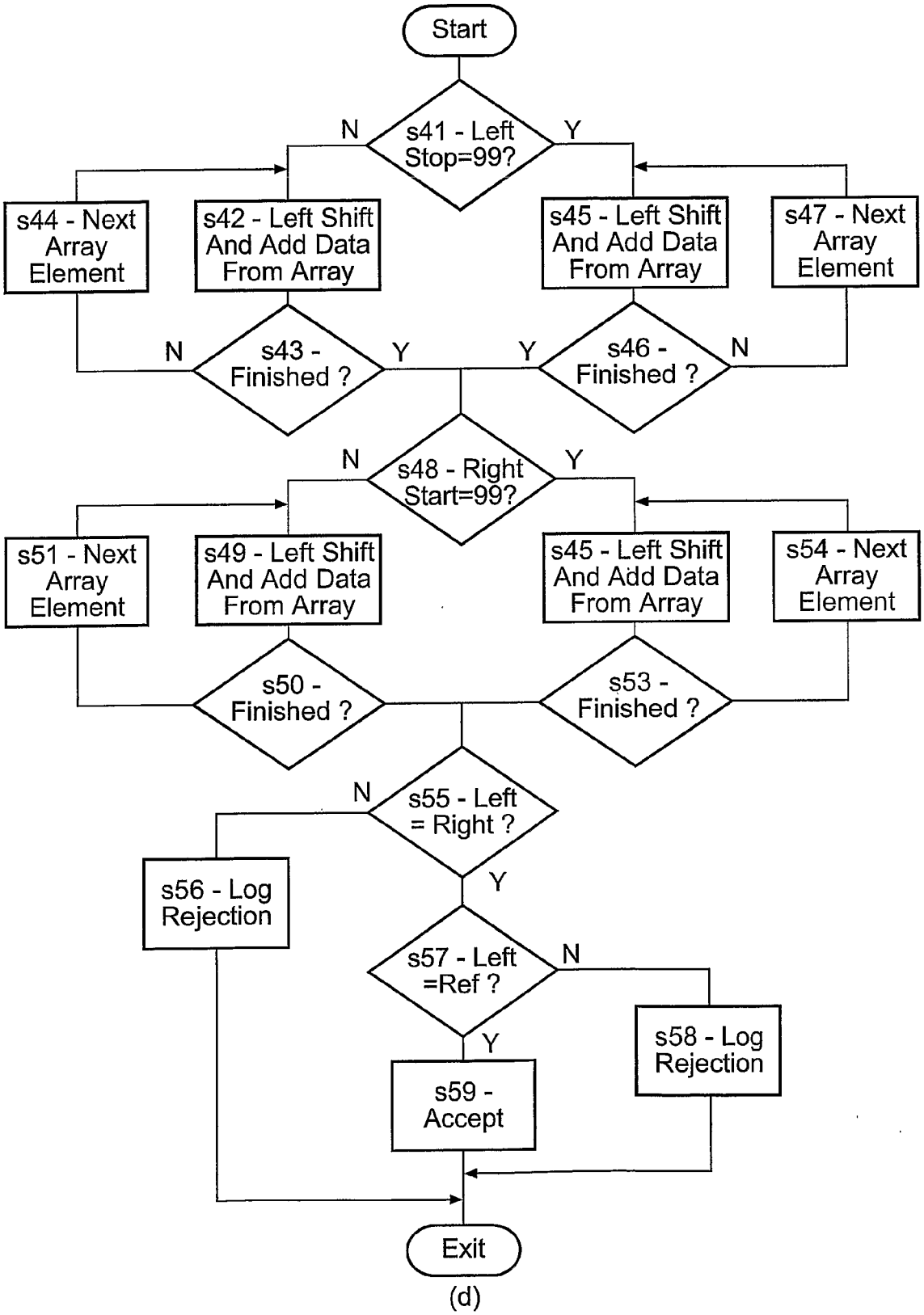


Fig. 8

K-FEE SYSTEM GMBH, EX2009, page 3203
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923



(d)

Fig. 8 (continued)

K-FEE SYSTEM GMBH, EX2009, page 3204
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

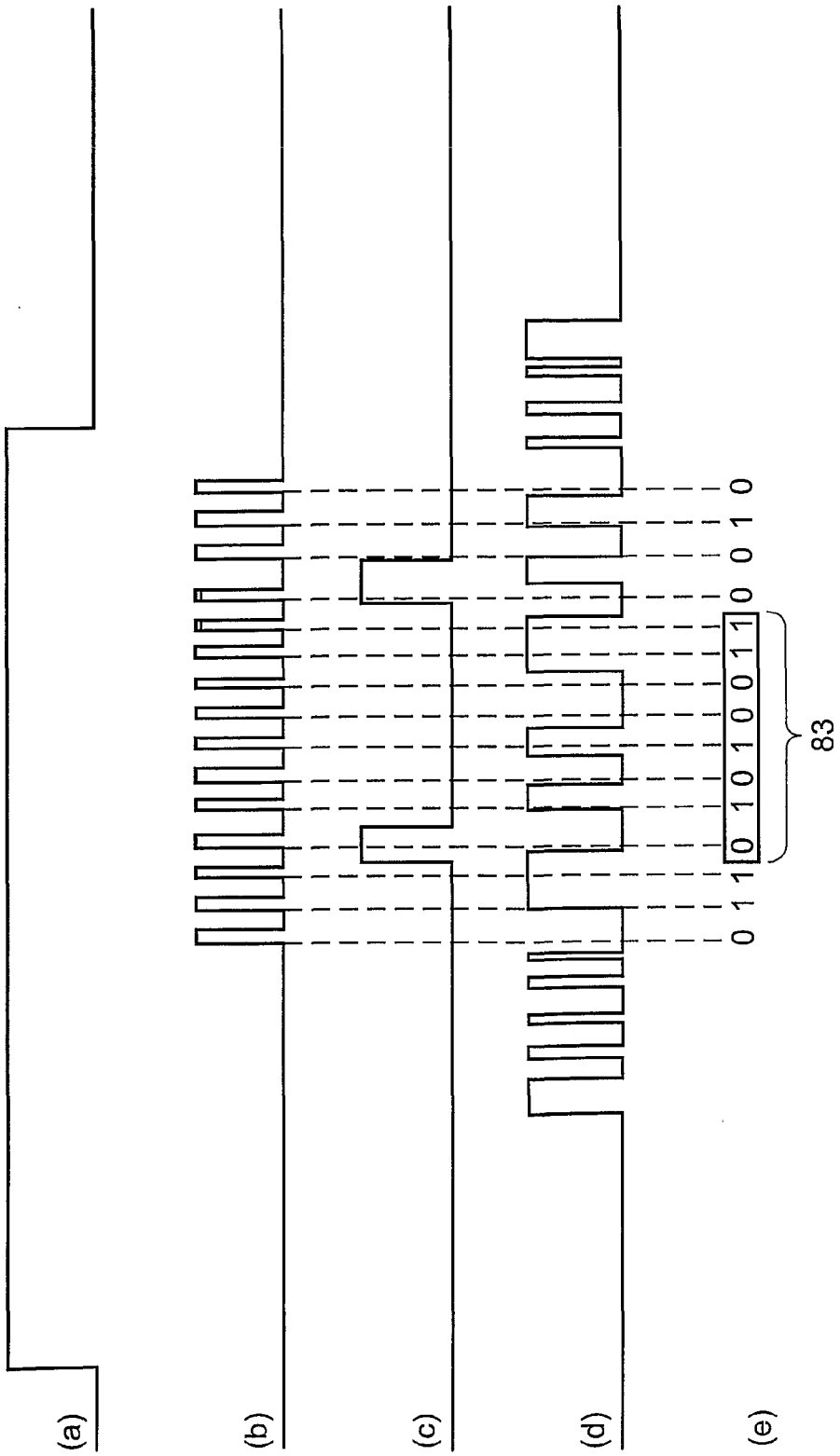


Fig. 9

K-FEE SYSTEM GMBH, EX2009, page 3205
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

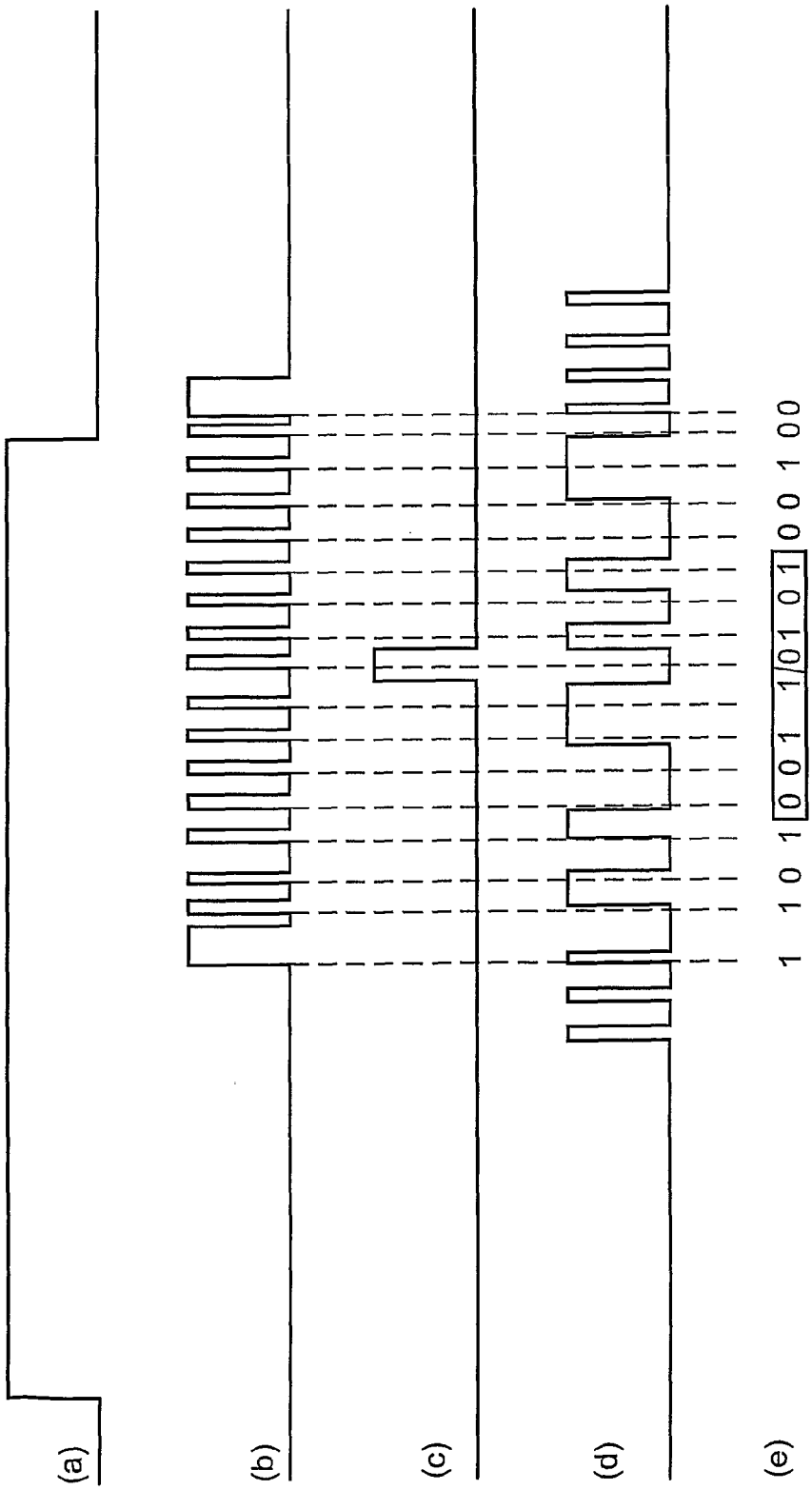


Fig. 10

K-FEE SYSTEM GMBH, EX2009, page 3206
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

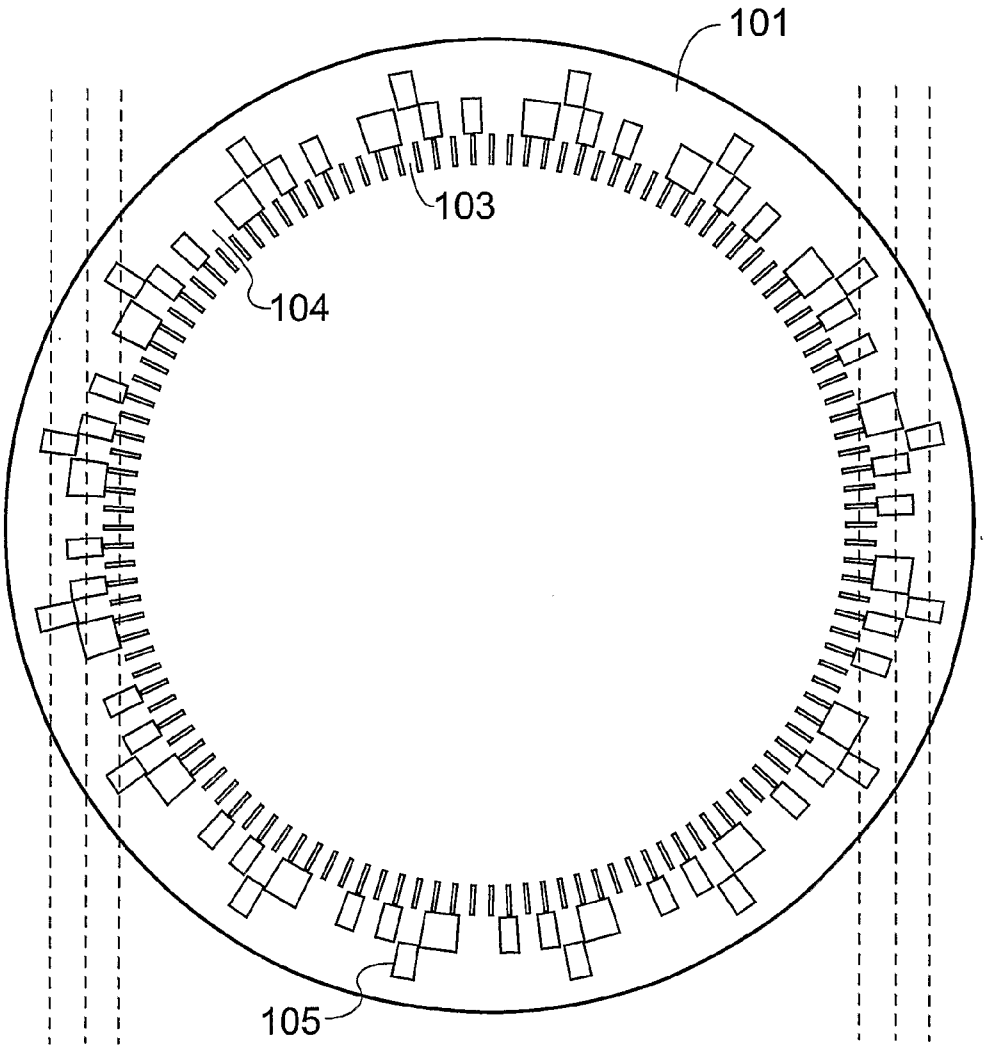


Fig. 11

K-FEE SYSTEM GMBH, EX2009, page 3207
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

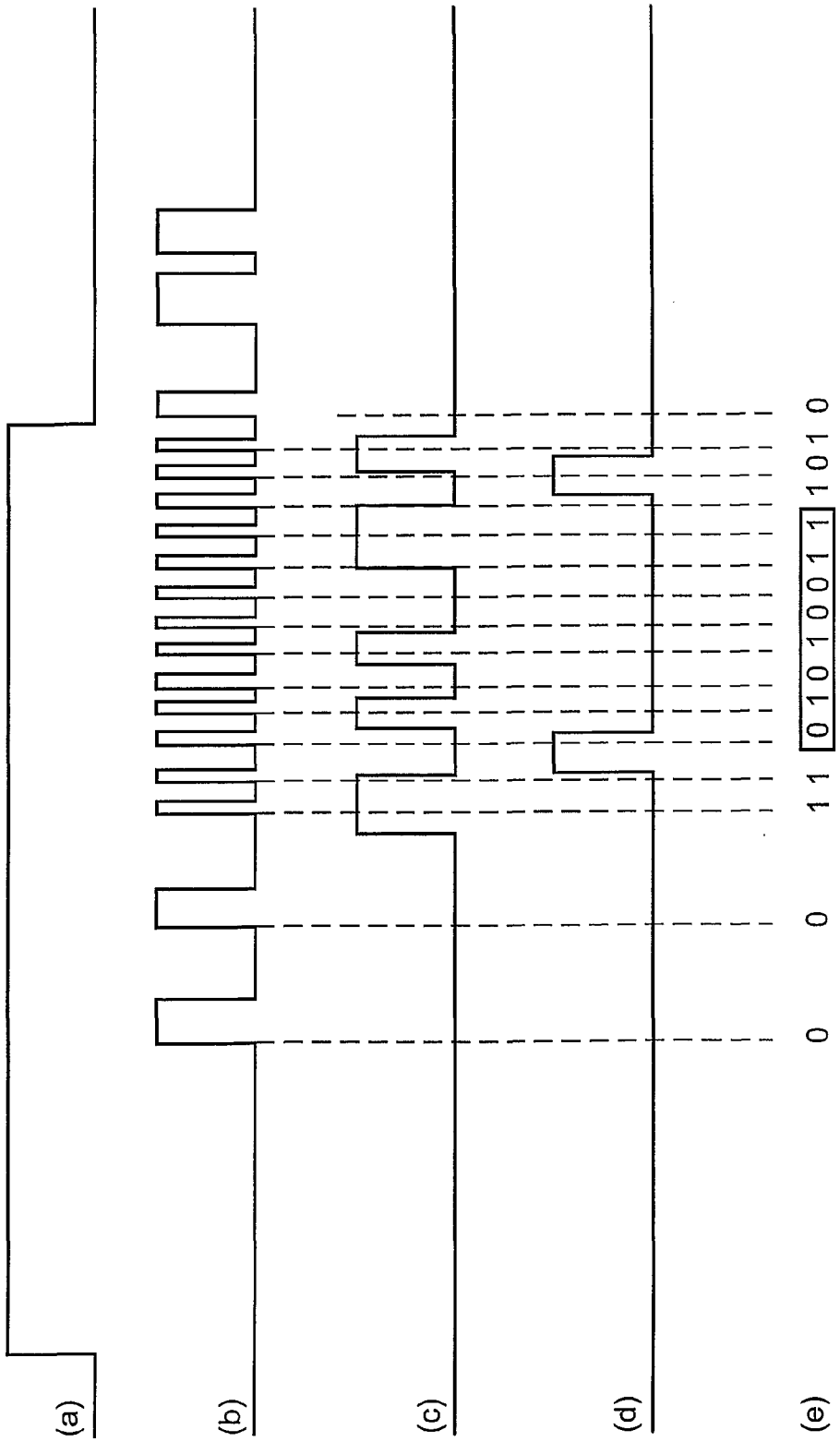


Fig. 12

K-FEE SYSTEM GMBH, EX2009, page 3208
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

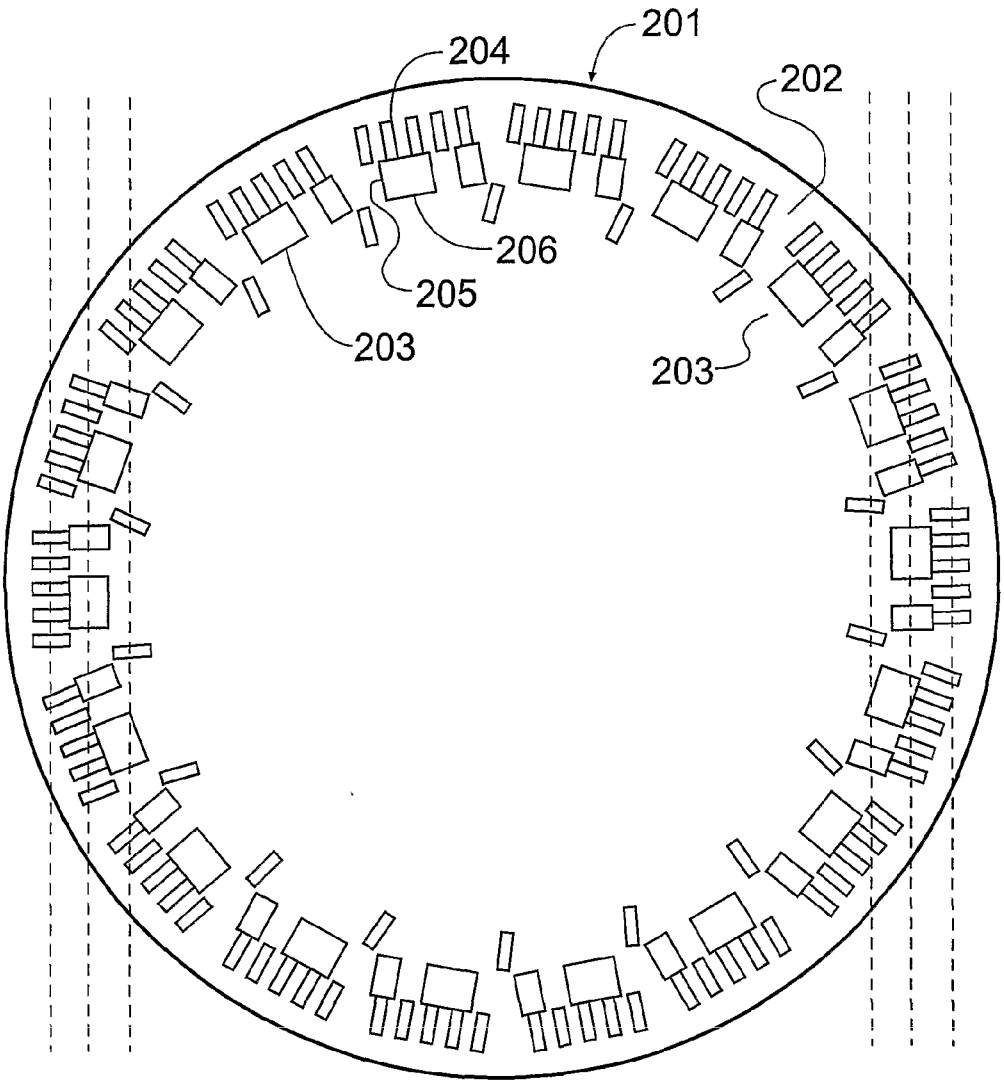


Fig. 13

K-FEE SYSTEM GMBH, EX2009, page 3209
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

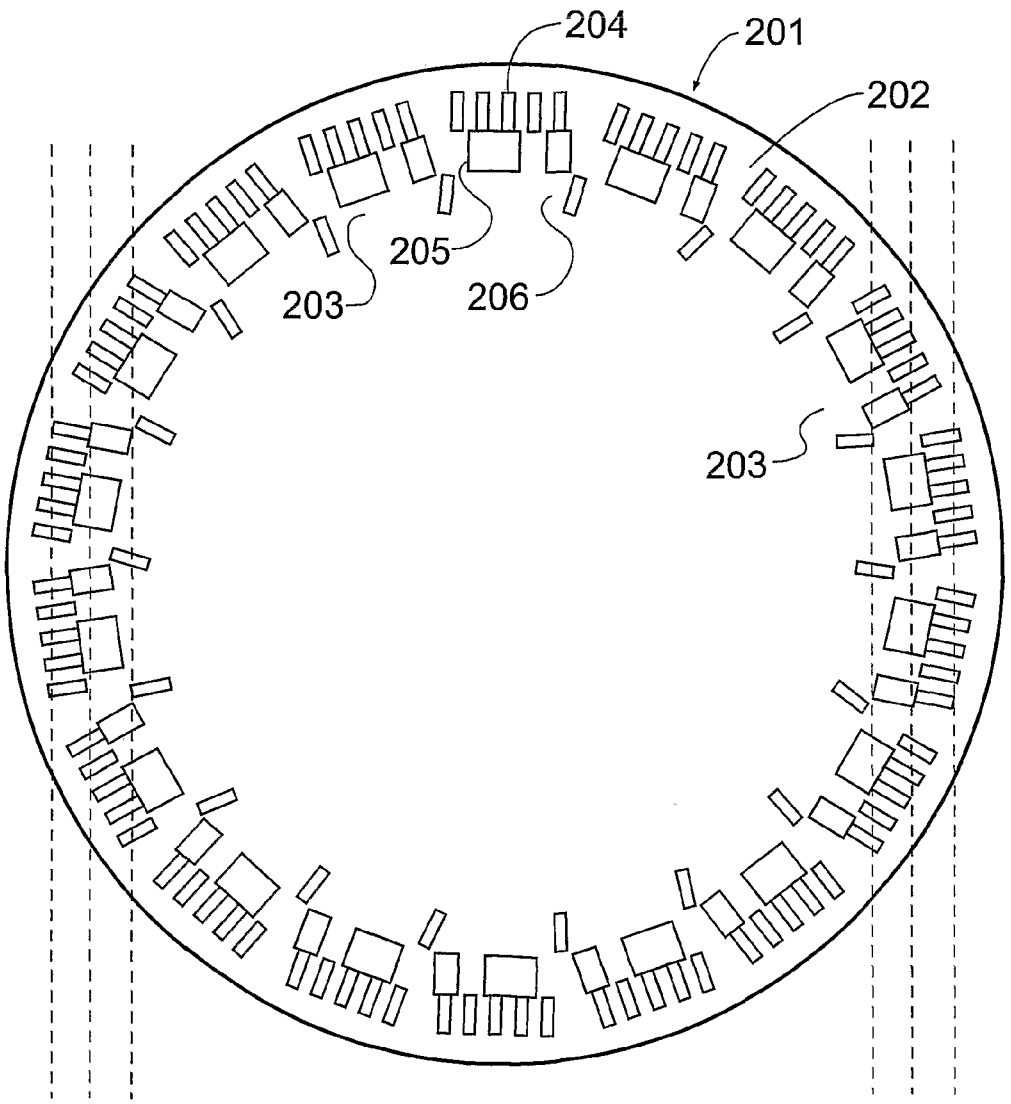


Fig. 14

K-FEE SYSTEM GMBH, EX2009, page 3210
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

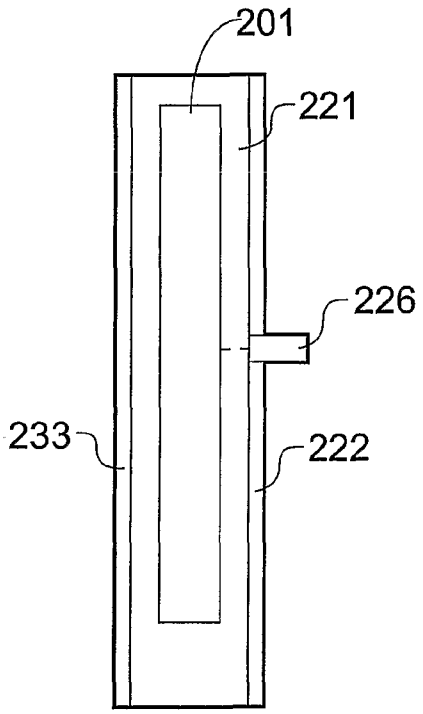


Fig. 15

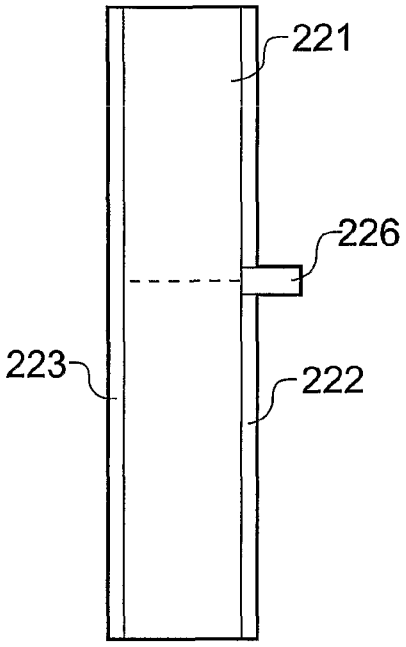


Fig. 16

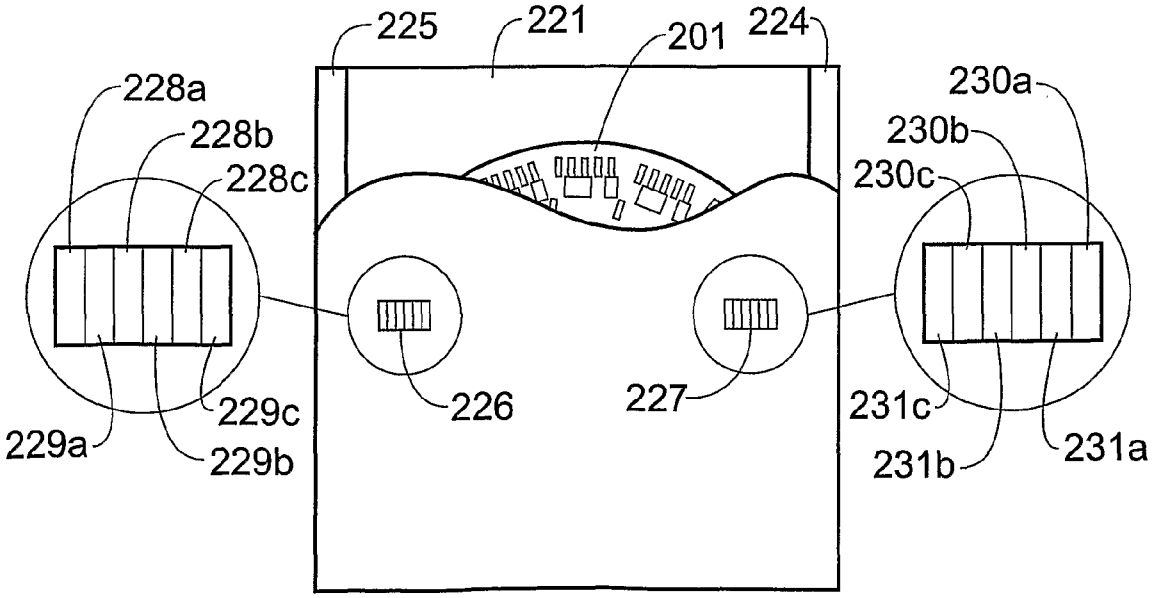


Fig. 17

K-FEE SYSTEM GMBH, EX2009, page 3211
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

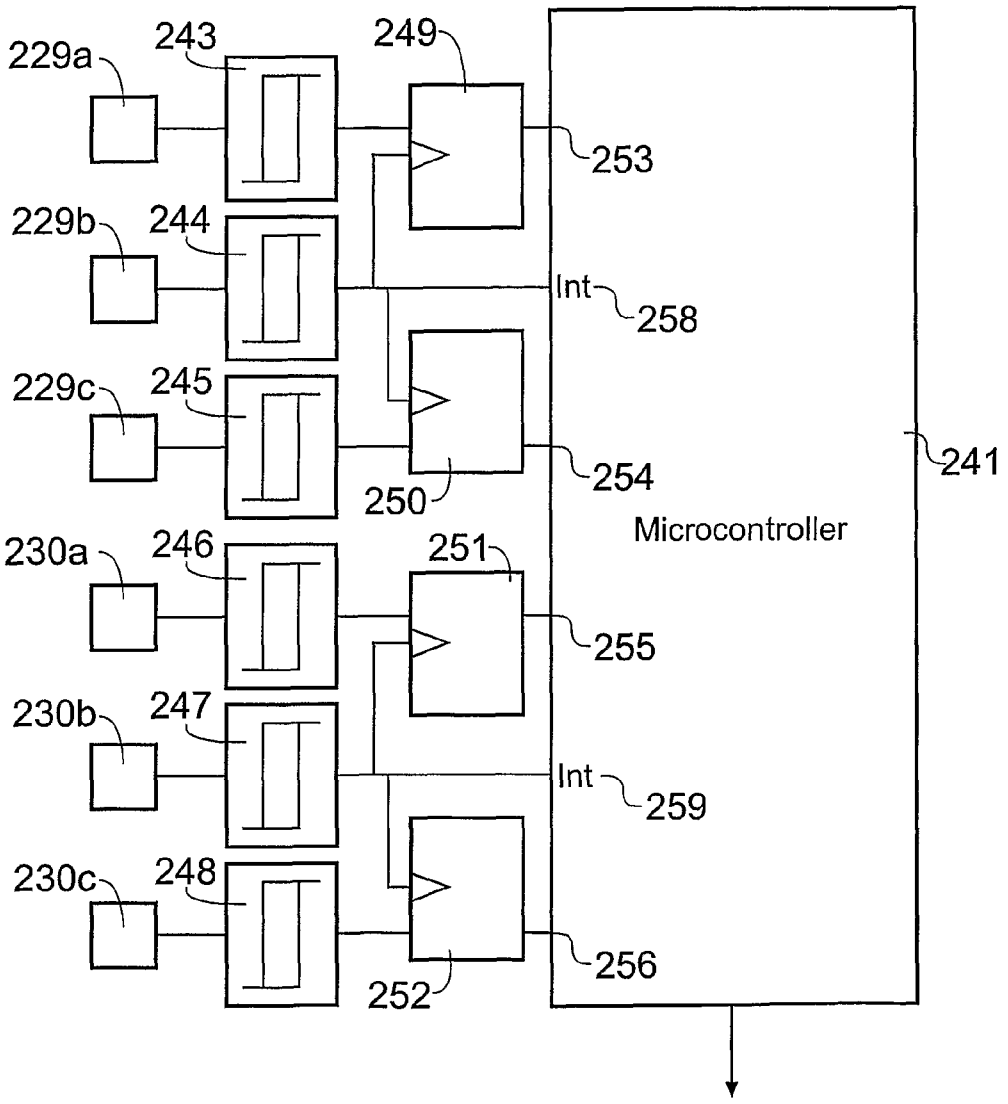


Fig. 18

K-FEE SYSTEM GMBH, EX2009, page 3212
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

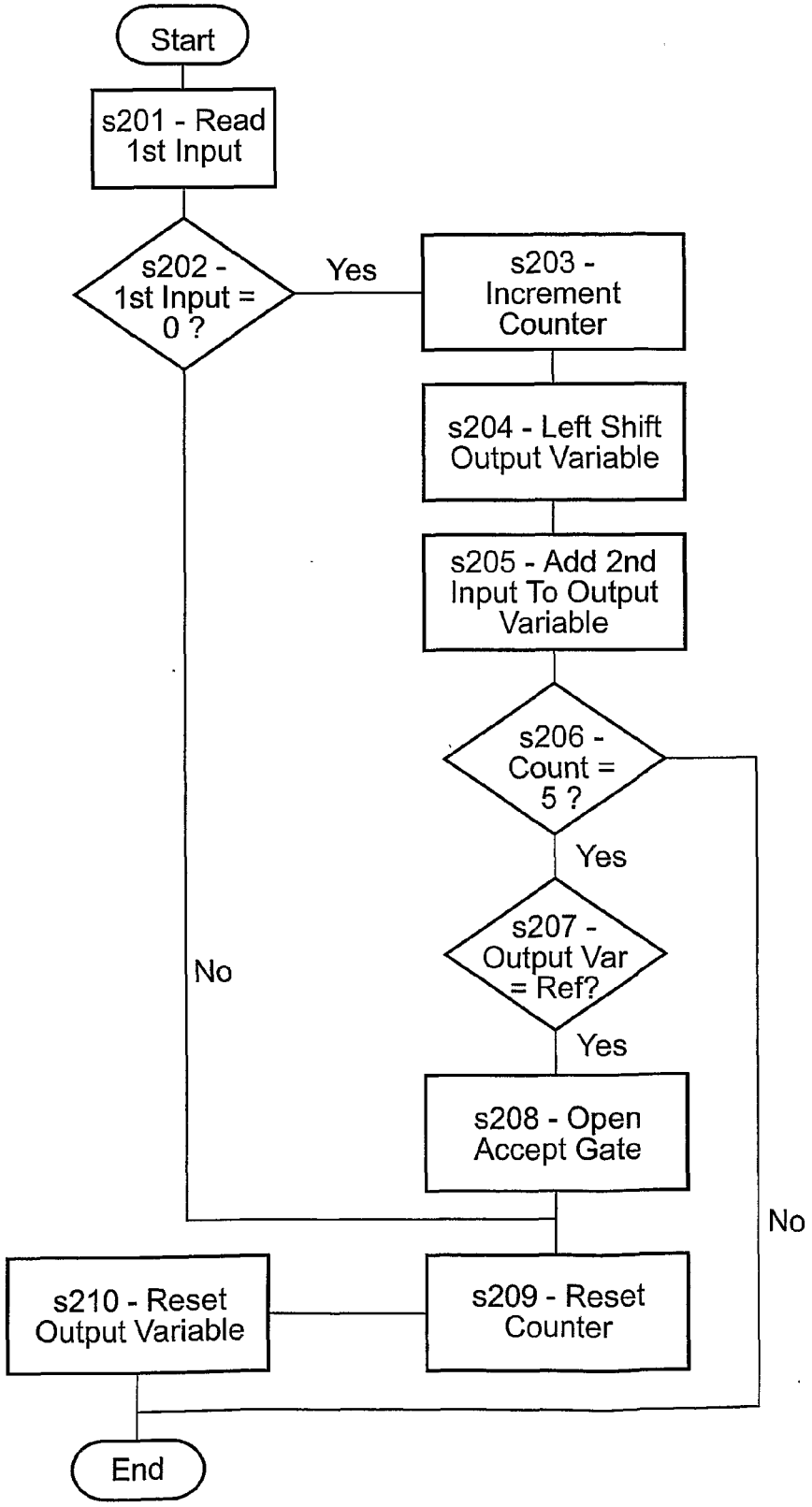


Fig. 19

K-FEE SYSTEM GMBH, EX2009, page 3213
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

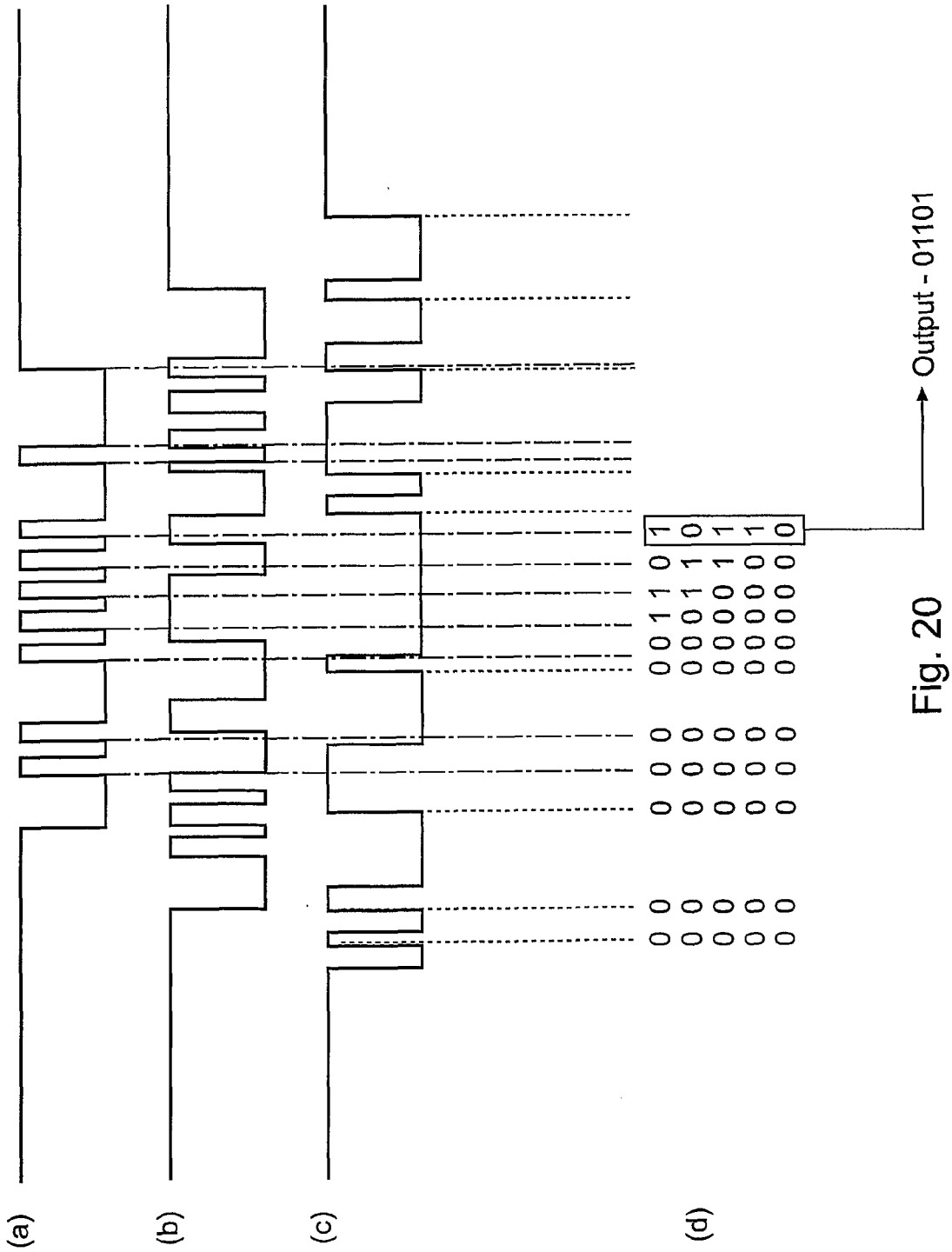


Fig. 20

K-FEE SYSTEM GMBH, EX2009, page 3214
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

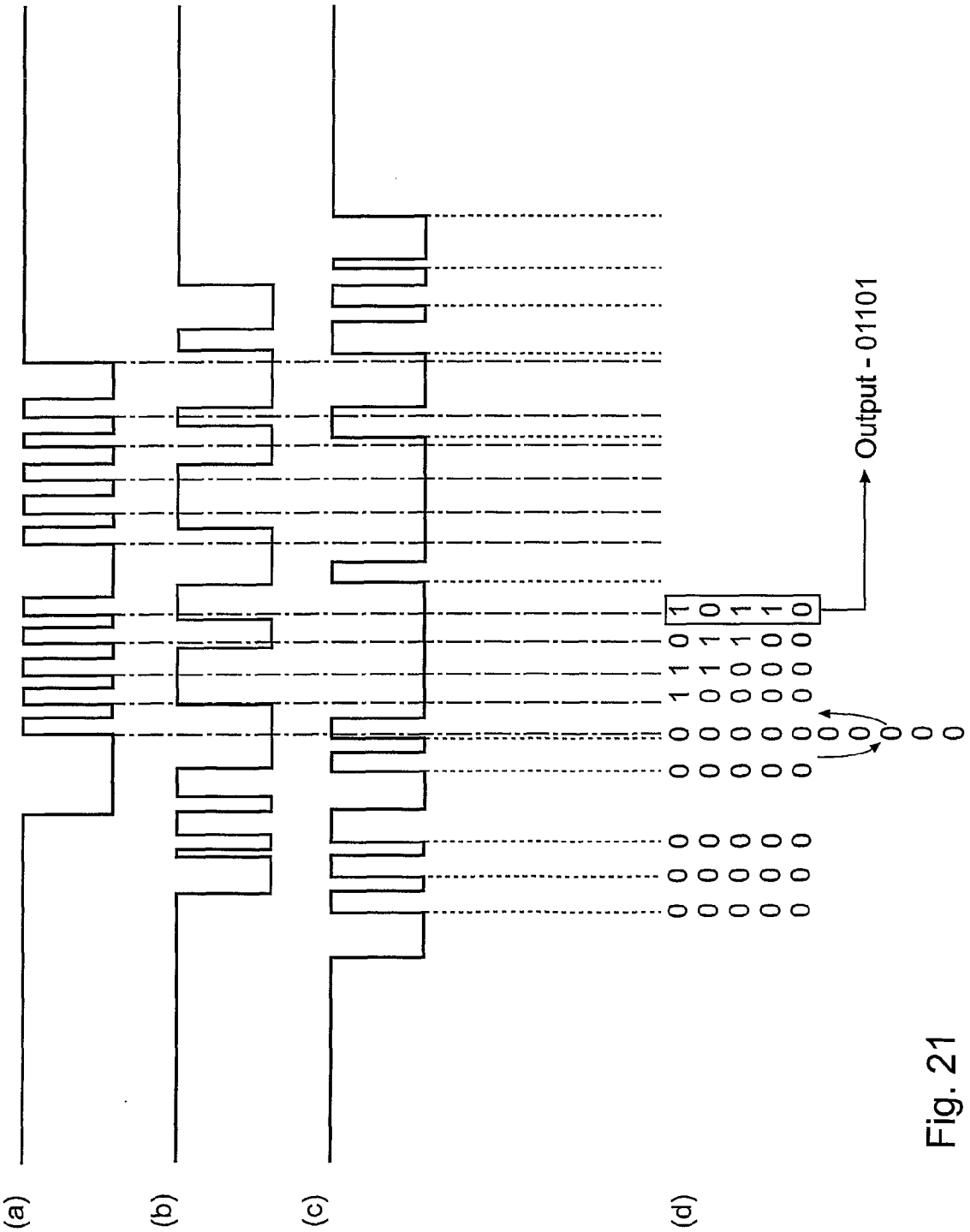


Fig. 21

K-FEE SYSTEM GMBH, EX2009, page 3215
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

INTERNATIONAL SEARCH REPORT

In nal Application No
PCT/GB 01/02720

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06K19/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 625 348 A (MASAKI HIDEO) 30 June 1989 (1989-06-30) page 2, line 8 -page 5, line 30; figures 1,2,10	1,2,9, 10,17, 18,26, 34-36, 44,51, 58,66,82
A	US 3 808 405 A (JOHNSON E ET AL) 30 April 1974 (1974-04-30) column 3, line 8-24; figure 1	1,9,10, 17,18, 26,34, 35,44, 51,58, 66,82

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

'A' document defining the general state of the art which is not considered to be of particular relevance

'E' earlier document but published on or after the international filing date

'L' document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

'O' document referring to an oral disclosure, use, exhibition or other means

'P' document published prior to the international filing date but later than the priority date claimed

'T' later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

'X' document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

'Y' document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

'&' document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 September 2001	05/10/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Schauler, M

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

In ınal Application No
PCT/GB 01/02720

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 260 556 A (LAKE ROYDEN J ET AL) 9 November 1993 (1993-11-09) column 2, line 57-66	1,9,10, 17,18, 26,34, 35,44, 51,58, 66,82

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

In nal Application No
PCT/GB 01/02720

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
FR 2625348	A	30-06-1989	JP	1245386 A	29-09-1989
			JP	1175093 A	11-07-1989
			JP	1718133 C	14-12-1992
			JP	4006036 B	04-02-1992
			FR	2625348 A1	30-06-1989
US 3808405	A	30-04-1974	CA	1067619 A1	04-12-1979
			DE	2328821 A1	07-02-1974
			FR	2193517 A5	15-02-1974
			GB	1417200 A	10-12-1975
			IT	991186 B	30-07-1975
			JP	49053329 A	23-05-1974
			JP	53024250 B	19-07-1978
US 5260556	A	09-11-1993	AU	630408 B2	29-10-1992
			WO	9007162 A1	28-06-1990
			NZ	231883 A	28-04-1993

Form PCT/ISA/210 (patent family annex) (July 1992)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors:	Jarisch et al.
Applicant:	Société des Produits Nestlé S.A.
Appl. No.:	13/697,297
Conf. No.:	1065
Filed:	November 9, 2012
Title:	CAPSULE, SYSTEM AND METHOD FOR PREPARING A BEVERAGE BY CENTRIFUGATION
Art Unit:	1792
Examiner:	Chaim A. Smith
Docket No.:	3712036-01693

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT TRANSMITTAL LETTER

Sir:

Submitted herewith is an Information Disclosure Statement for consideration in the above-identified application. In accordance with the provisions of 37 C.F.R. 1.56, 37 C.F.R. 1.97, and 37 C.F.R. 1.98, Applicants request that a citation and examination of the references cited on the enclosed form PTO/SB/08a be made during the course of examination of the above-identified application for United States patent. Pursuant to 37 C.F.R. 1.98, copies of any cited foreign patent documents and non-patent documents are enclosed.

This Information Disclosure Statement is submitted as follows:

Submission without Certification

[ ] Within three months of filing of a national application; within three months of the date of entry of the national stage as set forth in 37 C.F.R. §1.491 in an international application; before the mailing date of a first Office Action on the merits, or before the mailing of a first Office Action after the filing of a Request for Continued Examination.

[X] After the period specified above, but before the mailing date of a Final Action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an Action that otherwise closes prosecution in the application and is accompanied by payment of the fee set forth in 37 CFR 1.17(p).

Submission with Certification

[ ] Within three months of filing of a national application; within three months of the date of entry of the national stage as set forth in 37 C.F.R. §1.491 in an international application; before the mailing date of a first Office Action on the merits, or before the mailing of a first Office Action after the filing of a Request for Continued Examination.

K-FEE SYSTEM GMBH, EX2009, page 3219
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

[ ] After the period specified above, but before the mailing date of a Final Action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an Action that otherwise closes prosecution in the application and is accompanied by the Certification specified in 37 CFR 1.97(e) which is set forth below.

[ ] After the mailing date of a Final Action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an Action that otherwise closes prosecution in the application and is accompanied by the fee set forth in 37 CFR 1.17(p) and the Certification specified in 37 CFR 1.97(e) which is set forth below.

Certification under 37 CFR 1.97(e)

[ ] The undersigned counsel for applicant(s) hereby certifies that each item of information contained in the accompanying Information Disclosure Statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than **three months** prior to the filing of the Information Disclosure Statement.

[ ] The undersigned counsel for applicant(s) hereby certifies that no item of information contained in the accompanying Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned, after making reasonable inquiry, no item of information contained in the accompanying Information Disclosure Statement was known to any individual designated in 37 CFR 1.56(c) more than **three months** prior to the filing of the Information Disclosure Statement.

Statement under 37 CFR 1.704(d)

[ ] The undersigned counsel for applicant(s) hereby states that each item of information contained in the accompanying Information Disclosure Statement was first cited in any communication from a patent office in a counterpart foreign or international application or from the Office, and/or is a communication that was issued by a patent office in a counterpart foreign or international application or by the Office, and this communication was not received by any individual designated in § 1.56(c) more than **thirty days** prior to the filing of the information disclosure statement.

[ ] A copy of a Search Report from a corresponding foreign patent application is enclosed.

[X] The Commissioner is hereby authorized to charge the amount of $240.00 to cover the required fee to Deposit Account No. 02-1818.

K-FEE SYSTEM GMBH, EX2009, page 3220
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

[X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-1818.

Respectfully submitted,

K&L GATES LLP

BY /Aaron J. Morrow/
Aaron J. Morrow
Reg. No. 55,819
Customer No. 29157

Dated: September 30, 2019

K-FEE SYSTEM GMBH, EX2009, page 3221
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor:	Jarisch, et al.	Group Art Unit:	1792
Application No.:	13/697,297	Examiner:	Smith, Chaim A.
Filing Date:	November 9, 2012	Confirmation No.:	1065
Title:	CAPSULE, SYSTEM AND METHOD FOR PREPARING A BEVERAGE BY CENTRIFUGATION	Atty. Docket No.:	3712036-01693

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 23313-1450

SUGGESTION FOR DECLARATION OF
INTERFERENCE PURSUANT TO 37 C.F.R. § 41.202

In accordance with 37 C.F.R. § 41.202(a), and subject to the procedures set forth in Subpart D- Contested Cases of Part 41, Practice Before the Patent Trial and Appeal Board of 37 C.F.R., Applicant of the Present Application, Application No. 13/697,297 ("the '297 Application" or "the Jarisch Application"), hereby suggests an interference with Application No. 15/646,980 ("the '980 Application" or "the Kruger Application"). A copy of this Suggestion for Declaration of Interference will be provided to counsel of record for the Kruger Application.

Applicant also submits under 37 C.F.R. § 41.202 Appendices A-G in support of its Suggestion for Declaration of Interference.

Appendix A is a copy of the current claims in the Kruger Application, for which the U.S. Patent Office mailed a Notice of Allowance on July 11, 2019.

Appendix B is a copy of the current claims in the Jarisch Application, which are not rejected over any prior art and thus believed to be in condition for allowance.

K-FEE SYSTEM GMBH, EX2009, page 3222
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Appendix C is a copy PCT/EP2011/057657, filed in English on May 12, 2011, from which the Jarisch Application is a National Stage Entry, and which provides constructive reduction to practice of the proposed count.

Appendix D is a copy of EP 10169374.5, to which the Jarisch Application claims priority, and which provides constructive reduction to practice of the proposed count.

Appendix E is a copy of EP 10162741.2, to which the Jarisch Application claims priority, and which provides constructive reduction to practice of the proposed count.

Appendix F is a copy of the Wikipedia web address https://en.wikipedia.org/wiki/Barcode, last accessed July 19, 2019.

Appendix G is a copy of WO 01/99047A1 to D'Haens et al.

I. SUGGESTION OF INTERFERENCE

A. Status of Currently Pending Claims

On May 10, 2019, the Patent Trial and Appeal Board issued a Decision reversing the Examiner's prior rejection of claims 1, 2, 5-10 and 19 in the Present Application, Application No. 13/697,297 ("the '297 Application" or "the Jarisch Application"). After the Decision, Applicant for the Jarisch Application submitted a Request for Continued Examination (RCE) on July 19, 2019. Applicant also submitted an Amendment with the RCE, and the Amendment added new claims 20-28, which copy allowed claims 1, 10, 13, 16, 18, 20-22, and 24 of U.S. Application No. 15/646,980 ("the '980 Application" or "the Kruger Application").

On August 7, 2019, the Patent Office mailed a Non-Final Office Action for the Jarisch Application, and claims 1, 2, 5-10 and 19-28 in the Jarisch Application are not rejected over any prior art. The Non-Final Office Action rejected claims 21-23 and 25 under 35 U.S.C. § 112, but the Response to Non-Final Office Action submitted concurrently herewith establishes that these

K-FEE SYSTEM GMBH, EX2009, page 3223
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

rejections are improper. The Response also adds new claims 29-34 as discussed in greater detail below. Applicant believes all of the claims in the Jarisch Application are in condition for allowance.

The allowed claims of the Kruger Application are not the same as, or for the same or substantially the same subject matter as, a claim of the published version of the Kruger Application, U.S. Pat. Pub. No. 2017/0305654.

B. Identification and Procedural Status of Interfering Applications

1. Status of U.S. Application No. 15/646,980 – the Kruger Application

The Kruger Application was filed July 11, 2017 and published October 26, 2017 as U.S. Pat. Pub. No. 2017/0305654. On May 31, 2019, the Examiner issued a Notice of Allowance for claims 1, 10, and 13-30. On June 12, 2019, the Applicant filed remarks and an after-allowance amendment to the claims. Also on June 12, 2019, the Applicant paid the issue fee. On July 3, 2019, the Applicant withdrew the Kruger Application from issuance and filed a Request for Continued Examination based on newly-submitted prior art references. On July 11, 2019, the Examiner issued a Corrected Notice of Allowance. A clean copy of current claims 1, 10, and 13-30 in the Kruger Application is provided in Appendix A.

2. Status of U.S. Application No. 13/697,297 – the Jarisch Application

The Present Application is U.S. Pat. Appl. No. 13/697,297 to Jarisch et al., which was filed November 9, 2012, and published Mar. 14, 2013 as U.S. Pat. Pub. No. 2013/0064937. As noted above, the Patent Office mailed a Non-Final Office Action for the Jarisch Application on August 7, 2019, and claims 1, 2, 5-10 and 19-28 in the Jarisch Application are not rejected over any prior art. The Non-Final Office Action rejected claims 21-23 and 25 under 35 U.S.C. § 112,

K-FEE SYSTEM GMBH, EX2009, page 3224
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

but the Response to Non-Final Office Action submitted concurrently herewith establishes that these rejections are improper.

Previously submitted claims 20-28 copy claims 1, 10, 13, 16, 18, 20-22, and 24 of the Kruger Application, and new claims 29-34 submitted in the accompanying Response to Office Action should also be included in the Interference Count, as further detailed herein. Claims 1, 2, 5-10, and 19-34 are pending in this Application. A clean copy of current claims 1, 2, 5-10, and 19-34, which Applicant believes are in condition for allowance, is provided in Appendix B.

C. Compliance with 35 U.S.C. § 135(b)

Applicant's Suggestion for Interference and corresponding claims comply with 35 U.S.C. § 135(b). Section 135(b)(1) does not apply here because the Kruger Application is not an issued patent. Section 135(b)(2) also does not apply because the Jarisch Application is not "an application filed after the [Kruger] application [] published." Indeed, 35 U.S.C. § 135(b)(2) recites:

> A claim which is the same as, or for the same or substantially the same subject matter as, a claim of an application published under section 122(b) may be made in an application filed after the application is published only if the claim is made before 1 year after the date on which the application is published.

First, as set forth above in Section I.B.2, the Jarisch Application was filed November 9, 2012, years before the Kruger Application published on October 26, 2017. Second, even if Kruger's International Application PCT/EP2011/003677 is considered (it should not be), it did not publish until January 26, 2012, which is later than the May 12, 2011 filing date of the Jarisch Application's International Application PCT/EP2011/057657. *See Loughlin v. Ling*, 684 F.3d 1289, 1294 (Fed. Cir. 2012) (An "an application filed" in 35 U.S.C. § 135(b)(2) includes priority to an earlier effective filing date under § 120.). Third, the claims copied from the Kruger

K-FEE SYSTEM GMBH, EX2009, page 3225
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Application are not substantially the same as the claims that published in the Kruger Application's publication.

Accordingly, for at least the foregoing reasons, 35 U.S.C. § 135(b)(2) does not apply.

D. Relevant Interference Rules

"An interference exists if the subject matter of a claim of one party would, if prior art, have anticipated or rendered obvious the subject matter of a claim of the opposing party and vice versa." *See* 37 C.F.R. § 41.203(a). The requirements for a Suggestion of Interference are set forth in 37 C.F.R. § 41.202 (a)(1)-(6) as follows:

(1) Provide sufficient information to identify the application or patent with which the applicant seeks an interference,

(2) Identify all claims the applicant believes interfere, propose one or more counts, and show how the claims correspond to one or more counts,

(3) For each count, provide a claim chart comparing at least one claim of each party corresponding to the count and show why the claims interfere within the meaning of § 41.203(a),

(4) Explain in detail why the applicant will prevail on priority,

(5) If a claim has been added or amended to provoke an Interference, provide a claim chart showing the written description for each claim in the applicant's specification, and

(6) For each constructive reduction to practice for which the applicant wishes to be accorded benefit, provide a chart showing where the disclosure provides a constructive reduction to practice within the scope of the interfering subject matter.

Applicant has provided herein information satisfying each of these requirements.

K-FEE SYSTEM GMBH, EX2009, page 3226
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

II. 37 C.F.R. § 41.202 (a)(1) – IDENTIFICATION OF APPLICATION

A. Identification of Interfering Patent Application

As set forth above in Section I.A-B, Applicant seeks a Declaration of Interference between the Present Application and the Kruger Application specified below:

U.S. Pat. Appl. No. 15/646,980

Filed:	July 11, 2017
Published:	October 26, 2017
Publication No.	2017/0305654 A1
Inventor:	Marc Krüger
Applicant:	K-Fee System GmbH
Title:	Portion Capsule Having an Identifier

B. Identification of Related U.S. Patents and Patent Applications

The Kruger Application is a Division of Application No. 15/211,823, filed on July 15, 2016 and currently pending, which is a Division of Application No. 13/744,623, filed on January 18, 2013 and now abandoned, which is a continuation of PCT/EP2011/003677, filed on July 22, 2011. Application No. 16/438,818 is a continuation-in-part of the Kruger Application, filed on June 12, 2019.

III. 37 C.F.R. § 41.202 (a)(2) – IDENTIFICATION OF INTERFERING CLAIMS, PROPOSED COUNT, AND CLAIM CORRESPONDENCE

A. Identification of Interfering Claims

In accordance with the requirements of 37 C.F.R. § 41.202(a)(2), Applicant states that claims 1, 2, 5-10, and 19-28 of the Jarisch Application and claims 1, 10, and 13-30 of the Kruger Application interfere with one another. Claims 1, 2, 5-10, 19 and 29-34 of the Jarisch Application claim subject matter that is not patentably distinct from claims 1, 10, and 13-30 of

K-FEE SYSTEM GMBH, EX2009, page 3227
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

the Kruger Application; and claims 20-28 of the Jarisch Application are identical to claims 1, 10, 13, 16, 18, 20-22 and 24 of the Kruger Application.

B. Proposed Count

37 C.F.R. § 41.201 defines the term "Count" as "the Board's description of the interfering subject matter that sets the scope of admissible proofs on priority." In accordance with the requirements of 37 C.F.R. § 41.202(a)(2), the proposed Count is defined as follows:

COUNT I: The product of claim 20 of Applicant's '297 Application or the product of claim 1 of the '980 Application.

Each of these claims is directed to, *inter alia*, embodiments of a beverage capsule that include a barcode on the bottom side of its flange or rim, opposite the lid or membrane, that extends along the circumference of the flange and is used to individualize the beverage capsule. As set forth herein, any differences between Proposed Count I and claims 1, 2, 5-10, and 19-34 of the Jarisch Application and/or claims 1, 10, and 13-30 of the Kruger Application are not patentable distinctions.

C. Correspondence of the Claims of the Kruger Application and the Jarisch Application to the Count

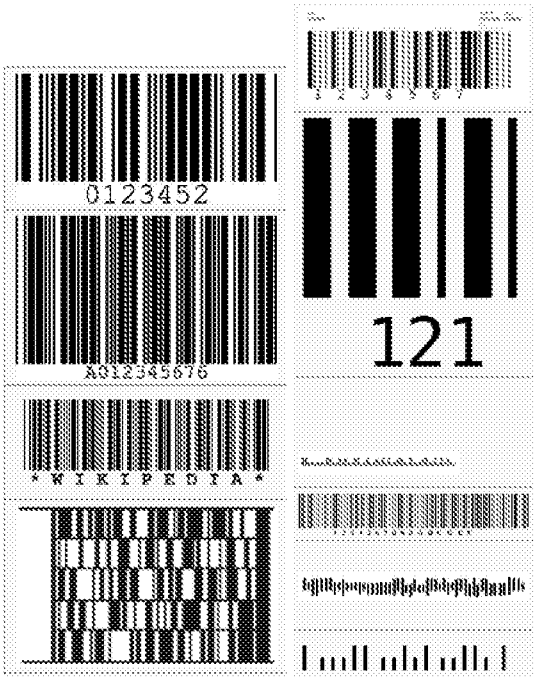
A (first) claim corresponds to another claim (a second claim) if the subject matter of the second claim, treated as prior art to the first claim, would have anticipated or rendered obvious the subject matter of the first claim. *See* 37 C.F.R. § 41.207(b)(2). Claims 1, 2, 5-10, and 19-34 of the Jarisch Application correspond to Proposed Count I because they claim the same patentable invention as the Proposed Count I. Claims 1, 10, and 13-30 of the Kruger Application correspond to Proposed Count I because they claim the same patentable invention as the Proposed Count I.

K-FEE SYSTEM GMBH, EX2009, page 3228
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

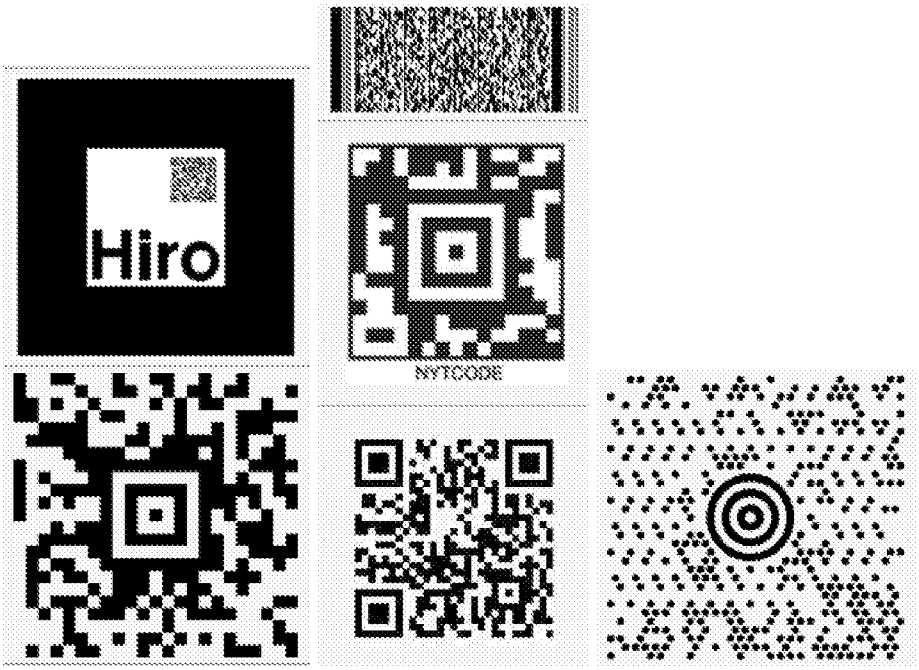
Any differences in claim language choice, or other claimed features that may differ from Proposed Count I do not provide patentable distinctions. Specifically, if the Proposed Count I were prior art to claims 1, 2, 5-10, and 19-34 of the Jarisch Application, and/or claims 1, 10, and 13-30 of the Kruger Application, they would be anticipated by and/or obvious thereover. 37 C.F.R. § 41.207(b)(2). There are no claims in the Jarisch and Kruger Applications that do not correspond to Proposed Count I.

1. Brief Background on Barcode Technology

Both the Jarisch Application and the Kruger Application disclose and claim barcodes on the bottom side of the capsule flange or rim. The term "barcode" is generally understood to refer to various different geometric shapes arranged in a pre-defined pattern in order to be read by an optical sensor. There are multiple types of barcodes that are used by optical readers to read data. (*See* Appendix F, https://en.wikipedia.org/wiki/Barcode.) Some barcodes represent data by varying the widths and spacings of parallel lines. (*Id.*) These are known as one-dimensional (1D) barcodes. Examples of different configurations of 1D barcodes are shown here:



(*Id.*) Two-dimensional (2D) barcodes also exist, which can use rectangles, dots, hexagons or other geometric patterns to represent data. (*Id.*) Examples of certain 2D barcodes are shown here:



(*Id.*)

Additionally, prior art barcode technologies such as WO 01/99047A1 to D'Haens et al. (*see* Appendix G), published in December 2001, describe a ***circular*** barcode for coins or discs made up of prism-shaped depressions (elements 10, 6, 7, 8) arranged in a surface according to a pre-defined pattern that can be read by an optical reader dependent on their reflective properties (*see e.g.,* page 6, lines 11-18). WO 01/99047A1 to D'Haens et al. repeatedly refer to this technology as barcode technology (*see, e.g.,* page 1, lines 4-29; page 1, line 32 – page 2, line 14; page 5, line 26-33). FIGs. 11 and 13 are shown herein:

K-FEE SYSTEM GMBH, EX2009, page 3230
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

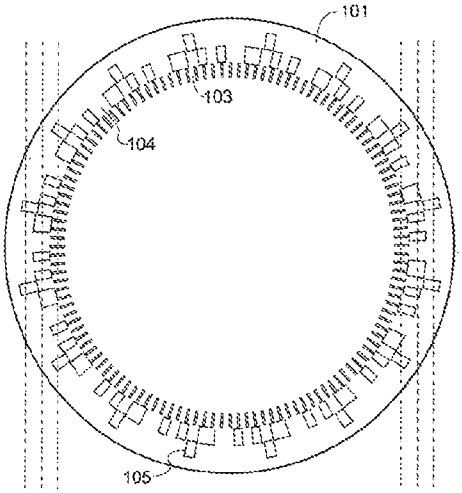


Fig. 11

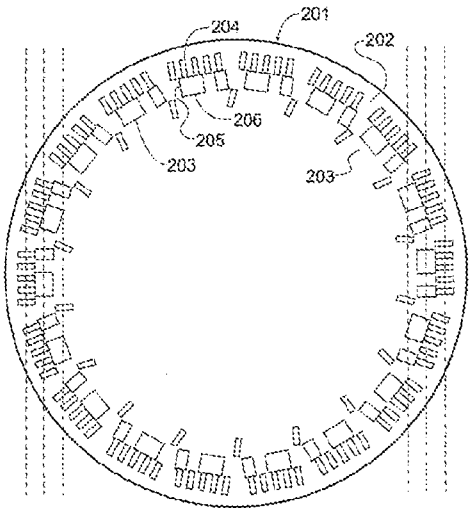


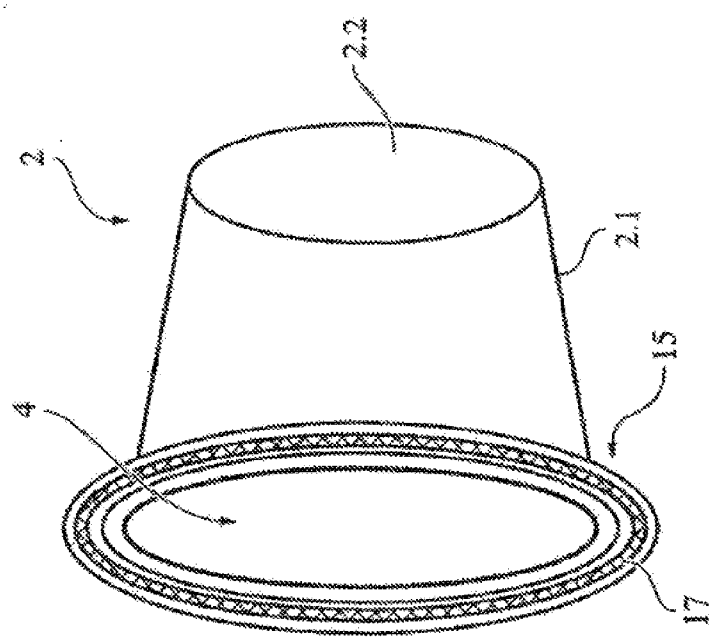
Fig. 13

Accordingly a person of ordinary skill in the art would understand a "barcode" to also include a series of reflective surfaces arranged in a circle, such as shown in WO 01/99047A1 to D'Haens et al.

2. The Kruger Application Barcode

Claim 1 of the Kruger Application (the subject of Proposed Count I) recites "an identifier . . . wherein the identifier is a ***barcode*** that is provided on a bottom side of the flange" and "extends around an entire circumference of the flange. . . ." The specification of the Kruger Application does not define or limit the claimed "barcode" to a particular type of barcode. For example, the Kruger Application does not limit the term "barcode" to thick and thin parallel lines arranged in a linear pattern. This is further evidenced by FIG. 2 of the Kruger Application where "barcode 17" printed on the membrane does not comprise bars, or thick and thin parallel lines, but rather, illustrates a pattern of geometrically shaped objects arranged about the circumference of the capsule. (*See* Kruger Application at [0064].) FIG. 2 of Kruger is reproduced in part below:

K-FEE SYSTEM GMBH, EX2009, page 3231
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923



Moreover, the Kruger Application explains that the "identifier" corresponding to the barcode "is composed of surface areas having different optical properties, for example reflection" and including "at least two areas which differ in their optical properties." (*See* Kruger Application at [0008].) This is further reflected in Kruger's dependent claim 21, which recites that "the barcode has at least two areas which differ in their optical properties."

Accordingly, the barcode positioned on the underside of the capsule flange as described and claimed by Kruger is not limited or defined, and one skilled in the art would understand that, if the Kruger Application was prior art to the Jarisch Application, it would anticipate or render obvious the code positioned on the bottom side of the capsule flange described and claimed in the Jarisch Application. Claims 1, 10, and 13-30 of the Kruger Application correspond to Proposed Count I.

3. The Jarisch Application Barcode

Claim 20 of the Jarisch Application (copied from claim 1 of the Kruger Application, and the subject of Proposed Count I) recites "an identifier . . . wherein the identifier is a ***barcode*** that

K-FEE SYSTEM GMBH, EX2009, page 3232
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

is provided on a bottom side of the flange" and "extends around an entire circumference of the flange. . . ." Claim 1 of the Jarisch Application recites "a code adapted for being identified or read by an external reader, the code is arranged on a bottom of the flange-like rim, which is opposed to the lid" and wherein "the code comprises successive segments. . . ." Dependent claim 6 of the Jarisch Application further modifies the code of claim 1 such that "the code is a bit code formed by a series of discrete polygonal or dot surfaces printed on and/or embossed in the container." Dependent claim 8 further modifies the code of claim 1 such that "the code is printed or embossed by a pattern which possesses surfaces having different reflective and/or absorbing properties to light." Dependent claim 9 further modifies the code of claim 8 such that "the pattern possesses a first surface having inclined mirroring or absorbing properties to light and a second surface having flat mirroring or flat reflective properties to light." All of these claims relate to permutations of barcode technology on the bottom side of the capsule flange.

Indeed, although the term "barcode" is not expressly used to describe the invention, the Jarisch Application indicates that "[p]referably, the code is an optical code" and "may be a bit code formed by a series of discrete polygonal (e.g., rectangles or squares) or dot surfaces printed on the container or embossed in the container." (*See* Jarisch Application at [0017].) The code "may comprise successive arch-shaped segments" and "may also comprise successive segments which are individually rectilinear." (*Id.* at [0037].) The bit code is read optically based on the reflective properties of the successive rectangular code segments. (*Id.* at [0063] – [0064].) The data read "depend[s] on the number and specific arrangement of mirror surfaces (e.g. rectangles) and diffusing or absorbing surfaces (e.g., zones between the rectangles)." (*Id.* at [0086].)

Accordingly, the optical code positioned on the bottom side of the capsule flange as described and claimed by Jarisch constitutes a type of barcode to one of ordinary skill in the art.

Thus, if the Jarisch Application was prior art to the Kruger Application, it would anticipate or render obvious the barcode positioned on the bottom side of the capsule flange described and claimed in the Kruger Application. Claims 1, 2, 5-10, 19-28 and 29-34 of the Jarisch Application correspond to Proposed Count I.

IV. 37 C.F.R. § 41.202 (a)(3) – CLAIM CHART COMPARING AT LEAST ONE CLAIM OF COUNT 1

37 C.F.R. § 41.202(a)(3) requires, for each count, a claim chart comparing at least one claim of each party corresponding to the count and show why the claims interfere within the meaning of 37 C.F.R. § 41.203(a). Under 37 C.F.R. § 41.203(a), claims interfere "if the subject matter of a claim of one party would, if prior art, have anticipated or rendered obvious the subject matter of a claim of the opposing party and vice versa."

The following chart compares claim 20 of the Jarisch Application and claim 1 of the Kruger Application, which are identical.

The '297 Appl., Claim 20	The '980 Appl., Claim 1	Differences
[a] A single-serve capsule for making a beverage, comprising:	[a] A single-serve capsule for making a beverage, comprising:	None.
[b] a base element with a cavity, in which a raw beverage material is provided, a flange horizontally extending from the base element,	[b] a base element with a cavity, in which a raw beverage material is provided, a flange horizontally extending from the base element,	None.
[c] a membrane that is configured to close the cavity, the membrane is fastened to a top side of the flange,	[c] a membrane that is configured to close the cavity, the membrane is fastened to a top side of the flange,	None.
[d] an identifier, which makes it possible to individualize the respective single-serve capsule, wherein the identifier is a barcode that is provided on a bottom side of the flange,	[d] an identifier, which makes it possible to individualize the respective single-serve capsule, wherein the identifier is a barcode that is provided on a bottom side of the flange,	None.

K-FEE SYSTEM GMBH, EX2009, page 3234
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

[e] the identifier extends around an entire circumference of the flange,	[e] the identifier extends around an entire circumference of the flange,	None.
[f] the bottom side of the flange is opposite the top side of the flange to which the membrane is fastened.	[f] the bottom side of the flange is opposite the top side of the flange to which the membrane is fastened.	None.

V. 37 C.F.R. § 41.202 (a)(4) – APPLICANT WILL PREVAIL ON PRIORITY

Applicant's Jarisch Application will prevail on priority at least because Applicant was first to invent the subject matter of Count I, as evidenced at least by constructive reduction to practice prior to Kruger's earliest possible constructive reduction to practice.

The Jarisch Application will prevail on priority with respect to Proposed Count I and thus Applicant should be designated the Senior Party in the interference proceeding because Applicant has the earliest constructive reduction to practice of the proposed count. The Jarisch Application is entitled to an earlier constructive reduction to practice than the earliest possible constructive reduction to practice of the Kruger Application. Thus, even assuming, ***arguendo***, that the Kruger Application is given its earliest possible reduction to practice date of July 22, 2010 to DE 102010031988.0, the Jarisch Application's May 12, 2010 constructive reduction to practice is earlier in time, rendering Jarisch the Senior Party to the interference. Moreover, even assuming, ***arguendo***, that the Jarisch Application could only claim priority back to its July 13, 2010 constructive reduction to practice, this would still be earlier than the Kruger Application's earliest possible constructive reduction to practice, rendering Jarisch the Senior Party to the interference.

Specifically, each of the following applications, to which the Jarisch Application claims priority, constitutes a constructive reduction to practice of an embodiment within the scope of the proposed count:

K-FEE SYSTEM GMBH, EX2009, page 3235
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

- **PCT/EP2011/057657, filed May 12, 2011**, from which the Jarisch Application is a National Stage Entry. Section VI.A provides a claim chart illustrating exemplary written disclosure in PCT/EP2011/057657 for each limitation of claims corresponding to the proposed count satisfying constructive reduction to practice. A copy of PCT/EP2011/057657 is attached hereto as Appendix C.
- **EP 10169374.5, filed July 13, 2010**, from which the Jarisch Application and PCT/EP2011/057657 claim priority. Section VI.B provides a claim chart illustrating exemplary written disclosure in EP 10169374.5 for each limitation of claims corresponding to the proposed count satisfying constructive reduction to practice. A copy of EP 10169374.5 is attached hereto as Appendix D.
- **EP 10162741.2, filed May 12, 2010**, from which the Jarisch Application and PCT/EP2011/057657 claim priority. Section VI.C provides a claim chart illustrating exemplary written disclosure in EP 10162741.2 for each limitation of claims corresponding to the proposed count satisfying constructive reduction to practice. A copy of EP 10162741.2 is attached hereto as Appendix E.

Accordingly, Applicant will be able to prove conception and constructive reduction to practice before the earliest possible date of constructive reduction to practice of the Kruger Application. Applicant reserves the right to rely upon additional evidence of conception, diligence and reduction to practice in connection with earlier dates.

VI. 37 C.F.R. § 41.202 (a)(5) – WRITTEN DESCRIPTION FOR CLAIMS 20-28 IN APPLICANT'S SPECIFICATION

Pursuant to 37 C.F.R. § 41.202(a)(5), "[i]f a claim has been added or amended to provoke an interference, provide a claim chart showing the written description for each claim in the

K-FEE SYSTEM GMBH, EX2009, page 3236
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

applicant's specification." Although claims 1, 2, 5-10 and 19 fall within the scope of Proposed Count I, and are subject to interference with the Kruger Application, they are preexisting claims that were not added or amended for purposes of provoking interference.

Claims 20-28 were previously added to further provoke interference. Although the Jarisch Application does expressly use the term "barcode" to describe the geometric optical code, as explained in Sections III.C.1-3, the Jarisch Application describes barcode technology and thus provides written description support for the claim term. *See Blue Calypso LLC v. Groupon, Inc.*, 117 USPQ.2d, 2016 WL 791107, at *9-11 (Fed. Cir. 2016) (vacating PTAB's finding that a specification failed to meet the written description requirement when the disputed claim term was not present in the specification because "when examining the written description for support for the claimed invention, [the Federal Circuit has] held that the exact terms appearing in the claim 'need not be used *in haec verba*'").

Accordingly, the following claim chart shows exemplary written description for each new claim in the Jarisch Application copied from the Kruger Application. Applicant reserves the right to rely upon additional portions of the disclosure to support written description.

Claims 20-28	**Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al.**
20. A single-serve capsule for making a beverage, comprising:	[0001] The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device. [0002] The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity. [0004] The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. . . . The capsule can be single use.

K-FEE SYSTEM GMBH, EX2009, page 3237
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 20-28	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al.
a base element with a cavity, in which a raw beverage material is provided,	[0001] The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device. [0002] The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity. [0004] The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. . . . The capsule can be single use. [0005] The term ingredient means any suitable beverage substance such as ground coffee, soluble coffee, leaf tea, soluble tea, herbal tea, dairy powder, baby food, culinary powder and combination thereof. [0036] In the following examples (see FIG. 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. . . . The capsule is filled with beverage ingredient such as ground coffee. FIGs. 4-7.
a flange horizontally extending from the base element,	[0002] The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity. [0021] In an embodiment, the container comprises a body and a lid connected to the body . . . . [0036] In the following examples (see FIG. 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee. FIGs. 4-7.
a membrane that is configured to close the cavity, the membrane is	[0036] In the following examples (see FIG. 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable

K-FEE SYSTEM GMBH, EX2009, page 3238
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 20-28	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al.
fastened to a top side of the flange, and	to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee. FIGs. 4-7.
an identifier, which makes it possible to individualize the respective single-serve capsule,	[0006] The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof. [0014] The aim of the present invention is to propose an improved way to identify the capsule within a beverage production machine to ensure a more reliable and convenient retrieval or reading of information so as to adjust working parameters of the machine. [0015] The aim is achieved by a capsule for the preparation of a beverage comprising a container and a beverage ingredient contained therein, wherein the container comprises a code adapted for being identified or read by external reading means, wherein the code is arranged on the container to be read while the capsule is rotated around an axis of rotation traversing the capsule. FIGs. 4-7
wherein the identifier is a barcode that is provided on a bottom side of the flange,	[0006] The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof. [0017] Preferably, the code is an optical code. The code may be a bit code formed by a series of discrete polygonal (e.g., rectangles or squares) or dot surfaces printed on the container and/or embossed in the container. [0022] In another embodiment, the code is present on the rim of the capsule. In the most preferred embodiment, the code is present on the bottom of the rim of the capsule which is opposed to the lid of the capsule. The bottom of the rim is sufficiently away from the liquid injection and beverage delivery areas so that there is a lower risk for the code to become unreadable such if partly or totally hidden or soiled by

K-FEE SYSTEM GMBH, EX2009, page 3239
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 20-28	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al.
	beverage residues or otherwise (e.g., coffee particles). As a result, the reading is made more reliable. . . . [0024] In particular, the reading means may comprise a light emitter and a light sensor. . . . The optical reading means or inductive sensor may be arranged to detect a code on the rim of the capsule. [0063] 2) Optical Reading On Rim Bottom Side Of Capsule (FIGS. 4 to 7): [0064] The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties. The surfaces are arranged in a circular pattern or an arc-shaped pattern at least along an angular portion of the rim. FIGS. 4-7.
the identifier extends around an entire circumference of the flange, the bottom side of the flange is opposite the top side of the flange to which the membrane is fastened.	[0016] More particularly, the capsule has a circumference wherein the code is arranged on the container along an arc-shaped or circular path of the circumference. In a particular mode, the capsule has a circumference wherein the code comprises successive segments which are individually rectilinear but extend substantially along at least a part of the circumference. More particularly, the code is arranged along at least a eighth of the circumference. This configuration provides a reliable reading or retrieval of information as well as an effective portion for information. In order to ensure a reliable reading or retrieval of information, the code is repeated along said circumference. The repetition ensures a higher probability that at least one code is readable but also may potentially reduce the reading time. [0021] In an embodiment, the container comprises a body and a lid connected to the body and wherein the code is present on the lid of the container. The lid may be a closed foil and/or a filter, for example. [0022] In another embodiment, the code is present on the rim of the capsule. In the most preferred embodiment, the code is present on the bottom of the rim of the capsule which is opposed to the lid of the capsule. . . .

Claims 20-28	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al.
	[0036] In the following examples (see FIG. 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee. [0037] The capsule is designed for rotating around an axis A. This axis A crosses perpendicularly the center of the membrane which has the form of a disk. This axis A exits at the center of the bottom of the body. This axis A will help to define the notion of "circumference" which is a circular path located on the capsule and having the axis A as reference axis. This circumference can be on the lid, e.g., membrane or on the body part such as on the flange-like rim. The lid may be impervious to liquid before insertion in the device or it may be pervious to liquid by means of small openings or pores provided in the center and/or periphery of the lid. The code is spread along the circumference or a part of the circumference. The code may comprise successive arch-shaped segments. The code may also comprise successive segments which are individually rectilinear but extend along at least a part of the circumference. According to one embodiment, the sensor cannot read the code without the rotation of the capsule. This is the case where the code is spread along at least a eighth, preferably at least a quarter of the circumference or even more. The fact that the code is placed along an arc-shaped line render the reading by a sweep beam very difficult. This is why the rotation of the capsule plays an important role. In case that the code is located on the body, it is then necessary to rotate the capsule to have access, for the sensor, to the entire set of marks composing the code. The code is further located close to the peripheral edge of the capsule. The peripheral edge is defined as the outermost circular line of the capsule. Preferably, the distance of the code from the peripheral edge is not more than 10 mm, more preferably not more than 8 mm. [0039] The code is preferably repeated along the circumference in order to ensure a reliable reading. The code is repeated at least twice on the circumference. Preferably, the code is repeated three to six times on the circumference. Repetition of the code means that the same code is duplicated and the successive codes are positioned in series along the circumference so that upon a 360-degree rotation of the

K-FEE SYSTEM GMBH, EX2009, page 3241
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 20-28	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al.
	capsule, the same code can be detected or read more than one time. FIGs. 4-7.
21. The single-serve capsule according to claim 20, wherein the barcode is printed by material removal.	[0017] Preferably, the code is an optical code. The code may be a bit code formed by a series of discrete polygonal (e.g., rectangles or squares) or dot surfaces printed on the container and/or embossed in the container. [0019] Preferably, the code is printed or embossed to form a pattern which possesses surfaces having different reflective and/or absorbing properties to light. In particular, the pattern possesses first surfaces and second surfaces having different reflective and/or absorbing properties to light. More particularly, the pattern possesses first surfaces inclined mirroring or absorbing properties to light and second surfaces having flat mirroring or flat reflective properties to light. [0020] In a possible mode, the code is mechanically embossed or engraved on the container by laser or by other means such as a press. [0078] The code can be applied on the capsule by: Printing (absorbing/reflecting + diffusing), visible, invisible or, Laser engraving (e.g. for absorbing/reflecting−diffusing) surfaces or, Embossing: Flat and inclined mirroring surfaces. [0088] <u>3) Application modes of codes onto a capsule</u> The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology). FIGs. 4-7.
22. The single-serve capsule according to claim 20, wherein the base element is made of metal.	[0002] The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee

K-FEE SYSTEM GMBH, EX2009, page 3242
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 20-28	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al.
	machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity. [0004] The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use. [0089] The codes described in the previous examples can be applied by different methods onto a capsule such as by: Printing or mechanical deforming on a formed capsule or, Printing or mechanical deforming on the capsule raw material (foil) before container forming or, Printing on outer surface of a capsule container or, Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology). [0095] Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device.
23. The single-serve capsule according to claim 20, wherein the base element comprises a bottom and a wall region that extends between the flange and the bottom, the side wall has an electrically conductive section.	[0089] The codes described in the previous examples can be applied by different methods onto a capsule such as by: Printing or mechanical deforming on a formed capsule or, Printing or mechanical deforming on the capsule raw material (foil) before container forming or, Printing on outer surface of a capsule container or, Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology). [0095] Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps.

K-FEE SYSTEM GMBH, EX2009, page 3243
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 20-28	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al.
	When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device.
24. The single-serve capsule according to claim 20, wherein the identifier comprises metal.	[0024] In particular, the reading means may comprise a light emitter and a light sensor. In an alternative, the reading means comprises an inductive sensor. The optical reading means or inductive sensor may be arranged to detect a code on the rim of the capsule. [0089] The codes described in the previous examples can be applied by different methods onto a capsule such as by: Printing or mechanical deforming on a formed capsule or, Printing or mechanical deforming on the capsule raw material (foil) before container forming or, Printing on outer surface of a capsule container or, Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology). [0095] Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device.
25. The single-serve capsule according to claim 20, wherein the barcode extends around an entire perimeter of the base element.	[0016] More particularly, the capsule has a circumference wherein the code is arranged on the container along an arc-shaped or circular path of the circumference. In a particular mode, the capsule has a circumference wherein the code comprises successive segments which are individually rectilinear but extend substantially along at least a part of the circumference. More particularly, the code is arranged along at least a eighth of the circumference. This configuration provides a reliable reading or retrieval of information as well as an effective portion for information. In order to ensure a

K-FEE SYSTEM GMBH, EX2009, page 3244
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 20-28	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al.
	reliable reading or retrieval of information, the code is repeated along said circumference. The repetition ensures a higher probability that at least one code is readable but also may potentially reduce the reading time. [0037] The capsule is designed for rotating around an axis A. This axis A crosses perpendicularly the center of the membrane which has the form of a disk. This axis A exits at the center of the bottom of the body. This axis A will help to define the notion of "circumference" which is a circular path located on the capsule and having the axis A as reference axis. This circumference can be on the lid, e.g., membrane or on the body part such as on the flange-like rim. The lid may be impervious to liquid before insertion in the device or it may be pervious to liquid by means of small openings or pores provided in the center and/or periphery of the lid. The code is spread along the circumference or a part of the circumference. The code may comprise successive arch-shaped segments. The code may also comprise successive segments which are individually rectilinear but extend along at least a part of the circumference. According to one embodiment, the sensor cannot read the code without the rotation of the capsule. This is the case where the code is spread along at least a eighth, preferably at least a quarter of the circumference or even more. The fact that the code is placed along an arc-shaped line render the reading by a sweep beam very difficult. This is why the rotation of the capsule plays an important role. In case that the code is located on the body, it is then necessary to rotate the capsule to have access, for the sensor, to the entire set of marks composing the code. The code is further located close to the peripheral edge of the capsule. The peripheral edge is defined as the outermost circular line of the capsule. Preferably, the distance of the code from the peripheral edge is not more than 10 mm, more preferably not more than 8 mm. [0039] The code is preferably repeated along the circumference in order to ensure a reliable reading. The code is repeated at least twice on the circumference. Preferably, the code is repeated three to six times on the circumference. Repetition of the code means that the same code is duplicated and the successive codes are positioned in series along the circumference so that upon a 360-degree rotation of the capsule, the same code can be detected or read more than one time.

K-FEE SYSTEM GMBH, EX2009, page 3245
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 20-28	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al.
	FIGs. 4-7.
26. The single-serve capsule according to claim 20, wherein the barcode has at least two areas which differ in their optical properties.	[0019] Preferably, the code is printed or embossed to form a pattern which possesses surfaces having different reflective and/or absorbing properties to light. In particular, the pattern possesses first surfaces and second surfaces having different reflective and/or absorbing properties to light. More particularly, the pattern possesses first surfaces inclined mirroring or absorbing properties to light and second surfaces having flat mirroring or flat reflective properties to light. [0064] The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties. The surfaces are arranged in a circular pattern or an arc-shaped pattern at least along an angular portion of the rim. [0067] The bit code may consist of: Inclined mirroring or (flat) absorbing surfaces for bit "0" and Flat mirroring or flat reflective (diffusing) surfaces for bit "1" [0078] The code can be applied on the capsule by: Printing (absorbing/reflecting + diffusing), visible, invisible or, Laser engraving (e.g. for absorbing/reflecting−diffusing) surfaces or, Embossing: Flat and inclined mirroring surfaces. [0083] On FIG. 5, the light beam 74 from the light source "L" touches the mirror surface of the code (small rectangle 81) and is reflected into a reflective beam 76 to the sensor "S" with high intensity. A bit such as "0" or "1" is thereby provided to the control unit. [0084] On FIG. 6, the light beam 74 from the light source "L" touches diffusing or absorbing surfaces (surface 82 between two small rectangles). The light beam 77 that reaches the sensor S is of small intensity. Other beams such as beam 78 are diffused outside the sensor S due to the diffusing properties of the surface. [0085] In each configuration (e.g., FIGS. 5-6), a bit such as "1" or "0" is provided to the control unit. [0086] Therefore, the number of bits and their bit code depend on the number and specific arrangement of mirror surfaces (e.g.

K-FEE SYSTEM GMBH, EX2009, page 3246
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 20-28	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al.
	rectangles) and diffusing or absorbing surfaces (e.g., zones between the rectangles). The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provides redundancy and more reliability to the reading. FIGs. 4-7.
27. The single-serve capsule according to claim 20, wherein the identifier is electrically conductive.	[0024] In particular, the reading means may comprise a light emitter and a light sensor. In an alternative, the reading means comprises an inductive sensor. The optical reading means or inductive sensor may be arranged to detect a code on the rim of the capsule. [0089] The codes described in the previous examples can be applied by different methods onto a capsule such as by: Printing or mechanical deforming on a formed capsule or, Printing or mechanical deforming on the capsule raw material (foil) before container forming or, Printing on outer surface of a capsule container or, Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology). [0095] Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device.
28. The single-serve capsule according to claim 20, wherein the identifier is a machine-readable imprint.	[0017] Preferably, the code is an optical code. The code may be a bit code formed by a series of discrete polygonal (e.g., rectangles or squares) or dot surfaces printed on the container and/or embossed on the container. [0071] The reader may consist of -A light source with/without focusing optic and/ -A light sensor with/without focusing optic. [0078] The code can be applied on the capsule by:

K-FEE SYSTEM GMBH, EX2009, page 3247
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 20-28	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al.
	Printing (absorbing/reflecting+diffusing), visible, invisible or, Laser engraving (e.g. for absorbing/reflecting−diffusing) surfaces or, Embossing: Flat and inclined mirroring surfaces. [0082] In the embodiment of the FIG. 4, the light source is placed at the bottom of the centrifugal cell 3. This cell is light conductive allowing the beam to reach the bottom side 72 of its rim 73. The reflected light is conducted by the transparent (or light conductive) centrifugal cell 3 to reach the sensor 62. In case that the sensor 62 cannot be aligned with the transparent part of the centrifugal cell 3, a mirror can be placed as illustrated in the FIG. 4 to deflect the forward and backward beams. [0089] The codes described in the previous examples can be applied by different methods onto a capsule such as by: Printing or mechanical deforming on a formed capsule or, Printing or mechanical deforming on the capsule raw material (foil) before container forming or, Printing on outer surface of a capsule container or, Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology). FIGs. 2-7.

VII. 37 C.F.R. § 41.202 (a)(5) – WRITTEN DESCRIPTION FOR NEW CLAIMS IN APPLICANT'S SPECIFICATION

As noted above, 37 C.F.R. § 41.202(a)(5) sets forth: "[i]f a claim has been added or amended to provoke an interference, provide a claim chart showing the written description for each claim in the applicant's specification." Although claims 1, 2, 5-10 and 19 fall within the scope of Proposed Count I, and are subject to interference with the Kruger Application, they are preexisting claims that were not added or amended for purposes of provoking interference. Claims 20-28 were previously added to provoke interference and are discussed in the preceding section.

K-FEE SYSTEM GMBH, EX2009, page 3248
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 29-34 are newly added in the accompanying Response to Office Action as additional grounds for provoking interference. Accordingly, the following claim charts show exemplary written description for each of these new claims in the Jarisch Application, EP 10169374.5 to Jarisch et al., filed July 13, 2010 and EP 10162741.2 to Jarisch et al., filed May 12, 2010. Applicant reserves the right to rely upon additional portions of the disclosure to support written description.

A. ***Exemplary Chart Demonstrating Written Description Support for New Claims 29-34 found in U.S. Patent Appl. No. 13/697,297 to Jarisch et al***

Claims 29-34	**Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al**
29. The single-serve capsule according to Claim 20, wherein the identifier is mechanically embossed on the capsule.	[0017] Preferably, the code is an optical code. The code may be a bit code formed by a series of discrete polygonal (e.g., rectangles or squares) or dot surfaces printed on the container and/or embossed in the container. [0019] Preferably, the code is printed or embossed to form a pattern which possesses surfaces having different reflective and/or absorbing properties to light. In particular, the pattern possesses first surfaces and second surfaces having different reflective and/or absorbing properties to light. More particularly, the pattern possesses first surfaces inclined mirroring or absorbing properties to light and second surfaces having flat mirroring or flat reflective properties to light. [0020] In a possible mode, the code is mechanically embossed or engraved on the container by laser or by other means such as a press. [0078] The code can be applied on the capsule by: Printing (absorbing/reflecting + diffusing), visible, invisible or, Laser engraving (e.g. for absorbing/reflecting−diffusing) surfaces or, Embossing: Flat and inclined mirroring surfaces. [0088] 3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or

K-FEE SYSTEM GMBH, EX2009, page 3249
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 29-34	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al
	-Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology). FIGs. 4-7.
30. The single-serve capsule according to Claim 20, wherein the identifier is mechanically engraved on the capsule.	[0020] In a possible mode, the code is mechanically embossed or engraved on the container by laser or by other means such as a press. [0088] 3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology). FIGs. 4-7.
31. The single-serve capsule according to Claim 20, wherein the base element is made of aluminum.	[0002] The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity. [0004] The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use. [0089] The codes described in the previous examples can be applied by different methods onto a capsule such as by: Printing or mechanical deforming on a formed capsule or, Printing or mechanical deforming on the capsule raw material (foil) before container forming or, Printing on outer surface of a capsule container or,

K-FEE SYSTEM GMBH, EX2009, page 3250
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 29-34	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al
	Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology).
32. The single-serve capsule according to Claim 20, wherein the identifier is provided on a metallic surface of the capsule.	[0002] The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity. [0004] The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use. [0089] The codes described in the previous examples can be applied by different methods onto a capsule such as by: Printing or mechanical deforming on a formed capsule or, Printing or mechanical deforming on the capsule raw material (foil) before container forming or, Printing on outer surface of a capsule container or, Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology) .
33. The single-serve capsule according to Claim 32, wherein the identifier is configured to be sensed by an inductive sensor.	[0024] In particular, the reading means may comprise a light emitter and a light sensor. In an alternative, the reading means comprises an inductive sensor. The optical reading means or inductive sensor may be arranged to detect a code on the rim of the capsule. [0082] In the embodiment of the FIG. 4, the light source is placed at the bottom of the centrifugal cell 3. This cell is light conductive allowing the beam to reach the bottom side 72 of its rim 73. The reflected light is conducted by the transparent (or light conductive) centrifugal cell 3 to reach the sensor 62. In case that the sensor 62 cannot be aligned with the transparent part of the centrifugal cell 3, a mirror can be placed as illustrated in the FIG. 4 to deflect the forward and backward beams. [0089] The codes described in the previous examples can be applied by different methods onto a capsule such as by: Printing or mechanical deforming on a formed capsule or, Printing or mechanical deforming on the capsule raw material (foil) before container forming or, Printing on outer surface of a

K-FEE SYSTEM GMBH, EX2009, page 3251
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 29-34	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al
	capsule container or, Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology).
34. A single-serve capsule for making a beverage, comprising:	[0001] The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device. [0002] The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity. [0004] The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. . . . The capsule can be single use.
a base element with a cavity, in which a raw beverage material is provided,	[0001] The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device. [0002] The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity. [0004] The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. . . . The capsule can be single use. [0005] The term ingredient means any suitable beverage substance such as ground coffee, soluble coffee, leaf tea, soluble tea, herbal tea, dairy powder, baby food, culinary powder and combination thereof. [0036] In the following examples (see FIG. 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. . . . The capsule is filled with beverage ingredient such as ground coffee. FIGs. 4-7.

K-FEE SYSTEM GMBH, EX2009, page 3252
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 29-34	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al
a flange horizontally extending from the base element,	[0002] The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity. [0021] In an embodiment, the container comprises a body and a lid connected to the body . . . . [0036] In the following examples (see FIG. 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee. FIGs. 4-7.
a membrane that is configured to close the cavity, the membrane is fastened to a top side of the flange, and	[0036] In the following examples (see FIG. 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee. FIGs. 4-7.
an identifier, which makes it possible to individualize the respective single-serve capsule,	[0006] The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof. [0014] The aim of the present invention is to propose an improved way to identify the capsule within a beverage production machine to ensure a more reliable and convenient retrieval or reading of information so as to adjust working parameters of the machine. [0015] The aim is achieved by a capsule for the preparation of a beverage comprising a container and a beverage ingredient contained therein, wherein the container comprises a code adapted for being identified or read by external reading means, wherein the code is arranged on the container to be read while

K-FEE SYSTEM GMBH, EX2009, page 3253
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 29-34	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al
	the capsule is rotated around an axis of rotation traversing the capsule. FIGs. 4-7
wherein the identifier is a barcode that is provided on a bottom side of the flange, the barcode extends around an entire perimeter of the base element, the bottom side of the flange is opposite the top side of the flange to which the membrane is fastened.	[0006] The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof. [0016] More particularly, the capsule has a circumference wherein the code is arranged on the container along an arc-shaped or circular path of the circumference. In a particular mode, the capsule has a circumference wherein the code comprises successive segments which are individually rectilinear but extend substantially along at least a part of the circumference. More particularly, the code is arranged along at least a eighth of the circumference. This configuration provides a reliable reading or retrieval of information as well as an effective portion for information. In order to ensure a reliable reading or retrieval of information, the code is repeated along said circumference. The repetition ensures a higher probability that at least one code is readable but also may potentially reduce the reading time. [0017] Preferably, the code is an optical code. The code may be a bit code formed by a series of discrete polygonal (e.g., rectangles or squares) or dot surfaces printed on the container and/or embossed in the container. [0021] In an embodiment, the container comprises a body and a lid connected to the body and wherein the code is present on the lid of the container. The lid may be a closed foil and/or a filter, for example. [0022] In another embodiment, the code is present on the rim of the capsule. In the most preferred embodiment, the code is present on the bottom of the rim of the capsule which is opposed to the lid of the capsule. The bottom of the rim is sufficiently away from the liquid injection and beverage delivery areas so that there is a lower risk for the code to become unreadable such if partly or totally hidden or soiled by beverage residues or otherwise (e.g., coffee particles). As a result, the reading is made more reliable. . . .

K-FEE SYSTEM GMBH, EX2009, page 3254
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 29-34	Support in U.S. Patent Appl. No. 13/697,297 to Jarisch et al
	[0024] In particular, the reading means may comprise a light emitter and a light sensor. . . . The optical reading means or inductive sensor may be arranged to detect a code on the rim of the capsule. [0036] In the following examples (see FIG. 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee. [0063] 2) Optical Reading On Rim Bottom Side Of Capsule (FIGS. 4 to 7): [0064] The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties. The surfaces are arranged in a circular pattern or an arc-shaped pattern at least along an angular portion of the rim. FIGS. 4-7.

B. ***Exemplary Chart Demonstrating Written Description Support for New Claims 29-34 found in EP 10169374.5 to Jarisch et al., filed July 13, 2010***

Claims 29-34	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
29. The single-serve capsule according to Claim 20, wherein the identifier is mechanically embossed on the capsule.	Page 7, lines 9-12: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." • Page 8, lines 10-14: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or -Printing or mechanical deforming on the capsule raw material (foil) before container forming or,

K-FEE SYSTEM GMBH, EX2009, page 3255
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 29-34	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	-Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Page 10: Claim 10. FIGs. 4-7.
30. The single-serve capsule according to Claim 20, wherein the identifier is mechanically engraved on the capsule.	Page 7, lines 9-12: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." Page 8, lines 10-14: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Page 10: Claim 10. FIGs. 4-7.
31. The single-serve capsule according to Claim 20, wherein the base element is made of aluminum.	Page 8, lines 7-14: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule or, -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or,-Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)."
32. The single-serve capsule according to Claim 20,	Page 1 at lines 15-22: "4) Inductive code reading:

K-FEE SYSTEM GMBH, EX2009, page 3256
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 29-34	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
wherein the identifier is provided on a metallic surface of the capsule.	Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. **For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps**. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
33. The single-serve capsule according to Claim 32, wherein the identifier is configured to be sensed by an inductive sensor.	Page 1 at lines 15-22: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
34. A single-serve capsule for making a beverage, comprising:	Page 1, lines 4-5: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device." *Id.* at lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.* at lines 19-22: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use."

K-FEE SYSTEM GMBH, EX2009, page 3257
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 29-34	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
a base element with a cavity, in which a raw beverage material is provided,	Page 1 at lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.* at lines 19-22: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." *Id.* at lines 23-25: "The term ingredient means any suitable beverage substance such as ground coffee, soluble coffee, leaf tea, soluble tea, dairy powder, baby food, culinary powder and combination thereof." Page 4, lines 9-12: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee."
a flange horizontally extending from the base element,	Page 1, lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." Page 4, lines 9-12: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." Pages 15-16: FIGs. 4-7.
a membrane that is configured to close the cavity, the membrane is fastened to a top side of the flange, and	Page 4, lines 9-12: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee."

K-FEE SYSTEM GMBH, EX2009, page 3258
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 29-34	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	Pages 15-16: FIGs. 4-7.
an identifier, which makes it possible to individualize the respective single-serve capsule,	Page 1, lines 26-28: "The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof." Page 2, lines 24-30: "The aim of the present invention is to propose a way to identify the capsule within a production machine so as to adjust working parameters of the machine. This aim is achieved by a capsule for the preparation of a beverage comprising a container and a beverage ingredient contained therein, wherein the container comprises a code adapted for being identified or read by external reading means, wherein the code is arranged on the container to be read while the capsule is rotated around an axis of rotation traversing the capsule."
wherein the identifier is a barcode that is provided on a bottom side of the flange, the barcode extends around an entire perimeter of the base element, the bottom side of the flange is opposite the top side of the flange to which the membrane is fastened.	Page 1, lines 26-28: "The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof." Page 6, lines 20-24: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties." Page 10: Claims 1, 11, 12, 13, 14. Pages 15-16: FIGs. 4-7. Page 4, lines 9-12: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g.,

K-FEE SYSTEM GMBH, EX2009, page 3259
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims 29-34	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." *Id.* at lines 13-25: "The capsule is designed for rotating around an axis A. This axis A crosses perpendicularly the center of the membrane which has the form of a disk. This axis A exits at the center of the bottom of the body. This axis A will help to define the notion of "circumference" which is a circular path located on the capsule and having the axis A as reference axis. This circumference can be on the lid, e.g. membrane or on the body part such as on the flange-like rim. The lid may be impervious to liquid before insertion in the device or it may be pervious to liquid by means of small openings or pores provided in the center and/or periphery of the lid. The code is spread along the circumference or a part of the circumference. The code may comprise successive arch-shaped segments. The code may also comprise successive segments which are individually rectilinear but extend along at least a part of the

C. ***Exemplary Chart Demonstrating Written Description Support for New Claims 29-34 found in EP 10162741.2 to Jarisch et al., filed May 12, 2010***

Claims 29-34	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
29. The single-serve capsule according to Claim 20, wherein the identifier is mechanically embossed on the capsule.	Page 4: "The code can be applied on the capsule by: • Printing (absorbing / reflective + diffusing), visible, invisible, or • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or • Embossing: Flat and inclined mirroring surfaces" Page 5: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: 4.1 Printing or mechanical deforming on a formed capsule or, 4.2 Printing or mechanical deforming on the capsule raw material (foil) before container forming or, 4.3 Printing on outer surface of a capsule container or, 4.4 Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)."

K-FEE SYSTEM GMBH, EX2009, page 3260
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

30. The single-serve capsule according to Claim 20, wherein the identifier is mechanically engraved on the capsule.	Page 5: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: 4.1 Printing or mechanical deforming on a formed capsule or, 4.2 Printing or mechanical deforming on the capsule raw material (foil) before container forming or, 4.3 Printing on outer surface of a capsule container or, 4.4 Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)."
31. The single-serve capsule according to Claim 20, wherein the base element is made of aluminum.	Page 5: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: 4.1 Printing or mechanical deforming on a formed capsule or, 4.2 Printing or mechanical deforming on the capsule raw material (foil) before container forming or, 4.3 Printing on outer surface of a capsule container or, 4.4 Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)."
32. The single-serve capsule according to Claim 20, wherein the identifier is provided on a metallic surface of the capsule.	Page 5: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. **For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps**. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
33. The single-serve capsule according to Claim 32, wherein the identifier is configured to be sensed by an inductive sensor.	Page 5: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim

K-FEE SYSTEM GMBH, EX2009, page 3261
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

	which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
34. A single-serve capsule for making a beverage, comprising:	Page 1: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device. The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.*: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use."
a base element with a cavity, in which a raw beverage material is provided,	Page 1: The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.*: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." *Id.*: "The term ingredient means any suitable beverage substance such as ground coffee, soluble coffee, leaf tea, soluble tea, herbal tea, dairy powder, culinary powder and combination thereof."
a flange horizontally extending from the base element,	Page 2: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A foil or membrane (liquid-tight or permeable) 60 is

K-FEE SYSTEM GMBH, EX2009, page 3262
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

	connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee.
a membrane that is configured to close the cavity, the membrane is fastened to a top side of the flange, and	Page 2: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A foil or membrane (liquid-tight or permeable) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee."
an identifier, which makes it possible to individualize the respective single-serve capsule,	Page 1: "The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof." Page 3: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." Page 4: "The reader may consist of • A light source with/without focusing optic and, • A light sensor with/without focusing optic
wherein the identifier is a barcode that is provided on a bottom side of the flange, the barcode extends around an entire perimeter of the base element, the bottom side of the flange is opposite the top side of the flange to which the membrane is fastened.	Page 3: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.*: "Onto the capsule rim, a bit code is applied along a circular or arc-shaped path of the rim." Page 4: "The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provide redundancy and more reliability to the reading."

K-FEE SYSTEM GMBH, EX2009, page 3263
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

	Page 2: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A foil or membrane (liquid-tight or permeable) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." Page 3: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.*: "Onto the capsule rim, a bit code is applied along a circular or arc-shaped path of the rim." Page 4: "The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim.

VIII. 37 C.F.R. § 41.202 (a)(6) – CONSTRUCTIVE REDUCTION TO PRACTICE

Pursuant to 37 C.F.R. § 41.202(a)(6), "[f]or each constructive reduction to practice for which the applicant wishes to be accorded benefit, provide a chart showing where the disclosure provides a constructive reduction to practice within the scope of the interfering subject matter." As demonstrated in the following exemplary charts, Applicant is entitled to a constructive reduction to practice for the proposed count based on: (i) the filing of PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011; (ii) the filing of European Patent Application No. 10169374.5, filed July 13, 2010; and (iii) the filing of European Patent Application No. 10162741.2, filed May 12, 2010. The following citations in Sections VII.A-C are exemplary, and Applicant reserves the right to rely upon additional portions of the cited documents to demonstrate constructive reduction to practice.

K-FEE SYSTEM GMBH, EX2009, page 3264
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

A. ***Exemplary Chart Demonstrating Constructive Reduction to Practice of Claims Corresponding to Proposed Count I in PCT/EP2011/057657, filed May 12, 2011***

Claims Corresponding to Proposed Count I	**Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011**
1. A capsule for the preparation of a beverage, the capsule comprising	Page 1, lines 4-5: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device." *Id.* at lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.* at lines 19-22: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." Claim 1.
a container configured to house a beverage ingredient	Page 1, lines 4-5: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device." *Id.* at lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.* at lines 19-22: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." *Id.* at lines 23-25: "The term ingredient means any suitable beverage substance such as ground coffee, soluble coffee, leaf tea, soluble tea, dairy powder, baby food, culinary powder and combination thereof." Claim 1.
the container comprises a cup-shaped body having a	Page 5, lines 22-26: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a

K-FEE SYSTEM GMBH, EX2009, page 3265
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
flange-like rim a lid connected to the cup-shaped body, and	flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." FIGs. 4-7.
a code adapted for being identified or read by an external reader	Page 1, lines 26-28: "The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof." Page 2, lines 28-30: "The aim of the present invention is to propose a way to identify the capsule within a production machine so as to adjust working parameters of the machine." Page 3, lines 1-5: "This aim is achieved by a capsule for the preparation of a beverage comprising a container and a beverage ingredient contained therein, wherein the container comprises a code adapted for being identified or read by external reading means, wherein the code is arranged on the container to be read while the capsule is rotated around an axis of rotation traversing the capsule." Page 4, lines 15-19: "The invention further relates to a method for preparing a beverage from a system comprising a capsule as aforementioned and a beverage preparation device; wherein the device comprises capsule holding means for holding the capsule therein and rotational drive means for driving the holding means a capsule in rotation along said axis of rotation and reading means arranged for reading the code when the capsule is rotated along said axis." Claim 1. FIGs. 4-7.
the code is arranged on a bottom of the flange-like rim, which is opposed to the lid, to be read while the capsule is rotated around an axis of rotation traversing the capsule,	Page 3, line 31 – Page 4, line 6: "In another embodiment, the code is present on the rim of the capsule. In the most preferred embodiment, the code is present on the bottom of the rim of the capsule which is opposed to the lid of the capsule. The bottom of the rim is sufficiently away from the liquid injection and beverage delivery areas so that there is a lower risk for the code to become unreadable such if partly or totally hidden or

K-FEE SYSTEM GMBH, EX2009, page 3266
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	soiled by beverage residues or otherwise (e.g., coffee particles). As a result, the reading is made more reliable. The reading may also be carried out while the capsule is in place in the beverage production device. Therefore, the preparation of the beverage is simplified and the preparation time can be reduced." Page 4, lines 15-19: "The invention further relates to a method for preparing a beverage from a system comprising a capsule as aforementioned and a beverage preparation device; wherein the device comprises capsule holding means for holding the capsule therein and rotational drive means for driving the holding means and capsule in rotation along said axis of rotation and reading means arranged for reading the code when the capsule is rotated along said axis." Page 8, lines 5-10: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties." *Id.* at line 16: "The bit code is read by rotating the capsule along its central axis A." Claims 11, 12, 13, 14. FIGs. 4-7.
wherein the container comprises a circumference, the code comprises successive segments that extend substantially along at least an eighth of the circumference,	Page 3, lines 6-14: "More particularly, the capsule has a circumference wherein the code is arranged on the container along an arc-shaped or circular path of the circumference. In a particular mode, the capsule has a circumference wherein the code comprises successive segments which are individually rectilinear but extend substantially along at least a part of the circumference. More particularly, the code is arranged along at least a eighth of the circumference. This configuration provides a reliable reading or retrieval of information as well as an effective portion for information. In order to ensure a reliable reading or retrieval of information, the code is repeated along said circumference. The repetition ensures a higher

K-FEE SYSTEM GMBH, EX2009, page 3267
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	probability that at least one code is readable but also may potentially reduce the reading time." Page 5, line 27 – Page 6, line 7: "The capsule is designed for rotating around an axis A. This axis A crosses perpendicularly the center of the membrane which has the form of a disk. This axis A exits at the center of the bottom of the body. This axis A will help to define the notion of "circumference" which is a circular path located on the capsule and having the axis A as reference axis. This circumference can be on the lid, e.g. membrane or on the body part such as on the flange-like rim. The lid may be impervious to liquid before insertion in the device or it may be pervious to liquid by means of small openings or pores provided in the center and/or periphery of the lid. The code is spread along the circumference or a part of the circumference. The code may comprise successive arch-shaped segments. The code may also comprise successive segments which are individually rectilinear but extend along at least a part of the circumference. According to one embodiment, the sensor cannot read the code without the rotation of the capsule. This is the case where the code is spread along at least a eighth, preferably at least a quarter of the circumference or even more." Page 6, lines 18-23: "The code is preferably repeated along the circumference in order to ensure a reliable reading. The code is repeated at least twice on the circumference. Preferably, the code is repeated there to six times on the circumference. Repetition of the code means that the same code is duplicated and the successive codes are positioned in series along the circumference so that upon a 360-degree rotation of the capsule, the same code can be detected or read more than one time." Claims 2-4. FIGs. 4-7.
the cup-shaped body extends from a bottom end of the cup-shaped body to a top end of the cup-shaped body where the cup-shaped body terminates such that a height of the cup-shaped body is	Page 5, lines 23-26: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee."

K-FEE SYSTEM GMBH, EX2009, page 3268
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
the distance from the bottom end to the top end, the flange-like rim extends from the top end of the cup-shaped body, and the lid has a height that is less than the height of the cup-shaped body.	FIGs. 2-7.
2. The capsule of Claim 1, wherein the code is arranged on the container along an arc-shaped or circular path of the circumference of the container.	Page 3, lines 6-14: "More particularly, the capsule has a circumference wherein the code is arranged on the container along an arc-shaped or circular path of the circumference. In a particular mode, the capsule has a circumference wherein the code comprises successive segments which are individually rectilinear but extend substantially along at least a part of the circumference. More particularly, the code is arranged along at least a eighth of the circumference. This configuration provides a reliable reading or retrieval of information as well as an effective portion for information. In order to ensure a reliable reading or retrieval of information, the code is repeated along said circumference. The repetition ensures a higher probability that at least one code is readable but also may potentially reduce the reading time." Page 5, line 27 – Page 6, line 7: "The capsule is designed for rotating around an axis A. This axis A crosses perpendicularly the center of the membrane which has the form of a disk. This axis A exits at the center of the bottom of the body. This axis A will help to define the notion of "circumference" which is a circular path located on the capsule and having the axis A as reference axis. This circumference can be on the lid, e.g. membrane or on the body part such as on the flange-like rim. The lid may be impervious to liquid before insertion in the device or it may be pervious to liquid by means of small openings or pores provided in the center and/or periphery of the lid. The code is spread along the circumference or a part of the circumference. The code may comprise successive arch-shaped segments. The code may also comprise successive segments which are individually rectilinear but extend along at least a part of the circumference. According to one embodiment, the sensor cannot read the code without the rotation of the capsule. This is the case where the code is spread along at least a eighth, preferably at least a quarter of the circumference or even more."

K-FEE SYSTEM GMBH, EX2009, page 3269
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	Page 6, lines 18-23: "The code is preferably repeated along the circumference in order to ensure a reliable reading. The code is repeated at least twice on the circumference. Preferably, the code is repeated three to six times on the circumference. Repetition of the code means that the same code is duplicated and the successive codes are positioned in series along the circumference so that upon a 360-degree rotation of the capsule, the same code can be detected or read more than one time." Page 8, line 12: "Onto the capsule rim, a bit code is applied along a circular or arc-shaped path of the rim." Claim 2. FIGs. 4-7.
5. The capsule of Claim 1, wherein the code is repeated along the circumference of the container.	Page 3, lines 6-14: "More particularly, the capsule has a circumference wherein the code is arranged on the container along an arc-shaped or circular path of the circumference. In a particular mode, the capsule has a circumference wherein the code comprises successive segments which are individually rectilinear but extend substantially along at least a part of the circumference. More particularly, the code is arranged along at least a eighth of the circumference. This configuration provides a reliable reading or retrieval of information as well as an effective portion for information. In order to ensure a reliable reading or retrieval of information, the code is repeated along said circumference. The repetition ensures a higher probability that at least one code is readable but also may potentially reduce the reading time." Page 6, lines 18-23: "The code is preferably repeated along the circumference in order to ensure a reliable reading. The code is repeated at least twice on the circumference. Preferably, the code is repeated three to six times on the circumference. Repetition of the code means that the same code is duplicated and the successive codes are positioned in series along the circumference so that upon a 360-degree rotation of the capsule, the same code can be detected or read more than one time."

K-FEE SYSTEM GMBH, EX2009, page 3270
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	Page 8, line 12: "Onto the capsule rim, a bit code is applied along a circular or arc-shaped path of the rim." Page 9, lines 15-19: "Therefore, the number of bits and their bit code depends on the number and specific arrangement of mirror surfaces (e.g. rectangles) and diffusing or absorbing surfaces (e.g., zones between the rectangles). The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provides redundancy and more reliability to the reading." Claims 2 and 4. FIGs. 4-7.
6. The capsule of Claim 1, wherein the code is a bit code formed by a series of discrete polygonal or dot surfaces printed on and/or embossed in the container.	Page 3, lines 15-17: "Preferably, the code is an optical code. The code may be a bit code formed by a series of discrete polygonal (e.g., rectangles or squares) or dot surfaces printed on the container and/or embossed in the container." *Id.* at lines 20-25: "Preferably, the code is printed or embossed to form a pattern which possesses surfaces having different reflective and/or absorbing properties to light. In particular, the pattern possesses first surfaces and second surfaces having different reflective and/or absorbing properties to light. More particularly, the pattern possesses first surfaces inclined mirroring or absorbing properties to light and second surfaces having flat mirroring or flat reflective properties to light." Page 8, lines 6-10: "The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.* at lines 13-15: "The bit code may consist of: • Inclined mirroring or (flat) absorbing surfaces for bit "0" and • Flat mirroring or flat reflective (diffusing) surfaces for bit "1" Page 8, lines 24-27: "The code can be applied on the capsule by:

K-FEE SYSTEM GMBH, EX2009, page 3271
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	• Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." Claim 6. FIGs. 4-7.
7. The capsule of Claim 1, wherein the code is printed by an ink which is not visible by a human eye under natural light.	Page 3, lines 18-19: "The code may printed by a visible ink by human eyes under natural light or, alternatively, an ink which is not visible by human eyes under natural light (e.g., ink visible under UV)." Page 6, lines 15-17: "According to an embodiment, the code is printed by an ink which is not visible by human eyes under natural light (e.g., ink visible under UV). In this case, the sensor further comprises a UV-light beam source and a UV detector." Claim 7.
8. The capsule of Claim 1, wherein the code is printed or embossed by a pattern which possesses surfaces having different reflective and/or absorbing properties to light.	Page 3 at lines 20-25: "Preferably, the code is printed or embossed to form a pattern which possesses surfaces having different reflective and/or absorbing properties to light. In particular, the pattern possesses first surfaces and second surfaces having different reflective and/or absorbing properties to light. More particularly, the pattern possesses first surfaces inclined mirroring or absorbing properties to light and second surfaces having flat mirroring or flat reflective properties to light." Page 8, lines 6-10: "The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.* at lines 13-15: "The bit code may consist of: • Inclined mirroring or (flat) absorbing surfaces for bit "0" and

K-FEE SYSTEM GMBH, EX2009, page 3272
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	• Flat mirroring or flat reflective (diffusing) surfaces for bit "1" Page 8, lines 24-27: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." Page 9, lines 14-19: "In each configuration (e.g., Figs. 5-6), a bit such as "1" or "0" is provided to the control unit. Therefore, the number of bits and their bit code depends on the number and specific arrangement of mirror surfaces (e.g. rectangles) and diffusing or absorbing surfaces (e.g., zones between the rectangles). The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provides redundancy and more reliability to the reading." Claim 8. FIGs. 4-7.
9. The capsule of Claim 8, wherein the pattern possesses a first surface having inclined mirroring or absorbing properties to light and a second surface having flat mirroring or flat reflective properties to light.	Page 3 at lines 20-25: "Preferably, the code is printed or embossed to form a pattern which possesses surfaces having different reflective and/or absorbing properties to light. In particular, the pattern possesses first surfaces and second surfaces having different reflective and/or absorbing properties to light. More particularly, the pattern possesses first surfaces inclined mirroring or absorbing properties to light and second surfaces having flat mirroring or flat reflective properties to light." Page 8, lines 6-10: "The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim."

K-FEE SYSTEM GMBH, EX2009, page 3273
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	Id. at lines 13-15: "The bit code may consist of: • Inclined mirroring or (flat) absorbing surfaces for bit "0" and • Flat mirroring or flat reflective (diffusing) surfaces for bit "1" Page 8, lines 24-27: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." Page 9, lines 7-19: "On figure 5, the light beam 74 from the light source "L" touches the mirror surface of the code (small rectangle 81) and is reflected into a reflective beam 76 to the sensor "S" with high intensity. A bit such as "0" or "1" is thereby provided to the control unit. On figure 6, the light beam 74 from the light source "L" touches diffusing or absorbing surfaces (surface 82 between two small rectangles). The light beam 77 that reaches the sensor S is of small intensity. Other beams such as beam 78 are diffused outside the sensor S due to the diffusing properties of the surface. In each configuration (e.g., Figs. 5-6), a bit such as "1" or "0" is provided to the control unit. Therefore, the number of bits and their bit code depends on the number and specific arrangement of mirror surfaces (e.g. rectangles) and diffusing or absorbing surfaces (e.g., zones between the rectangles). The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provides redundancy and more reliability to the reading." Claim 8-9. FIGs. 4-7.

K-FEE SYSTEM GMBH, EX2009, page 3274
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
10. The capsule of Claim 1, wherein the code is mechanically embossed or engraved on the container by a laser.	Page 3 at lines 20-25: "Preferably, the code is printed or embossed to form a pattern which possesses surfaces having different reflective and/or absorbing properties to light. In particular, the pattern possesses first surfaces and second surfaces having different reflective and/or absorbing properties to light. More particularly, the pattern possesses first surfaces inclined mirroring or absorbing properties to light and second surfaces having flat mirroring or flat reflective properties to light." *Id.* at lines 26-27: "In a possible mode, the code is mechanically embossed or engraved on the container by laser or by other means such as a press." Page 8, lines 24-27: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." Page 9, line 24 – Page 10, line 2: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Claim 10.
19. The capsule of Claim 1, comprising a peripheral edge that is an outermost circular line of the capsule, wherein the code is positioned within	Page 6, lines 11-14: "The code is further located close to the peripheral edge of the capsule. The peripheral edge is defined as the outermost circular line of the capsule. Preferably, the distance of the code from the peripheral edge is not more than 10 mm, more preferably not more than 8 mm."

K-FEE SYSTEM GMBH, EX2009, page 3275
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
10mm of the peripheral edge.	FIGs. 2-7.
20. A single-serve capsule for making a beverage, comprising:	Page 1, lines 4-5: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device." *Id.* at lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.* at lines 19-22: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." Claim 1.
a base element with a cavity, in which a raw beverage material is provided,	Page 1, lines 4-5: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device." *Id.* at lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.* at lines 19-22: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." *Id.* at lines 23-25: "The term ingredient means any suitable beverage substance such as ground coffee, soluble coffee, leaf tea, soluble tea, dairy powder, baby food, culinary powder and combination thereof." Page 5, lines 22-26: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a

K-FEE SYSTEM GMBH, EX2009, page 3276
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." Claim 1. FIGs. 4-7.
a flange horizontally extending from the base element,	Page 1, lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." Page 5, lines 22-26: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." FIGs. 4-7.
a membrane that is configured to close the cavity, the membrane is fastened to a top side of the flange, and	Page 5, lines 22-26: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." FIGs. 4-7.
an identifier, which makes it possible to individualize the respective single-serve capsule,	Page 1, lines 26-28: "The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof." Page 2, line 28 – Page 3, line 5: "The aim of the present invention is to propose an improved way to identify the capsule within a beverage production machine to ensure a more reliable and convenient retrieval or reading of information so as to adjust working parameters of the machine.

K-FEE SYSTEM GMBH, EX2009, page 3277
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	This aim is achieved by a capsule for the preparation of a beverage comprising a container and a beverage ingredient contained therein, wherein the container comprises a code adapted for being identified or read by external reading means, wherein the code is arranged on the container to be read while the capsule is rotated around an axis of rotation traversing the capsule." Claim 1. FIGs. 4-7.
wherein the identifier is a barcode that is provided on a bottom side of the flange,	Page 1, lines 26-28: "The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof." Page 3, lines 6-14: "More particularly, the capsule has a circumference wherein the code is arranged on the container along an arc-shaped or circular path of the circumference. In a particular mode, the capsule has a circumference wherein the code comprises successive segments which are individually rectilinear but extend substantially along at least a part of the circumference. More particularly, the code is arranged along at least a eighth of the circumference. This configuration provides a reliable reading or retrieval of information as well as an effective portion for information. In order to ensure a reliable reading or retrieval of information, the code is repeated along said circumference. The repetition ensures a higher probability that at least one code is readable but also may potentially reduce the reading time." Page 3, lines 15-17: "Preferably, the code is an optical code. The code may be a bit code formed by a series of discrete polygonal (e.g., rectangles or squares) or dot surfaces printed on the container and/or embossed in the container." Page 3, line 31 – Page 4, line 6: "In another embodiment, the code is present on the rim of the capsule. In the most preferred embodiment, the code is present on the bottom of the rim of the capsule which is opposed to the lid of the capsule. The bottom of the rim is sufficiently away from the liquid injection and beverage delivery areas so that there is a lower risk for the

K-FEE SYSTEM GMBH, EX2009, page 3278
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	code to become unreadable such if partly or totally hidden or soiled by beverage residues or otherwise (e.g., coffee particles). As a result, the reading is made more reliable. The reading may also be carried out while the capsule is in place in the beverage production device. Therefore, the preparation of the beverage is simplified and the preparation time can be reduced." Page 8, lines 5-10: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties. The surfaces are arranged in a circular pattern or an arc-shaped pattern at least along an angular portion of the rim." Claims 1, 11, 12, 13, 14. FIGs. 4-7.
the identifier extends around an entire circumference of the flange, the bottom side of the flange is opposite the top side of the flange to which the membrane is fastened.	Page 3, lines 6-14: "More particularly, the capsule has a circumference wherein the code is arranged on the container along an arc-shaped or circular path of the circumference. In a particular mode, the capsule has a circumference wherein the code comprises successive segments which are individually rectilinear but extend substantially along at least a part of the circumference. More particularly, the code is arranged along at least a eighth of the circumference. This configuration provides a reliable reading or retrieval of information as well as an effective portion for information. In order to ensure a reliable reading or retrieval of information, the code is repeated along said circumference. The repetition ensures a higher probability that at least one code is readable but also may potentially reduce the reading time." Page 3, line 31 – Page 4, line 6: "In another embodiment, the code is present on the rim of the capsule. In the most preferred embodiment, the code is present on the bottom of the rim of the capsule which is opposed to the lid of the capsule. The bottom of the rim is sufficiently away from the liquid injection and beverage delivery areas so that there is a lower risk for the code to become unreadable such if partly or totally hidden or

K-FEE SYSTEM GMBH, EX2009, page 3279
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	soiled by beverage residues or otherwise (e.g., coffee particles). As a result, the reading is made more reliable. The reading may also be carried out while the capsule is in place in the beverage production device. Therefore, the preparation of the beverage is simplified and the preparation time can be reduced." Page 5, lines 23-26: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." Page 5, line 27 – Page 6, line 7: "The capsule is designed for rotating around an axis A. This axis A crosses perpendicularly the center of the membrane which has the form of a disk. This axis A exits at the center of the bottom of the body. This axis A will help to define the notion of "circumference" which is a circular path located on the capsule and having the axis A as reference axis. This circumference can be on the lid, e.g. membrane or on the body part such as on the flange-like rim. The lid may be impervious to liquid before insertion in the device or it may be pervious to liquid by means of small openings or pores provided in the center and/or periphery of the lid. The code is spread along the circumference or a part of the circumference. The code may comprise successive arch-shaped segments. The code may also comprise successive segments which are individually rectilinear but extend along at least a part of the circumference. According to one embodiment, the sensor cannot read the code without the rotation of the capsule. This is the case where the code is spread along at least a eighth, preferably at least a quarter of the circumference or even more." Page 6, lines 18-23: "The code is preferably repeated along the circumference in order to ensure a reliable reading. The code is repeated at least twice on the circumference. Preferably, the code is repeated three to six times on the circumference. Repetition of the code means that the same code is duplicated and the successive codes are positioned in series along the circumference so that upon a 360-degree rotation of the capsule, the same code can be detected or read more than one time."

K-FEE SYSTEM GMBH, EX2009, page 3280
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	Claim 2. FIGs. 4-7.
21. The single-serve capsule according to claim 20, wherein the barcode is printed by material removal.	Page 3 at lines 20-25: "Preferably, the code is printed or embossed to form a pattern which possesses surfaces having different reflective and/or absorbing properties to light. In particular, the pattern possesses first surfaces and second surfaces having different reflective and/or absorbing properties to light. More particularly, the pattern possesses first surfaces inclined mirroring or absorbing properties to light and second surfaces having flat mirroring or flat reflective properties to light." *Id.* at lines 26-27: "In a possible mode, the code is mechanically embossed or engraved on the container by laser or by other means such as a press." Page 8, lines 24-27: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." Page 9, line 24 – Page 10, line 2: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Claim 10. FIGs. 4-7.

K-FEE SYSTEM GMBH, EX2009, page 3281
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
22. The single-serve capsule according to claim 20, wherein the base element is made of metal.	Page 1, lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.* at lines 19-22: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." Page 9, line 24 – Page 10, line 2: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Page 10 at lines 3-10: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
23. The single-serve capsule according to claim 20, wherein the base element comprises a bottom and a	Page 9, line 24 – Page 10, line 2: "3) Application modes of codes onto a capsule

K-FEE SYSTEM GMBH, EX2009, page 3282
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
wall region that extends between the flange and the bottom, the side wall has an electrically conductive section.	The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Page 10 at lines 3-10: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
24. The single-serve capsule according to claim 20, wherein the identifier comprises metal.	Page 9, line 24 – Page 10, line 2: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Page 10 at lines 3-10: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps.

K-FEE SYSTEM GMBH, EX2009, page 3283
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
25. The single-serve capsule according to claim 20, wherein the barcode extends around an entire perimeter of the base element.	Page 3, lines 6-14: "More particularly, the capsule has a circumference wherein the code is arranged on the container along an arc-shaped or circular path of the circumference. In a particular mode, the capsule has a circumference wherein the code comprises successive segments which are individually rectilinear but extend substantially along at least a part of the circumference. More particularly, the code is arranged along at least a eighth of the circumference. This configuration provides a reliable reading or retrieval of information as well as an effective portion for information. In order to ensure a reliable reading or retrieval of information, the code is repeated along said circumference. The repetition ensures a higher probability that at least one code is readable but also may potentially reduce the reading time." Page 5, line 27 – Page 6, line 7: "The capsule is designed for rotating around an axis A. This axis A crosses perpendicularly the center of the membrane which has the form of a disk. This axis A exits at the center of the bottom of the body. This axis A will help to define the notion of "circumference" which is a circular path located on the capsule and having the axis A as reference axis. This circumference can be on the lid, e.g. membrane or on the body part such as on the flange-like rim. The lid may be impervious to liquid before insertion in the device or it may be pervious to liquid by means of small openings or pores provided in the center and/or periphery of the lid. The code is spread along the circumference or a part of the circumference. The code may comprise successive arch-shaped segments. The code may also comprise successive segments which are individually rectilinear but extend along at least a part of the circumference. According to one embodiment, the sensor cannot read the code without the rotation of the capsule. This is the case where the code is spread along at least a eighth, preferably at least a quarter of the circumference or even more."

K-FEE SYSTEM GMBH, EX2009, page 3284
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	Page 6, lines 18-23: "The code is preferably repeated along the circumference in order to ensure a reliable reading. The code is repeated at least twice on the circumference. Preferably, the code is repeated three to six times on the circumference. Repetition of the code means that the same code is duplicated and the successive codes are positioned in series along the circumference so that upon a 360-degree rotation of the capsule, the same code can be detected or read more than one time." Claim 2. FIGs. 4-7.
26. The single-serve capsule according to claim 20, wherein the barcode has at least two areas which differ in their optical properties.	Page 3 at lines 20-25: "Preferably, the code is printed or embossed to form a pattern which possesses surfaces having different reflective and/or absorbing properties to light. In particular, the pattern possesses first surfaces and second surfaces having different reflective and/or absorbing properties to light. More particularly, the pattern possesses first surfaces inclined mirroring or absorbing properties to light and second surfaces having flat mirroring or flat reflective properties to light." Page 8, lines 6-10: "The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.* at lines 13-15: "The bit code may consist of: • Inclined mirroring or (flat) absorbing surfaces for bit "0" and • Flat mirroring or flat reflective (diffusing) surfaces for bit "1" Page 8, lines 24-27: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or,

K-FEE SYSTEM GMBH, EX2009, page 3285
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	• Embossing: Flat and inclined mirroring surfaces." Page 9, lines 7-19: "On figure 5, the light beam 74 from the light source "L" touches the mirror surface of the code (small rectangle 81) and is reflected into a reflective beam 76 to the sensor "S" with high intensity. A bit such as "0" or "1" is thereby provided to the control unit. On figure 6, the light beam 74 from the light source "L" touches diffusing or absorbing surfaces (surface 82 between two small rectangles). The light beam 77 that reaches the sensor S is of small intensity. Other beams such as beam 78 are diffused outside the sensor S due to the diffusing properties of the surface. In each configuration (e.g., Figs. 5-6), a bit such as "1" or "0" is provided to the control unit. Therefore, the number of bits and their bit code depends on the number and specific arrangement of mirror surfaces (e.g. rectangles) and diffusing or absorbing surfaces (e.g., zones between the rectangles). The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provides redundancy and more reliability to the reading." Claims 8-9. FIGs. 4-7.
27. The single-serve capsule according to claim 20, wherein the identifier is electrically conductive.	Page 4, lines 12-15: "In particular, the reading means may comprise a light emitter and a light sensor. In an alternative, the reading means comprises an inductive sensor. The optical reading means or inductive sensor may be arranged to detect a code on the rim of the capsule." Page 9, line 24 – Page 10, line 2: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or

K-FEE SYSTEM GMBH, EX2009, page 3286
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	-Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Page 10 at lines 3-10: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
28. The single-serve capsule according to claim 20, wherein the identifier is a machine-readable imprint.	Page 3, lines 15-17: "Preferably, the code is an optical code. The code may be a bit code formed by a series of discrete polygonal (e.g., rectangles or squares) or dot surfaces printed on the container and/or embossed in the container." Page 8, lines 17-19: "The reader may consist of -A light source with/without focusing optic and/ -A light sensor with/without focusing optic." Page 8, lines 24-27: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." Page 9, lines 1-6: "In the embodiment of figure 4, the light source is placed at the bottom of the centrifugal cell 3. This cell is light conductive allowing the beam to reach the bottom side 72 of its rim 73. The reflected light is conducted by the transparent (or light conductive) centrifugal cell 3 to reach the sensor 62. In case that the sensor 62 cannot be aligned with the

K-FEE SYSTEM GMBH, EX2009, page 3287
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in PCT/EP2011/057657 to Jarisch et al., filed May 12, 2011
	transparent part of the centrifugal cell 3, a mirror can be placed as illustrated in the figure 4 to deflect the forward and backward beams." Page 9, line 24 – Page 10, line 2: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." FIGs. 2-7.

B. ***Exemplary Chart Demonstrating Constructive Reduction to Practice of Claims Corresponding to Proposed Count I in EP 10169374.5 to Jarisch et al., filed July 13, 2010***

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
1. A capsule for the preparation of a beverage, the capsule comprising	Page 1, lines 4-5: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device." *Id.* at lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.* at lines 19-22: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." Page 10: Claim 1.

K-FEE SYSTEM GMBH, EX2009, page 3288
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
a container configured to house a beverage ingredient	Page 1, lines 4-5: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device." *Id.* at lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.* at lines 19-22: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." *Id.* at lines 23-25: "The term ingredient means any suitable beverage substance such as ground coffee, soluble coffee, leaf tea, soluble tea, dairy powder, baby food, culinary powder and combination thereof." Page 10: Claim 1.
the container comprises a cup-shaped body having a flange-like rim a lid connected to the cup-shaped body, and	Page 4, lines 9-12: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." Pages 15-16: FIGs. 4-7.
a code adapted for being identified or read by an external reader	Page 1, lines 26-28: "The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof." Page 2, lines 24-30: "The aim of the present invention is to propose a way to identify the capsule within a production machine so as to adjust working parameters of the machine. This aim is achieved by a capsule for the preparation of a beverage comprising a container and a beverage ingredient contained therein, wherein the container comprises a code

K-FEE SYSTEM GMBH, EX2009, page 3289
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	adapted for being identified or read by external reading means, wherein the code is arranged on the container to be read while the capsule is rotated around an axis of rotation traversing the capsule." Page 3, lines 1-5: "The invention further relates to a method for preparing a beverage from a system comprising a capsule as aforementioned and a beverage preparation device; wherein the device comprises capsule holding means for holding the capsule therein and rotational drive means for driving the holding means a capsule in rotation along said axis of rotation and reading means arranged for reading the code when the capsule is rotated along said axis." Page 10: Claim 1. FIGs. 4-7.
the code is arranged on a bottom of the flange-like rim, which is opposed to the lid, to be read while the capsule is rotated around an axis of rotation traversing the capsule,	Page 6, lines 20-24: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties." Page 7, line 1: "The bit code is read by rotating the capsule along its central axis A." Page 10: Claims 11, 12, 13, 14. Pages 15-16: FIGs. 4-7.
wherein the container comprises a circumference, the code comprises successive segments that extend substantially along at least an eighth of the circumference,	Page 4, lines 13-25: "The capsule is designed for rotating around an axis A. This axis A crosses perpendicularly the center of the membrane which has the form of a disk. This axis A exits at the center of the bottom of the body. This axis A will help to define the notion of "circumference" which is a circular path located on the capsule and having the axis A as reference axis. This circumference can be on the lid, e.g. membrane or on the body part such as on the flange-like rim. The lid may be impervious to liquid before insertion in the device or it may be pervious to liquid by means of small openings or pores provided in the center and/or periphery of

K-FEE SYSTEM GMBH, EX2009, page 3290
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	the lid. The code is spread along the circumference or a part of the circumference. The code may comprise successive arch-shaped segments. The code may also comprise successive segments which are individually rectilinear but extend along at least a part of the circumference. According to one embodiment, the sensor cannot read the code without the rotation of the capsule. This is the case where the code is spread along at least a eighth, preferably at least a quarter of the circumference or even more." Page 5, lines 4-9: "The code is preferably repeated along the circumference in order to ensure a reliable reading. The code is repeated at least twice on the circumference. Preferably, the code is repeated there to six times on the circumference. Repetition of the code means that the same code is duplicated and the successive codes are positioned in series along the circumference so that upon a 360-degree rotation of the capsule, the same code can be detected or read more than one time." Page 10: Claims 2-4. Pages 15-16: FIGs. 4-7.
the cup-shaped body extends from a bottom end of the cup-shaped body to a top end of the cup-shaped body where the cup-shaped body terminates such that a height of the cup-shaped body is the distance from the bottom end to the top end, the flange-like rim extends from the top end of the cup-shaped body, and the lid has a height that is less than the height of the cup-shaped body.	Page 4, lines 9-12: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." Pages 14-16: FIGs. 2-7.
2. The capsule of Claim 1, wherein the code is arranged on the container along an arc-shaped or circular path of the circumference of the container.	Page 4, lines 13-25: "The capsule is designed for rotating around an axis A. This axis A crosses perpendicularly the center of the membrane which has the form of a disk. This axis A exits at the center of the bottom of the body. This axis A will help to define the notion of "circumference" which is a circular path located on the capsule and having the axis A as

K-FEE SYSTEM GMBH, EX2009, page 3291
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	reference axis. This circumference can be on the lid, e.g. membrane or on the body part such as on the flange-like rim. The lid may be impervious to liquid before insertion in the device or it may be pervious to liquid by means of small openings or pores provided in the center and/or periphery of the lid. The code is spread along the circumference or a part of the circumference. The code may comprise successive arch-shaped segments. The code may also comprise successive segments which are individually rectilinear but extend along at least a part of the circumference. According to one embodiment, the sensor cannot read the code without the rotation of the capsule. This is the case where the code is spread along at least a eighth, preferably at least a quarter of the circumference or even more." Page 5, lines 4-9: "The code is preferably repeated along the circumference in order to ensure a reliable reading. The code is repeated at least twice on the circumference. Preferably, the code is repeated three to six times on the circumference. Repetition of the code means that the same code is duplicated and the successive codes are positioned in series along the circumference so that upon a 360-degree rotation of the capsule, the same code can be detected or read more than one time." Page 6, line 26: "Onto the capsule rim, a bit code is applied along a circular or arc-shaped path of the rim." Page 10: Claim 2. Pages 15-16: FIGs. 4-7.
5. The capsule of Claim 1, wherein the code is repeated along the circumference of the container.	Page 5, lines 4-9: "The code is preferably repeated along the circumference in order to ensure a reliable reading. The code is repeated at least twice on the circumference. Preferably, the code is repeated three to six times on the circumference. Repetition of the code means that the same code is duplicated and the successive codes are positioned in series along the circumference so that upon a 360-degree rotation of the capsule, the same code can be detected or read more than one time." Page 7, line 27- Page 8, line 2: "Therefore, the number of bits and their bit code depends on the number and specific arrangement of mirror surfaces (e.g. rectangles) and diffusing

K-FEE SYSTEM GMBH, EX2009, page 3292
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	or absorbing surfaces (e.g., zones between the rectangles). The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provides redundancy and more reliability to the reading." Page 10: Claims 2 and 4. Pages 15-16: FIGs. 4-7.
6. The capsule of Claim 1, wherein the code is a bit code formed by a series of discrete polygonal or dot surfaces printed on and/or embossed in the container.	Page 6, lines 21-24: "The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.* at lines 27-29: "The bit code may consist of: • Inclined mirroring or (flat) absorbing surfaces for bit "0" and • Flat mirroring or flat reflective (diffusing) surfaces for bit "1" Page 7, lines 9-12: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." Page 10: Claim 6. Pages 15-16: FIGs. 4-7.
7. The capsule of Claim 1, wherein the code is printed by an ink which is not visible by a human eye under natural light.	Page 5, lines 1-3: "According to an embodiment, the code is printed by an ink which is not visible by human eyes under natural light (e.g., ink visible under UV). In this case, the sensor further comprises a UV-light beam source and a UV detector." Page 10: Claim 7.
8. The capsule of Claim 1, wherein the code is printed or embossed by a pattern which possesses surfaces	Page 6, lines 21-24: "The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring

K-FEE SYSTEM GMBH, EX2009, page 3293
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
having different reflective and/or absorbing properties to light.	and/or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.* at lines 27-29: "The bit code may consist of: • Inclined mirroring or (flat) absorbing surfaces for bit "0" and • Flat mirroring or flat reflective (diffusing) surfaces for bit "1" Page 7, lines 9-12: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." Page 7, line 22 – Page 8, line 2: "On figure 6, the light beam 74 from the light source "L" touches diffusing or absorbing surfaces (surface 82 between two small rectangles). The light beam 77 that reaches the sensor is of small intensity. Other beams such as beam 78 are diffused outside the sensor S due to the diffusing properties of the surface. A bit such as "1" or "0" is provided to the control unit. Therefore, the number of bits and their bit code depends on the number and specific arrangement of mirror surfaces (e.g. rectangles) and diffusing or absorbing surfaces (e.g., zones between the rectangles). The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provides redundancy and more reliability to the reading." Page 10: Claim 8. Pages 15-16: FIGs. 4-7.
9. The capsule of Claim 8, wherein the pattern possesses a first surface having inclined mirroring or absorbing properties to light	Page 6, lines 21-24: "The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring

K-FEE SYSTEM GMBH, EX2009, page 3294
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
and a second surface having flat mirroring or flat reflective properties to light.	and/or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.* at lines 27-29: "The bit code may consist of: • Inclined mirroring or (flat) absorbing surfaces for bit "0" and • Flat mirroring or flat reflective (diffusing) surfaces for bit "1" Page 7, lines 9-12: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." Page 7, line 19 – Page 8, line 2: "On figure 5, the light beam 74 from the light source "L" touches the mirror surface of the code (small rectangle 81) and is reflected into a reflective beam 76 to the sensor "S" with high intensity. A bit such as "0" or "1" is thereby provided to the control unit. On figure 6, the light beam 74 from the light source "L" touches diffusing or absorbing surfaces (surface 82 between two small rectangles). The light beam 77 that reaches the sensor is of small intensity. Other beams such as beam 78 are diffused outside the sensor S due to the diffusing properties of the surface. A bit such as "1" or "0" is provided to the control unit. Therefore, the number of bits and their bit code depends on the number and specific arrangement of mirror surfaces (e.g. rectangles) and diffusing or absorbing surfaces (e.g., zones between the rectangles). The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provides redundancy and more reliability to the reading." Page 10: Claims 8-9. Pages 15-16: FIGs. 4-7.

K-FEE SYSTEM GMBH, EX2009, page 3295
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
10. The capsule of Claim 1, wherein the code is mechanically embossed or engraved on the container by a laser.	Page 7, lines 9-12: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." Page 8, lines 10-14: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Page 10: Claim 10.
19. The capsule of Claim 1, comprising a peripheral edge that is an outermost circular line of the capsule, wherein the code is positioned within 10mm of the peripheral edge.	Page 4, lines 29-32: "The code is further located close to the peripheral edge of the capsule. The peripheral edge is defined as the outermost circular line of the capsule. Preferably, the distance of the code from the peripheral edge is not more than 10 mm, more preferably not more than 8 mm." Pages 14-16: FIGs. 2-7.
20. A single-serve capsule for making a beverage, comprising:	Page 1, lines 4-5: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device." *Id.* at lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.* at lines 19-22: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient.

K-FEE SYSTEM GMBH, EX2009, page 3296
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." Page 10: Claim 1.
a base element with a cavity, in which a raw beverage material is provided,	Page 1, lines 4-5: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device." *Id.* at lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.* at lines 19-22: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." *Id.* at lines 23-25: "The term ingredient means any suitable beverage substance such as ground coffee, soluble coffee, leaf tea, soluble tea, dairy powder, baby food, culinary powder and combination thereof." Page 4, lines 9-12: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." Page 10: Claim 1. Pages 15-16: FIGs. 4-7.
a flange horizontally extending from the base element,	Page 1, lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity."

K-FEE SYSTEM GMBH, EX2009, page 3297
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	Page 4, lines 9-12: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." Pages 15-16: FIGs. 4-7.
a membrane that is configured to close the cavity, the membrane is fastened to a top side of the flange, and	Page 4, lines 9-12: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." Pages 15-16: FIGs. 4-7.
an identifier, which makes it possible to individualize the respective single-serve capsule,	Page 1, lines 26-28: "The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof." Page 2, lines 24-30: "The aim of the present invention is to propose a way to identify the capsule within a production machine so as to adjust working parameters of the machine. This aim is achieved by a capsule for the preparation of a beverage comprising a container and a beverage ingredient contained therein, wherein the container comprises a code adapted for being identified or read by external reading means, wherein the code is arranged on the container to be read while the capsule is rotated around an axis of rotation traversing the capsule." Page 10: Claim 1. Pages 15-16: FIGs. 4-7.
wherein the identifier is a barcode that is provided on a bottom side of the flange,	Page 1, lines 26-28: "The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate,

K-FEE SYSTEM GMBH, EX2009, page 3298
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	pressure, rotational speed, temperature and combinations thereof." Page 6, lines 20-24: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties." Page 10: Claims 1, 11, 12, 13, 14. Pages 15-16: FIGs. 4-7.
the identifier extends around an entire circumference of the flange, the bottom side of the flange is opposite the top side of the flange to which the membrane is fastened.	Page 4, lines 9-12: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A lid such as a foil or membrane (liquid-tight or permeable to liquid) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." *Id.* at lines 13-25: "The capsule is designed for rotating around an axis A. This axis A crosses perpendicularly the center of the membrane which has the form of a disk. This axis A exits at the center of the bottom of the body. This axis A will help to define the notion of "circumference" which is a circular path located on the capsule and having the axis A as reference axis. This circumference can be on the lid, e.g. membrane or on the body part such as on the flange-like rim. The lid may be impervious to liquid before insertion in the device or it may be pervious to liquid by means of small openings or pores provided in the center and/or periphery of the lid. The code is spread along the circumference or a part of the circumference. The code may comprise successive arch-shaped segments. The code may also comprise successive segments which are individually rectilinear but extend along at least a part of the circumference. According to one embodiment, the sensor cannot read the code without the rotation of the capsule. This is the case where the code is spread along at least a eighth, preferably at least a quarter of the circumference or even more."

K-FEE SYSTEM GMBH, EX2009, page 3299
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	Page 5, lines 4-9: "The code is preferably repeated along the circumference in order to ensure a reliable reading. The code is repeated at least twice on the circumference. Preferably, the code is repeated three to six times on the circumference. Repetition of the code means that the same code is duplicated and the successive codes are positioned in series along the circumference so that upon a 360-degree rotation of the capsule, the same code can be detected or read more than one time." Page 10: Claim 2. Pages 15-16: FIGs. 4-7.
21. The single-serve capsule according to claim 20, wherein the barcode is printed by material removal.	Page 7, lines 9-12: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." Page 8, lines 10-14: "<u>3) Application modes of codes onto a capsule</u> The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Page 10: Claim 10. FIGs. 4-7.
22. The single-serve capsule according to claim 20, wherein the base element is made of metal.	Page 1, lines 8-11: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity."

K-FEE SYSTEM GMBH, EX2009, page 3300
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	Id. at lines 19-22: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." Page 8, lines 7-14: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule or, -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or,-Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." *Id.* at lines 15-22: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
23. The single-serve capsule according to claim 20, wherein the base element comprises a bottom and a wall region that extends between the flange and the bottom, the side wall has an electrically conductive section.	Page 8, lines 7-14: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule or, -Printing or mechanical deforming on the capsule raw material (foil) before container forming or,

K-FEE SYSTEM GMBH, EX2009, page 3301
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	-Printing on outer surface of a capsule container or,-Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." *Id.* at lines 15-22: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
24. The single-serve capsule according to claim 20, wherein the identifier comprises metal.	Page 8, lines 7-14: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule or, -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or,-Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." *Id.* at lines 15-22: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."

K-FEE SYSTEM GMBH, EX2009, page 3302
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
25. The single-serve capsule according to claim 20, wherein the barcode extends around an entire perimeter of the base element.	Page 8, lines 13-25: "The capsule is designed for rotating around an axis A. This axis A crosses perpendicularly the center of the membrane which has the form of a disk. This axis A exits at the center of the bottom of the body. This axis A will help to define the notion of "circumference" which is a circular path located on the capsule and having the axis A as reference axis. This circumference can be on the lid, e.g. membrane or on the body part such as on the flange-like rim. The lid may be impervious to liquid before insertion in the device or it may be pervious to liquid by means of small openings or pores provided in the center and/or periphery of the lid. The code is spread along the circumference or a part of the circumference. The code may comprise successive arch-shaped segments. The code may also comprise successive segments which are individually rectilinear but extend along at least a part of the circumference. According to one embodiment, the sensor cannot read the code without the rotation of the capsule. This is the case where the code is spread along at least a eighth, preferably at least a quarter of the circumference or even more." Page 5, lines 4-9: "The code is preferably repeated along the circumference in order to ensure a reliable reading. The code is repeated at least twice on the circumference. Preferably, the code is repeated three to six times on the circumference. Repetition of the code means that the same code is duplicated and the successive codes are positioned in series along the circumference so that upon a 360-degree rotation of the capsule, the same code can be detected or read more than one time." Claim 2. Pages 15-16: FIGs. 4-7.
26. The single-serve capsule according to claim 20, wherein the barcode has at least two areas which differ in their optical properties.	Page 6, lines 21-24: "The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring and/or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.* at lines 27-29: "The bit code may consist of: • Inclined mirroring or (flat) absorbing surfaces for bit "0" and

K-FEE SYSTEM GMBH, EX2009, page 3303
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	• Flat mirroring or flat reflective (diffusing) surfaces for bit "1" Page 7, lines 9-12: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or, • Embossing: Flat and inclined mirroring surfaces." Page 7, line 19 – Page 8, line 2: "On figure 5, the light beam 74 from the light source "L" touches the mirror surface of the code (small rectangle 81) and is reflected into a reflective beam 76 to the sensor "S" with high intensity. A bit such as "0" or "1" is thereby provided to the control unit. On figure 6, the light beam 74 from the light source "L" touches diffusing or absorbing surfaces (surface 82 between two small rectangles). The light beam 77 that reaches the sensor is of small intensity. Other beams such as beam 78 are diffused outside the sensor S due to the diffusing properties of the surface. A bit such as "1" or "0" is provided to the control unit. Therefore, the number of bits and their bit code depends on the number and specific arrangement of mirror surfaces (e.g. rectangles) and diffusing or absorbing surfaces (e.g., zones between the rectangles). The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provides redundancy and more reliability to the reading." Page 10: Claims 8-9. Pages 15-16: FIGs. 4-7.
27. The single-serve capsule according to claim 20, wherein the identifier is electrically conductive.	Page 8, lines 7-14: "<u>3) Application modes of codes onto a capsule</u>

K-FEE SYSTEM GMBH, EX2009, page 3304
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule or, -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or,-Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." *Id.* at lines 15-22: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
28. The single-serve capsule according to claim 20, wherein the identifier is a machine-readable imprint.	Page 7, lines 2-4: "The reader may consist of -A light source with/without focusing optic and, -A light sensor with/without focusing optic." Page 7, lines 13-18: "In the embodiment of the figure 4, the light source is placed at the bottom of the centrifugal cell 3. This cell is light conductive allowing the beam to reach the bottom side 72 of its rim 73. The reflected light is conducted by the transparent (or light conductive) centrifugal cell 3 to reach the sensor 62. In case the sensor 62 cannot be aligned with the transparent part of the centrifugal cell 3, a mirror can be placed as illustrated in the figure 4 to deflect the forward and backward beams." Page 7, lines 9-12: "The code can be applied on the capsule by: • Printing (absorbing / reflecting + diffusing), visible, invisible or, • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or,

K-FEE SYSTEM GMBH, EX2009, page 3305
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10169374.5 to Jarisch et al., filed July 13, 2010
	• Embossing: Flat and inclined mirroring surfaces." Page 8, lines 10-14: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: -Printing or mechanical deforming on a formed capsule, or -Printing or mechanical deforming on the capsule raw material (foil) before container forming or, -Printing on outer surface of a capsule container or, -Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)."

C. ***Exemplary Chart Demonstrating Constructive Reduction to Practice of Claims Corresponding to Proposed Count I in EP 10162741.2 to Jarisch et al., filed May 12, 2010***

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
1. A capsule for the preparation of a beverage, the capsule comprising	Page 1: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device. The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.*: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." Page 6: Claim 1.
a container configured to house a beverage ingredient	Page 1: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device.

K-FEE SYSTEM GMBH, EX2009, page 3306
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
	The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.*: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." *Id.*: "The term ingredient means any suitable beverage substance such as ground coffee, soluble coffee, leaf tea, soluble tea, herbal tea, dairy powder, culinary powder and combination thereof." Page 6: Claim 1.
the container comprises a cup-shaped body having a flange-like rim a lid connected to the cup-shaped body, and	Page 2: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A foil or membrane (liquid-tight or permeable) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee."
a code adapted for being identified or read by an external reader	Page 1: "The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof." Page 3: "<u>2) Optical reading on rim bottom side of capsule (figures 4 to 7):</u> The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." Page 4: "The reader may consist of

K-FEE SYSTEM GMBH, EX2009, page 3307
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
	• A light source with/without focusing optic and, • A light sensor with/without focusing optic." Page 6: Claim 1.
the code is arranged on a bottom of the flange-like rim, which is opposed to the lid, to be read while the capsule is rotated around an axis of rotation traversing the capsule,	Page 3: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." Page 4: "The bit code is read by rotating the capsule along its central axis A." Page 6: Claims 8-10.
wherein the container comprises a circumference, the code comprises successive segments that extend substantially along at least an eighth of the circumference,	Page 3: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.*: "Onto the capsule rim, a bit code is applied along a circular or arc-shaped path of the rim." Page 4: "The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provide redundancy and more reliability to the reading." Page 6: Claims 2-3.
the cup-shaped body extends from a bottom end of the cup-shaped body to a top end of the cup-shaped body	Page 2: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A foil or membrane (liquid-tight or permeable) 60 is

K-FEE SYSTEM GMBH, EX2009, page 3308
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
where the cup-shaped body terminates such that a height of the cup-shaped body is the distance from the bottom end to the top end, the flange-like rim extends from the top end of the cup-shaped body, and the lid has a height that is less than the height of the cup-shaped body.	connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee."
2. The capsule of Claim 1, wherein the code is arranged on the container along an arc-shaped or circular path of the circumference of the container.	Page 3: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.*: "Onto the capsule rim, a bit code is applied along a circular or arc-shaped path of the rim." Page 6: Claim 2.
5. The capsule of Claim 1, wherein the code is repeated along the circumference of the container.	Page 4: "The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provide redundancy and more reliability to the reading." Page 6: Claims 2-3.
6. The capsule of Claim 1, wherein the code is a bit code formed by a series of discrete polygonal or dot surfaces printed on and/or embossed in the container.	Page 3: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.*: "The bit code may consist of:

K-FEE SYSTEM GMBH, EX2009, page 3309
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
	• Inclined mirroring or (flat) absorbing surfaces for bit "0" and • Flat mirroring or flat reflective (diffusing) surfaces for bit "1"." Page 4: "The code can be applied on the capsule by: • Printing (absorbing / reflective + diffusing), visible, invisible, or • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or • Embossing: Flat and inclined mirroring surfaces" Page 5: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: 4.1 Printing or mechanical deforming on a formed capsule or, 4.2 Printing or mechanical deforming on the capsule raw material (foil) before container forming or, 4.3 Printing on outer surface of a capsule container or, 4.4 Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Page 6: Claim 4.
7. The capsule of Claim 1, wherein the code is printed by an ink which is not visible by a human eye under natural light.	Page 4: "The code can be applied on the capsule by: • Printing (absorbing / reflective + diffusing), visible, invisible, or • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or • Embossing: Flat and inclined mirroring surfaces" Page 6: Claim 5.
8. The capsule of Claim 1, wherein the code is printed or embossed by a pattern which possesses surfaces having different reflective and/or absorbing properties to light.	Page 3: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim."

K-FEE SYSTEM GMBH, EX2009, page 3310
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
	Id.: "The bit code may consist of: • Inclined mirroring or (flat) absorbing surfaces for bit "0" and • Flat mirroring or flat reflective (diffusing) surfaces for bit "1"." Page 4: "On figure 5, the light beam 74 from the light source "L" touches the mirror surface of the code (small rectangle 81) and is reflected into a reflective beam 76 to the sensor "S" with high intensity. A bit such as "0" or "1" is thereby provided to the control unit. On figure 6, the light beam 74 from the light source "L" touches diffusing or absorbing surfaces (surface 82 between two small rectangles). The light beam 77 that reaches the sensor is of small intensity. Other beams such as beam 78 are diffused outside the sensor S due to the diffusing properties of the surface. A bit such as "1" or "0" is provided to the control unit." Page 4: "The code can be applied on the capsule by: • Printing (absorbing / reflective + diffusing), visible, invisible, or • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or • Embossing: Flat and inclined mirroring surfaces" Page 5: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: 4.1 Printing or mechanical deforming on a formed capsule or, 4.2 Printing or mechanical deforming on the capsule raw material (foil) before container forming or, 4.3 Printing on outer surface of a capsule container or, 4.4 Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Page 6: Claim 6.

K-FEE SYSTEM GMBH, EX2009, page 3311
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
9. The capsule of Claim 8, wherein the pattern possesses a first surface having inclined mirroring or absorbing properties to light and a second surface having flat mirroring or flat reflective properties to light.	Page 3: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.*: "The bit code may consist of: • Inclined mirroring or (flat) absorbing surfaces for bit "0" and • Flat mirroring or flat reflective (diffusing) surfaces for bit "1"." Page 4: "The code can be applied on the capsule by: • Printing (absorbing / reflective + diffusing), visible, invisible, or • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or • Embossing: Flat and inclined mirroring surfaces" Page 4: "On figure 5, the light beam 74 from the light source "L" touches the mirror surface of the code (small rectangle 81) and is reflected into a reflective beam 76 to the sensor "S" with high intensity. A bit such as "0" or "1" is thereby provided to the control unit. On figure 6, the light beam 74 from the light source "L" touches diffusing or absorbing surfaces (surface 82 between two small rectangles). The light beam 77 that reaches the sensor is of small intensity. Other beams such as beam 78 are diffused outside the sensor S due to the diffusing properties of the surface. A bit such as "1" or "0" is provided to the control unit." Page 6: Claim 6.
10. The capsule of Claim 1, wherein the code is mechanically embossed or	Page 4: "The code can be applied on the capsule by: • Printing (absorbing / reflective + diffusing), visible, invisible, or

K-FEE SYSTEM GMBH, EX2009, page 3312
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
engraved on the container by a laser.	• Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or • Embossing: Flat and inclined mirroring surfaces" Page 5: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: 4.1 Printing or mechanical deforming on a formed capsule or, 4.2 Printing or mechanical deforming on the capsule raw material (foil) before container forming or, 4.3 Printing on outer surface of a capsule container or, 4.4 Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Page 6: Claim 7.
20. A single-serve capsule for making a beverage, comprising:	Page 1: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device. The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.*: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." Page 6: Claim 1.
a base element with a cavity, in which a raw beverage material is provided,	Page 1: "The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device. The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee

K-FEE SYSTEM GMBH, EX2009, page 3313
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
	machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.*: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." *Id.*: "The term ingredient means any suitable beverage substance such as ground coffee, soluble coffee, leaf tea, soluble tea, herbal tea, dairy powder, culinary powder and combination thereof." Page 2: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A foil or membrane (liquid-tight or permeable) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." Page 6: Claim 1.
a flange horizontally extending from the base element,	Page 1: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." Page 2: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A foil or membrane (liquid-tight or permeable) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee."
a membrane that is configured to close the cavity, the membrane is fastened to a top side of the flange, and	Page 1: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." Page 2: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A foil or membrane (liquid-tight or permeable) 60 is

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
	connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee."
an identifier, which makes it possible to individualize the respective single-serve capsule,	Page 1: "The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof."
wherein the identifier is a barcode that is provided on a bottom side of the flange,	Page 1: "The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof." Page 3: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." Page 4: "The reader may consist of • A light source with/without focusing optic and, • A light sensor with/without focusing optic." Page 6: Claim 9.
the identifier extends around an entire circumference of the flange, the bottom side of the flange is opposite the top side of the flange to which the membrane is fastened.	Page 2: "In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A foil or membrane (liquid-tight or permeable) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee." Page 3: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small

K-FEE SYSTEM GMBH, EX2009, page 3315
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
	rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.*: "Onto the capsule rim, a bit code is applied along a circular or arc-shaped path of the rim." Page 4: "The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim."
21. The single-serve capsule according to claim 20, wherein the barcode is printed by material removal.	Page 4: "The code can be applied on the capsule by: • Printing (absorbing / reflective + diffusing), visible, invisible, or • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or • Embossing: Flat and inclined mirroring surfaces" Page 5: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: 4.1 Printing or mechanical deforming on a formed capsule or, 4.2 Printing or mechanical deforming on the capsule raw material (foil) before container forming or, 4.3 Printing on outer surface of a capsule container or, 4.4 Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Page 6: Claim 7.
22. The single-serve capsule according to claim 20, wherein the base element is made of metal.	Page 1: "The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity." *Id.*: "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use."

K-FEE SYSTEM GMBH, EX2009, page 3316
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
	Page 5: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: 4.1 Printing or mechanical deforming on a formed capsule or, 4.2 Printing or mechanical deforming on the capsule raw material (foil) before container forming or, 4.3 Printing on outer surface of a capsule container or, 4.4 Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." *Id.*: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
23. The single-serve capsule according to claim 20, wherein the base element comprises a bottom and a wall region that extends between the flange and the bottom, the side wall has an electrically conductive section.	Page 5: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: 4.1 Printing or mechanical deforming on a formed capsule or, 4.2 Printing or mechanical deforming on the capsule raw material (foil) before container forming or, 4.3 Printing on outer surface of a capsule container or, 4.4 Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." Page 5: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface.

K-FEE SYSTEM GMBH, EX2009, page 3317
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
	For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
24. The single-serve capsule according to claim 20, wherein the identifier comprises metal.	Page 5: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: 4.1 Printing or mechanical deforming on a formed capsule or, 4.2 Printing or mechanical deforming on the capsule raw material (foil) before container forming or, 4.3 Printing on outer surface of a capsule container or, 4.4 Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." *Id.*: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
25. The single-serve capsule according to claim 20, wherein the barcode extends around an entire perimeter of the base element.	Page 3: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim."

K-FEE SYSTEM GMBH, EX2009, page 3318
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
	Id.: "Onto the capsule rim, a bit code is applied along a circular or arc-shaped path of the rim." Page 4: "The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim." Page 6: Claims 2-3.
26. The single-serve capsule according to claim 20, wherein the barcode has at least two areas which differ in their optical properties.	Page 3: "2) Optical reading on rim bottom side of capsule (figures 4 to 7): The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim." *Id.*: "The bit code may consist of: • Inclined mirroring or (flat) absorbing surfaces for bit "0" and • Flat mirroring or flat reflective (diffusing) surfaces for bit "1"." Page 4: "On figure 5, the light beam 74 from the light source "L" touches the mirror surface of the code (small rectangle 81) and is reflected into a reflective beam 76 to the sensor "S" with high intensity. A bit such as "0" or "1" is thereby provided to the control unit. On figure 6, the light beam 74 from the light source "L" touches diffusing or absorbing surfaces (surface 82 between two small rectangles). The light beam 77 that reaches the sensor is of small intensity. Other beams such as beam 78 are diffused outside the sensor S due to the diffusing properties of the surface. A bit such as "1" or "0" is provided to the control unit. Therefore, the number of its and their bit code depends on the number and specific arrangement of mirror surfaces (e.g. rectangles) and diffusing or absorbing surfaces (e.g., zones between the rectangles). The same sequence of bits forming a "code" can be repeated several times on the circumference of

K-FEE SYSTEM GMBH, EX2009, page 3319
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
	the rim. This repetition provide redundancy and more reliability to the reading." Page 6: Claim 6.
27. The single-serve capsule according to claim 20, wherein the identifier is electrically conductive.	Page 5: "3) Application modes of codes onto a capsule The codes described in the previous examples can be applied by different methods onto a capsule such as by: 4.1 Printing or mechanical deforming on a formed capsule or, 4.2 Printing or mechanical deforming on the capsule raw material (foil) before container forming or, 4.3 Printing on outer surface of a capsule container or, 4.4 Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)." *Id.*: "4) Inductive code reading: Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device."
28. The single-serve capsule according to claim 20, wherein the identifier is a machine-readable imprint.	Page 4: "The reader may consist of -A light source with/without focusing optic and, -A light sensor with/without focusing optic." Page 4: "The code can be applied on the capsule by: • Printing (absorbing / reflective + diffusing), visible, invisible, or • Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or • Embossing: Flat and inclined mirroring surfaces" Page 5: "3) Application modes of codes onto a capsule

K-FEE SYSTEM GMBH, EX2009, page 3320
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Claims Corresponding to Proposed Count I	Support in EP 10162741.2 to Jarisch et al., filed May 12, 2010
	The codes described in the previous examples can be applied by different methods onto a capsule such as by: 4.1 Printing or mechanical deforming on a formed capsule or, 4.2 Printing or mechanical deforming on the capsule raw material (foil) before container forming or, 4.3 Printing on outer surface of a capsule container or, 4.4 Printing on the inner surface of a capsule container, using the curl as information support (Aluminum capsule technology)."

IX. CONCLUSION

As set forth herein, Applicant respectfully submits that Claims 1, 2, 5-10, and 19-34 of Application No. 13/697,297 ("the '297 Application" or "the Jarisch Application") interfere with Claims 1, 10, and 13-30 of Application No. 15/646,980 ("the '980 Application" or "the Kruger Application") and, pursuant to 37 C.F.R. § 41.202, suggest that the Office declare an Interference between the Jarisch Application and the Kruger Application.

Respectfully submitted,

Date: September 30, 2019

By: /Aaron J. Morrow/
Reg. No. 55,819
Customer No.: 29157
Telephone No. 312-781-6043

K-FEE SYSTEM GMBH, EX2009, page 3321
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

APPENDIX E

WIPO
WORLD
INTELLECTUAL PROPERTY
ORGANIZATION

DOCUMENT MADE AVAILABLE UNDER THE PATENT COOPERATION TREATY (PCT)

International application number:		**PCT/EP2011/057657**
International filing date:		**12 May 2011 (12.05.2011)**
Document type:		**Certified copy of priority document**
Document details:	Country/Office:	**EP**
	Number:	**10162741.2**
	Filing date:	**12 May 2010 (12.05.2010)**
Date of receipt at the International Bureau:		**20 June 2011 (20.06.2011)**

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-*bis*)

34, chemin des Colombettes
1211 Geneva 20, Switzerland
www.wipo.int

K-FEE SYSTEM GMBH, EX2009, page 3323
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Europäisches Patentamt
European Patent Office
Office européen des brevets

Bescheinigung	Certificate	Attestation
Die angehefteten Unterlagen stimmen mit der als ursprünglich eingereicht geltenden Fassung der auf dem nächsten Blatt bezeichneten europäischen Patentanmeldung überein.	The attached documents are exact copies of the text in which the European patent application described on the following page is deemed to have been filed.	Les documents joints à la présente attestation sont conformes au texte, considéré comme initialement déposé, de la demande de brevet européen qui est spécifiée à la page suivante.

Patentanmeldung Nr.	**Patent application No.**	**Demande de brevet n°**
	10162741.2 / EP10162741	

The organization code and number of your priority application, to be used for filing abroad under the Paris Convention, is EP10162741.

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le President de l'Office européen des brevets
p.o.

R.C. van Dijk

EPA/EPO/OEB Form 1014 12.08

Anmeldung Nr:
Application no.: 10162741.2
Demande no :

Anmeldetag:
Date of filing: 12.05.10
Date de dépôt :

Anmelder / Applicant(s) / Demandeur(s):

Nestec S.A.
IP Department
Avenue Nestlé 55
1800 Vevey/CH

Bezeichnung der Erfindung / Title of the invention / Titre de l'invention:
(Falls die Bezeichnung der Erfindung nicht angegeben ist, siehe Beschreibung.
If no title is shown please refer to the description.
Si aucun titre n'est indiqué se référer à la description.)

Capsule for preparing a beverage by centrifugation, system and method for preparing a beverage by centrifugation.

In Anspruch genommene Priorität(en) / Priority(Priorities) claimed / Priorité(s) revendiquée(s)
Staat/Tag/Aktenzeichen / State/Date/File no. / Pays/Date/Numéro de dépôt:

Internationale Patentklassifikation / International Patent Classification / Classification internationale de brevets:

A47J31/22

Am Anmeldetag benannte Vertragstaaten / Contracting States designated at date of filing / Etats contractants désignées lors du dépôt:

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR

K-FEE SYSTEM GMBH, EX2009, page 3325
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Capsule for preparing a beverage by centrifugation, system and method for preparing a beverage by centrifugation.

The invention relates to the preparation of a beverage by use of a capsule containing beverage ingredient in a beverage production device.

The preparation of a beverage by a capsule containing beverage ingredient is known. In general, the capsule is inserted in a beverage production device, such as a coffee machine, liquid is fed in the capsule and a beverage is extracted from the capsule under pressure or by gravity.

The preparation of a beverage by using the centrifugation is known. The principle mainly consists in providing beverage ingredient in a container of the capsule, feeding liquid in the receptacle and rotating the receptacle at elevated speed to ensure interaction of liquid with powder while creating a gradient of pressure of liquid in the receptacle; such pressure increasing gradually from the centre towards the periphery of the receptacle. As liquid traverses the coffee bed, extraction of the coffee compounds takes place and a liquid extract is obtained that flows out at the periphery of the receptacle.

The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use.

The term ingredient means any suitable beverage substance such as ground coffee, soluble coffee, leaf tea, soluble tea, herbal tea, dairy powder, culinary powder and combination thereof.

The invention relates more particularly to the identification of the capsule by means of a code. The code may be necessary to control parameters in the beverage preparation device such as liquid or beverage flow rate, pressure, rotational speed, temperature and combinations thereof.

WO2010/026053 relates to a controlled beverage production device using centrifugal forces. The capsule may comprise a barcode provided on an outside face of the capsule and which enables a detection of the type of capsule and/or the nature of ingredients provided within the capsule in order to apply a predefined extraction profile for the beverage to be prepared.

K-FEE SYSTEM GMBH, EX2009, page 3326
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

The present invention is defined by the appended claims.

Figure 1 illustrates an example of a beverage preparation system 1 as described in WO2010/026053 for which the capsule of the invention can be used.

The centrifugal unit 2 comprises a centrifugal cell 3. The cell 3 may comprise a capsule holder and a capsule received therein. The centrifugal unit is connected to driving means 5 such as rotary motor. The centrifugal unit comprises a collecting part and an outlet 35. A receptacle 48 can be disposed below the outlet to collect the extracted beverage. The system further comprises liquid supply means such as a water reservoir 6 and a fluid circuit 4. Heating means 31 may also be provided in the reservoir or along the fluid circuit. The liquid supply means may further comprise a pump 7 connected to the reservoir. A flow restriction means 19 is provided to create a restriction to the flow of the centrifuged liquid which leaves the capsule. The system further comprises control means 9 and a user interface 13. Further characteristics can be found in WO2010/026053.

In the following examples (see figure 4), the capsule comprises a cup-shaped body 69 extending by a flange-like rim 73. A foil or membrane (liquid-tight or permeable) 60 is connected to the body, e.g., sealed on the rim. The capsule is filled with beverage ingredient such as ground coffee.

EXAMPLES:

1) Optical reading on foil, respectively on top side rim of capsule (figures 2 and 3):

A light beam is projected onto the capsule foil 60 as illustrated on figure 2.

Onto the capsule foil 60, a bit code 61 is applied along a circular or arc-shaped path.

The barcode may consists of:

- Mirroring or absorbing surfaces for providing bit "0" and,
- Diffusing and reflective surfaces for providing bit "1"

The code is read by rotating the capsule along a central axis A (figure 1).

The reader or sensor 62 is part of the centrifugal unit 2 and consists of

- A light source with/without focusing optic and
- A light sensor with/without focusing optic.

K-FEE SYSTEM GMBH, EX2009, page 3327
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

The light can be:

- Non polarized or
- Polarized (laser) or
- Spectrum: Any, but preferably infra red.

The code can be applied on the capsule by:

- Printing (absorbing / reflecting + diffusing), visible, invisible or
- Embossing (mirror + rough reflecting + diffusing) or
- Laser engraving.

Optionally, the bit code could also be consisting of different colour patterns combined with a colour reading device. The combination of different colours and reading at a specific rotational speed results in a well defined "mixed colour". As an example, a capsule with half the circumference in blue and the other half in yellow would result in reading a green colour during rotation.

As illustrated in figure 2, when the light beam 63, sent by the light source of the sensor 62, touches the mirror code pattern (small rectangles 65) it reflects in a reflective beam 64 which is not received by the sensor.

As the capsule is rotated (figure 3), the light beam 63 touches a diffuse reflecting surface (surface between the small rectangles) and is partially reflected to the sensor. A reflective beam 66 is received by the sensor whereas other beams 67, 68 are diffused or reflected outside the sensor.

2) Optical reading on rim bottom side of capsule (figures 4 to7):

The capsule 7 may comprise a code 70 on the bottom side 72 of its rim 73. The bit code is formed of a succession of small rectangular surfaces having light mirroring properties and intermediate surfaces having flat mirroring or diffusing properties. The surfaces are arranged in a circular pattern or at least along an angular portion of the rim.

A light beam 74 is projected to the capsule's rim 73.

Onto the capsule rim, a bit code is applied along a circular or arc-shaped path of the rim.

The bit code may consist of:

- Inclined mirroring or (flat) absorbing surfaces for bit "0" and
- Flat mirroring or flat reflective (diffusing) surfaces for bit "1"

K-FEE SYSTEM GMBH, EX2009, page 3328
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

The bit code is read by rotating the capsule along its central axis A.

The reader may consist of

- A light source with/without focusing optic and,
- A light sensor with/without focusing optic.

The light can be:

- Non polarized or
- Polarized (laser) or
- Spectrum: Any, but preferably infra red.

The code can be applied on the capsule by:

- Printing (absorbing / reflecting + diffusing), visible, invisible or,
- Laser engraving (e.g. for absorbing / reflecting-diffusing) surfaces or,
- Embossing: Flat and inclined mirroring surfaces.

On figure 5, the light beam 74 from the light source "L" touches the mirror surface of the code (small rectangle 81) and is reflected into a reflective beam 76 to the sensor "S" with high intensity. A bit such as "0" or "1" is thereby provided to the control unit.

On figure 6, the light beam 74 from the light source "L" touches diffusing or absorbing surfaces (surface 82 between two small rectangles). The light beam 77 that reaches the sensor is of small intensity. Other beams such as beam 78 are diffused outside the sensor S due to the diffusing properties of the surface.

A bit such as "1" or "0" is provided to the control unit.

Therefore, the number of bits and their bit code depends on the number and specific arrangement of mirror surfaces (e.g. rectangles) and diffusing or absorbing surfaces (e.g., zones between the rectangles). The same sequence of bits forming a "code" can be repeated several times on the circumference of the rim. This repetition provide redundancy and more reliability to the reading.

Optionally (figure 7), the code comprises different colour patterns combined with a colour reading device. The combination of different colours and reading at a specific rotational speed results in a well defined "mixed colour". As an example, a capsule with half the "dots" in blue and the other half in yellow would result in reading a green colour during rotation.

K-FEE SYSTEM GMBH, EX2009, page 3329
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

3) Application modes of codes onto a capsule

The codes described in the previous examples can be applied by different methods onto a capsule such as by:

4.1 Printing or mechanical deforming on a formed capsule or,

4.2 Printing or mechanical deforming on the capsule raw material (foil) before container forming or,

4.3 Printing on outer surface of a capsule container or,

4.4 Printing on the inner surface of a capsule container, using the curl as information support (Aluminium capsule technology).

4) Inductive code reading:

Another mode consists in sensing a code provided on a metallic surface of the capsule using an inductive sensor. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device.

The speed for reading can, for instance, be comprised between 0.1 and 1000 rpm.

When reading the code, liquid can already fed in the capsule for providing a pre-wetting of the beverage ingredients.

K-FEE SYSTEM GMBH, EX2009, page 3330
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

CLAIMS :

1. Capsule for the preparation of a beverage comprising a container and a beverage ingredient contained therein, wherein the container comprises a code adapted for being identified or read by external reading means, wherein the code is arranged on the container to be read while the capsule is rotated around an axis of rotation traversing the capsule.

2. Capsule according to claim 1, wherein the code is arranged on the container along an arc-shaped or circular path.

3. Capsule according to claim 2, wherein the code is repeated along said path.

4. Capsule according to any of the preceding claims, wherein the code is a bit code formed by a series of discrete polygonal (e.g., rectangles) or dot surfaces printed on and/or embossed in the container.

5. Capsule according to claims 3 or 4, wherein the code is printed by an ink which is not visible by human eyes under natural light (e.g., ink visible under UV).

6. Capsule according to claims 4 or 5, wherein the code is printed by a pattern which possesses surfaces having different reflective and/or absorbing properties.

7. Capsule according to claims 3 or 4, wherein the code is mechanically embossed or engraved on the container by laser.

8. Capsule according to any of claims 1 to 7, wherein the code is present on the rim of the capsule.

9. Capsule according to any of claim 8, wherein the code is present on the bottom of the rim of the capsule which is opposed to the lid or foil of the capsule.

10. System for preparing a beverage from a capsule according to any of the preceding claims and further comprising a beverage preparation device; wherein the device comprises capsule holding means for holding the capsule and rotational drive means for driving the holding means and capsule in rotation along said axis of rotation and reading means for reading the code when the capsule is rotated along said axis.

11. System according to any of claims 10, wherein the reading means comprises a light emitter and a light sensor.

K-FEE SYSTEM GMBH, EX2009, page 3331
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

12. System according to claim 10, wherein the reading means comprises an inductive sensor.

13. System according to claim 12, wherein the inductive sensor is arranged to detect a code on the rim of the capsule.

14. Method for preparing a beverage from a system according to any one of claims 10 to 13, wherein the beverage is extracted from the capsule by rotating the capsule along said axis.

15. Method according to claims 14, wherein the code is read at a first rotational speed and the beverage is extracted from the capsule at a second rotational speed.

16. Method according to claim 15, wherein the first speed is lower than the second speed.

K-FEE SYSTEM GMBH, EX2009, page 3332
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

ABSTRACT:

Capsule for the preparation of a beverage comprising a container and a beverage ingredient contained therein, wherein the container comprises a code adapted for being identified or read by external reading means, wherein the code is arranged on the container to be read while the capsule is rotated around an axis of rotation traversing the capsule.

K-FEE SYSTEM GMBH, EX2009, page 3333
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/697,297	11/09/2012	Christian Jarisch	3712036-01693	1065

29157 7590 10/08/2019

K&L Gates LLP-Chicago
P.O. Box 1135
Chicago, IL 60690

EXAMINER	
SMITH, CHAIM A	

ART UNIT	PAPER NUMBER
1792	

NOTIFICATION DATE	DELIVERY MODE
10/08/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

USpatentmail@klgates.com

K-FEE SYSTEM GMBH, EX2009, page 3334
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Applicant-Initiated Interview Summary	**Application No.** 13/697,297	**Applicant(s)** Jarisch et al.	
	Examiner CHAIM A SMITH	**Art Unit** 1792	**AIA (FITF) Status** No

All participants (applicant, applicants representative, PTO personnel):

(1) CHAIM A. SMITH.

(2) ARRON MORROW.

(3) CLAYTON McCRAW.

(4) _____.

Date of Interview: 30 September 2019.

Type: ☑ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☑ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☐103 ☑Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: _____.

Identification of prior art discussed: _____.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Messrs Morrow and McCraw called to advise the Examiner that an amendment had been filed even date, to inquire regarding the status of the subject application, and to ask if application 15646980 was going to issue since there is a new Issue Notification in the file wrapper. This concerning the filing of a SUGGESTION FOR DECLARATION OF INTERFERENCE PURSUANT TO 37 C.F.R. § 41.202 against application 15/646,980 subsequent to a decision of the Patent Trial and Appeal Board and as noted in the interview summary dated 31 July 2019. Since application 15646980 has not been perfected as set forth in the interview summary of 13 August 2019 regarding that case it is not seen that the application can issue at this time..

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/C.S./ Examiner, Art Unit 1792	/VIREN A THAKUR/ Primary Examiner, Art Unit 1792

K-FEE SYSTEM GMBH, EX2009, page 3335
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiners responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicants correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,-
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicants record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiners version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, Interview Record OK on the paper recording the substance of the interview along with the date and the examiners initials.

Receipt date: 09/30/2019

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13697297
Filing Date	2012-11-09
First Named Inventor	Jarisch et al.
Art Unit	1792
Examiner Name	Chaim A. Smith
Attorney Docket Number	3712036-01693

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	4136202		1979-01-23	Favre	

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2010034662	WO		2010-04-01	UNIV BONN		☐
	2	03039309	WO		2003-05-15	NESTLE SA		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.A.S/

Receipt date: 09/30/2019

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13697297
Filing Date	2012-11-09
First Named Inventor	Jarisch et al.
Art Unit	1792
Examiner Name	Chaim A. Smith
Attorney Docket Number	3712036-01693

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Wikipedia "Binary code" - htttp://de.wikipedia.org/wiki/binary code - 5 pages	☐
	2	Rosenbaum Oliver, "The Bar Code Dictionary" Cbhv	☐
	3	Rosenbaum Oliver et al. "Bar-Code" Theory Distionary Software; Verlag Technik Berlin	☐
	4	Potter Mathias et al, "BARCODE Introduction and applications," Verlag Heinz Heise	☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature	/CHAIM A SMITH/	Date Considered	11/19/2019

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.A.S/

K-FEE SYSTEM GMBH, EX2009, page 3338
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Receipt date: 09/30/2019

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13697297
Filing Date	2012-11-09
First Named Inventor	Jarisch et al.
Art Unit	1792
Examiner Name	Chaim A. Smith
Attorney Docket Number	3712036-01693

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Aaron J. Morrow/	Date (YYYY-MM-DD)	2019-09-30
Name/Print	Aaron J. Morrow	Registration Number	55819

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.A.S/

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /C.A.S/

K-FEE SYSTEM GMBH, EX2009, page 3340
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13/697,297	Jarisch et al.
	Examiner	**Art Unit**
	CHAIM A SMITH	1792

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM			DATE							
Final	Original		07/29/2019	07/29/2019	07/29/2019	07/29/2019	07/29/2019	11/19/2019		
	1	÷	✓	✓	✓	✓	=	=		
	2	÷	✓	✓	✓	✓	=	=		
	3	÷	✓	-	-	-	-	-		
	4	÷	✓	✓	-	-	-	-		
	5	÷	✓	✓	✓	✓	=	=		
	6	÷	✓	✓	✓	✓	=	=		
	7	÷	✓	✓	✓	✓	=	=		
	8	÷	✓	✓	✓	✓	=	=		
	9	÷	✓	✓	✓	✓	=	=		
	10	÷	✓	✓	✓	✓	=	=		
	11	÷	✓	✓	-	-	-	-		
	12	÷	✓	-	-	-	-	-		
	13	÷	✓	-	-	-	-	-		
	14	÷	N	N	N	N	N	-		
	15	÷	N	N	N	N	N	-		
	16	÷	N	N	N	N	N	-		
	17	÷	N	N	N	N	N	-		
	18	÷	N	N	N	N	N	-		
	19					✓	=	=		
	20						=	=		
	21						✓	=		
	22						✓	✓		
	23						✓	✓		
	24						=	=		
	25						✓	=		
	26						=	=		
	27						=	=		
	28						=	=		
	29							=		
	30							=		
	31							✓		
	32							=		
	33							=		
	34							=		

K-FEE SYSTEM GMBH, EX2009, page 3341
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/697,297	11/09/2012	Christian Jarisch	3712036-01693	1065

29157 7590 11/27/2019

K&L Gates LLP-Chicago
P.O. Box 1135
Chicago, IL 60690

EXAMINER	
SMITH, CHAIM A	

ART UNIT	PAPER NUMBER
1792	

NOTIFICATION DATE	DELIVERY MODE
11/27/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

USpatentmail@klgates.com

K-FEE SYSTEM GMBH, EX2009, page 3342
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Office Action Summary	Application No. 13/697,297	Applicant(s) Jarisch et al.	
	Examiner CHAIM A SMITH	Art Unit 1792	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 30 September 2019.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☑ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-2,5-10 and 19-34 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☑ Claim(s) 1, 2. 5-10, 19-21, 24-30, and 32-34 is/are allowed.

7) ☑ Claim(s) 22-23 and 31 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date 09/30/2019.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

K-FEE SYSTEM GMBH, EX2009, page 3343
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

DETAILED ACTION

1. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

> (a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 22, 23, and 31 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention.

4. Claim 22 recites that the base element of the single-serve capsule is made of metal. Whilst applicant's specification discloses "the capsule raw material (foil)" on

page 9, line 28, it is noted that the term "foil" can be defined as "anything flat and thin" which is to say "a thin layer of any material" (Oxford English Dictionary). Applicant's specification does not further define what material would constitute said foil. Further, while the applicant does disclose on page 1, lines 4 – 6, of the specification that the "the capsule comprises a circumferential metal rim" there is no support found for other portions of the capsule to be made of metal, therefore the recitation that the base element of said capsule would be made of metal is seen to constitute an issue of new matter and as such must be deleted.

5. Claim 23 recites that "the base element comprises a bottom and a wall region that extends between the flange and the bottom, the side wall has an electrically conductive section". While it is seen that applicant discusses one or more electrically conductive areas formed on the body of the package which can be sensed electrically this is not disclosed as a feature of the claimed invention but in reference to a prior art package containing comestibles for the preparation of beverages. Thus, as above since applicant's disclosure does not define what material the sidewall of the base element would be made of no support is found in applicant's specification for the sidewall having an electrically conductive section and said recitation is seen to constitute an issue of new matter and as such must be deleted.

6. Claim 31 recites that "the base element is made of aluminum". For the same reasons set forth above in the new matter rejection of claim 22 the recitation that the base element of said capsule would be made of aluminum is seen to constitute an issue of new matter and as such must be deleted.

Response to Arguments

7. Applicant's arguments filed 30 September 2019 have been fully and carefully considered but they are not found persuasive.

8. Regarding claim 22 applicant urges that since the prior art references recited in the "Background Art" portion of the specification recite certain various features, support for claim 22 can be found therein. This urging is not deemed persuasive.

9. Since the mentioned prior art references have not been incorporated by reference in the present application said references cannot be relied upon to provide support for limitations recited in the amended or new claims but not originally found in the present specification.

10. Further regarding claim 22, applicant appears to urge that the term "foil" would refer to aluminium foil and that since the capsule would comprise a metal surface there is support for the base element being made of metal. Still further applicant urges that since the code can be placed on any portion of the container body support is provided for the base element of the capsule to be metal. These urgings are not found persuasive and have been fully addressed in the rejections above.

11. Applicant also urges that "in fact, the present application explicitly identifies that the "capsule" includes the container body, such that an aluminum capsule would necessarily include an aluminum body". This urging is not deemed persuasive.

12. Nowhere in the present specification is it found that the entire capsule would be made of metal, much less aluminum. Applicant's reference to the PCT application, which equates to WO 2011 141532 and the present application, recites "The term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage

ingredient. Other synonymous to a capsule are: "pod", "pad", "cartridge" or "sachet". The capsule can be single use. The container can also be filled with ingredient by the user to form the capsule just before use." Nothing is seen in the referenced citation to indicate that the capsule would contain any metal whatsoever. It is also again noted that while the applicant does disclose on page 1, lines 4 – 6, of the specification that the "the capsule comprises a circumferential metal rim" there is no support found for other portions of the capsule to be made of metal.

13. Regarding claim 23, applicant continues to urge that the cited prior art would seemingly provide support for the capsule body to be made of metal and that all the urgings regarding claim 22 would also apply with respect to support being found for claim 23. These urgings are not found persuasive.

14. As set forth above in the response to applicant's urgings regarding claim 22 the mentioned prior art references have not been incorporated by reference and therefore cannot be relied upon to provide support for limitations recited in the amended or new claims but not originally found in the present specification. With respect to applicant's urgings regarding claim 22 further applying to claim 23 applicant is referred to the responses given above regarding claim 22.

Allowable Subject Matter

15. Claims 1, 2, 5 – 10, 19, and new claims 20, 21, and 25 – 34 are allowable for the same reasons given in the Patent Trial and Appeal Board decision dated 10 May 2019.

Conclusion

16. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

17. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHAIM A SMITH whose telephone number is (571)270-7369. The examiner can normally be reached on Monday-Thursday 09:00-18:00.

19. Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to telephone the Examiner.

20. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Erik Kashnikow can be reached on (571) 270-3475. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

21. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see https://ppair-my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private

PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C.S./
Chaim Smith
Examiner, Art Unit 1792
19 November 2019

/ERIK KASHNIKOW/
Supervisory Patent Examiner, Art Unit 1792

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/697,297	Filing Date 11/09/2012	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $62 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $250 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	01/24/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 24	Minus	** 24	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/ANNIE C SINGLETON/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Patent Application Fee Transmittal

Application Number:	13697297
Filing Date:	09-Nov-2012
Title of Invention:	CAPSULE, SYSTEM AND METHOD FOR PREPARING A BEVERAGE BY CENTRIFUGATION
First Named Inventor/Applicant Name:	Christian Jarisch
Filer:	Aaron J. Morrow/Katie Cochrane
Attorney Docket Number:	3712036-01693

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
		Total in USD ($)		**240**

Electronic Acknowledgement Receipt

EFS ID:	38389838
Application Number:	13697297
International Application Number:	
Confirmation Number:	1065
Title of Invention:	CAPSULE, SYSTEM AND METHOD FOR PREPARING A BEVERAGE BY CENTRIFUGATION
First Named Inventor/Applicant Name:	Christian Jarisch
Customer Number:	29157
Filer:	Aaron J. Morrow/US Patent Mail
Filer Authorized By:	Aaron J. Morrow
Attorney Docket Number:	3712036-01693
Receipt Date:	24-JAN-2020
Filing Date:	09-NOV-2012
Time Stamp:	16:11:31
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$240
RAM confirmation Number	E20201NG11517097
Deposit Account	021818
Authorized User	US Patent Mail

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.492 (National application filing, search, and examination fees)

37 CFR 1.492(a) (Basic national fee only)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		01693.pdf	196243 14947c5b44b00bd03766bd99d0b4d8b313f1e97e	yes	11
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Response After Final Action		1	1	
	Claims		2	5	
	Applicant Arguments/Remarks Made in an Amendment		6	11	
Warnings:					
Information:					
2	Foreign Reference	WO2008148601A1.pdf	2598911 bf283166d88947bd47b6f0c7499bda73993ea1ee	no	43
Warnings:					
Information:					
3	Foreign Reference	WO2010026053A1.pdf	3224096 6f587ab6e114a3d022522dd18e840ce5b076596f	no	62
Warnings:					
Information:					
4	Foreign Reference	WO2010099806A1.pdf	1248118 db48885357b58a5629ac5231293034a65224de95	no	21
Warnings:					
Information:					
5	Foreign Reference	EP1867261A1.pdf	909268 38b92e229b4256d16ba4d91dc854293854a6eefe	no	13

Warnings:					
Information:					
6	Foreign Reference	GB2451508A.pdf	1491569 15ebb618b43faba07249bd6436be88252b d37f5b	no	26
Warnings:					
Information:					
7	Foreign Reference	WO2013160278A1.pdf	2181652 13d27576f6075a28487a6cb9ac49c62f5eb7 15cd	no	32
Warnings:					
Information:					
8	Foreign Reference	jp02180073.pdf	122530 da1f21c801c3ca1b2c95722f2e3934ed9602 fa0d	no	4
Warnings:					
Information:					
9	Foreign Reference	WO2008134910A1.pdf	1155692 4da8af36e36b77d8c321c174f39fd2bf4dab 9b8f	no	16
Warnings:					
Information:					
10	Foreign Reference	JP6248878.pdf	707968 0336d80030ad7d6500ae7305547988ba6cc ec4fa	no	14
Warnings:					
Information:					
11	Foreign Reference	WO2005044067.pdf	1480031 3bd2bc564c648d3e35b474ddd85f12f8cd4 3b8ff	no	22
Warnings:					
Information:					
12	Foreign Reference	EP1849718A1.pdf	946353 be5469a013b66f0dac94dc5b235660e7383 bac32	no	10
Warnings:					
Information:					

13	Non Patent Literature	OA-1.pdf	972060 85599bd739d55fde01d9d882d1484ce74dc c834a	no	25
Warnings:					
Information:					
14	Non Patent Literature	01693oa2.pdf	518208 1d7b9dcd79bc0e181bb41aa77450c6c4894 81769	no	14
Warnings:					
Information:					
15	Transmittal Letter	01693idstrans.pdf	91188 fcb47aeb871acbdcea3da58ff0039a279a24 572e	no	3
Warnings:					
Information:					
16	Information Disclosure Statement (IDS) Form (SB08)	01693sb08.pdf	1720876 91419666eb262eb62bc56f87cd4795af19fd ca29	no	7
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
17	Fee Worksheet (SB06)	fee-info.pdf	30712 089d837ff495188da923229d736e42055bd c2112	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	19595475		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13697297
Filing Date	2012-11-09
First Named Inventor	Jarisch et al.
Art Unit	1792
Examiner Name	Chaim A. Smith
Attorney Docket Number	3712036-01693

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5103081		1992-04-07	Fisher	
	2	6527181		2003-03-04	Kleeberg et al.	
	3	6802454		2004-10-12	McMurty et al.	
	4	6698333		2004-03-02	Halliday et al.	
	5	7097074		2006-08-29	Halliday et al.	
	6	7335387		2008-02-26	Hayes et al.	
	7	7607385		2009-10-27	Halliday et al.	
	8	6081326		2000-06-27	Rousseau et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13697297
	Filing Date	2012-11-09
	First Named Inventor	Jarisch et al.
	Art Unit	1792
	Examiner Name	Chaim A. Smith
	Attorney Docket Number	3712036-01693

	9	5004913		1991-04-02	Kleinerman	
	10					

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20100078480		2010-04-01	AKER	
	2	20020048631		2002-04-25	Boyd et al.	
	3	20020048631		2002-04-25	Kamijima	
	4	20050150391		2005-06-14	Schifferle	
	5	20130064937		2013-03-14	Jarisch et al.	
	6	20020020659		2002-02-21	Sweeney et al.	
	7	20020048621		2002-04-25	Boyd et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13697297
	Filing Date	2012-11-09
	First Named Inventor	Jarisch et al.
	Art Unit	1792
	Examiner Name	Chaim A. Smith
	Attorney Docket Number	3712036-01693

	8	20040089158		2004-05-13	Mahlich	
	9	20110315711		2011-12-29	HECHT ET AL.	
	10	20070203587		2007-08-30	Erlandsson et al.	
	11	20080148948		2008-01-26	Evers et al.	
	12	20100078480		2010-04-01	Aker	
	13	20140134299		2014-05-15	Guidorzi et al.	
	14	20160280454		2016-09-29	Mills et al.	
	15	20130098940		2013-04-25	BEM et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2008148601	WO		2008-12-11	DENISART JEAN-PAUL		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13697297
	Filing Date	2012-11-09
	First Named Inventor	Jarisch et al.
	Art Unit	1792
	Examiner Name	Chaim A. Smith
	Attorney Docket Number	3712036-01693

	2	2010026053	WO		2010-03-11	DENISART JEAN-PAUL		☐
	3	2010099806	WO		2009-03-06	BRASILIA SPA		☐
	4	1867261	EP		2007-12-19	RANCILIO MACCHINE CAFFE		☐
	5	2451508	GB		2009-02-04	FRIEDMAN ET AL.		☐
	6	2013160278	WO		2013-10-31	NESTEC S.A.		☐
	7	02180073	JP		1990-08-29	UNKNOWN		☐
	8	2008134910	WO		2008-11-13	BOEGLI-GRAVURES S. A.		☐
	9	6248878	JP		1987-10-15	TOUYOU GLASS KK		☐
	10	2005044067	WO		2005-05-19	GRIFFES CONSULTING SA		☐
	11	1849718	EP		2007-10-31	CAFE DO BRASIL S P A		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

K-FEE SYSTEM GMBH, EX2009, page 3361
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13697297
Filing Date	2012-11-09
First Named Inventor	Jarisch et al.
Art Unit	1792
Examiner Name	Chaim A. Smith
Attorney Docket Number	3712036-01693

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Non-Final Office Action for U.S. Serial No. 16/517,054 dated November 13, 2019	☐
	2	Non-Final Office Action for U.S. Serial No. 16/538,752 dated November 8, 2019	☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

K-FEE SYSTEM GMBH, EX2009, page 3362
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13697297
Filing Date	2012-11-09
First Named Inventor	Jarisch et al.
Art Unit	1792
Examiner Name	Chaim A. Smith
Attorney Docket Number	3712036-01693

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☒ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Aaron J. Morrow/	Date (YYYY-MM-DD)	2020-01-24
Name/Print	Aaron J. Morrow	Registration Number	55819

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

K-FEE SYSTEM GMBH, EX2009, page 3363
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

K-FEE SYSTEM GMBH, EX2009, page 3364
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors:	Jarisch et al.
Applicant:	Société des Produits Nestlé S.A.
Appl. No.:	13/697,297
Conf. No.:	1065
Filed:	November 9, 2012
Title:	CAPSULE, SYSTEM AND METHOD FOR PREPARING A BEVERAGE BY CENTRIFUGATION
Art Unit:	1792
Examiner:	Chaim A. Smith
Docket No.:	3712036-01693

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT TRANSMITTAL LETTER

Sir:

Submitted herewith is an Information Disclosure Statement for consideration in the above-identified application. In accordance with the provisions of 37 C.F.R. 1.56, 37 C.F.R. 1.97, and 37 C.F.R. 1.98, Applicants request that a citation and examination of the references cited on the enclosed form PTO/SB/08a be made during the course of examination of the above-identified application for United States patent. Pursuant to 37 C.F.R. 1.98, copies of any cited foreign patent documents and non-patent documents are enclosed.

This Information Disclosure Statement is submitted as follows:

Submission without Certification

[] Within three months of filing of a national application; within three months of the date of entry of the national stage as set forth in 37 C.F.R. §1.491 in an international application; before the mailing date of a first Office Action on the merits, or before the mailing of a first Office Action after the filing of a Request for Continued Examination.

[ ] After the period specified above, but before the mailing date of a Final Action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an Action that otherwise closes prosecution in the application and is accompanied by payment of the fee set forth in 37 CFR 1.17(p).

Submission with Certification

[ ] Within three months of filing of a national application; within three months of the date of entry of the national stage as set forth in 37 C.F.R. §1.491 in an international application; before the mailing date of a first Office Action on the merits, or before the mailing of a first Office Action after the filing of a Request for Continued Examination.

K-FEE SYSTEM GMBH, EX2009, page 3365
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

[ ] After the period specified above, but before the mailing date of a Final Action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an Action that otherwise closes prosecution in the application and is accompanied by the Certification specified in 37 CFR 1.97(e) which is set forth below.

[X] After the mailing date of a Final Action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an Action that otherwise closes prosecution in the application and is accompanied by the fee set forth in 37 CFR 1.17(p) and the Certification specified in 37 CFR 1.97(e) which is set forth below.

Certification under 37 CFR 1.97(e)

[ ] The undersigned counsel for applicant(s) hereby certifies that each item of information contained in the accompanying Information Disclosure Statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than **three months** prior to the filing of the Information Disclosure Statement.

[X] The undersigned counsel for applicant(s) hereby certifies that no item of information contained in the accompanying Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned, after making reasonable inquiry, no item of information contained in the accompanying Information Disclosure Statement was known to any individual designated in 37 CFR 1.56(c) more than **three months** prior to the filing of the Information Disclosure Statement.

Statement under 37 CFR 1.704(d)

[X] The undersigned counsel for applicant(s) hereby states that each item of information contained in the accompanying Information Disclosure Statement was first cited in any communication from a patent office in a counterpart foreign or international application or from the Office, and/or is a communication that was issued by a patent office in a counterpart foreign or international application or by the Office, and this communication was not received by any individual designated in § 1.56(c) more than **thirty days** prior to the filing of the information disclosure statement.

[ ] A copy of a Search Report from a corresponding foreign patent application is enclosed.

[X] The Commissioner is hereby authorized to charge the amount of $240.00 to cover the required fee to Deposit Account No. 02-1818.

K-FEE SYSTEM GMBH, EX2009, page 3366
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

[X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-1818.

Respectfully submitted,

K&L GATES LLP

BY /Aaron J. Morrow/
Aaron J. Morrow
Reg. No. 55,819
Customer No. 29157

Dated: January 24, 2020

K-FEE SYSTEM GMBH, EX2009, page 3367
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 849 718 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
31.10.2007 Bulletin 2007/44

(51) Int Cl.:
B65D 85/804 *(2006.01)*

(21) Application number: **07106724.3**

(22) Date of filing: **23.04.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **24.04.2006 IT RM20060227**

(71) Applicant: **Cafè do Brasil S.p.A.**
80129 Napoli (IT)

(72) Inventor: **Rubino, Michele**
c/o Cafè do Brasil S.p.A.
80129 Napoli (IT)

(74) Representative: **Papa, Elisabetta et al**
Società Italiana Brevetti S.p.A
Piazza di Pietra, 38-39
00186 Roma (IT)

(54) Monodose capsule containing a preparation for beverages

(57) A capsule (1) containing ground coffee (C) for making a beverage in an extraction process envisaging the passing through the capsule itself by an extraction fluid, said capsule (1) comprising a cylindrical main body (2, 3, 4) defining an internal housing (10) for receiving the coffee (C), said main body (2, 3, 4) having, in correspondence of the lateral wall (4) of the housing (10), a plurality of longitudinal grooves (5) arranged in the direction of the fluid flow in the extraction process and apt to convey such a fluid through the capsule (1) itself (Figure 8).

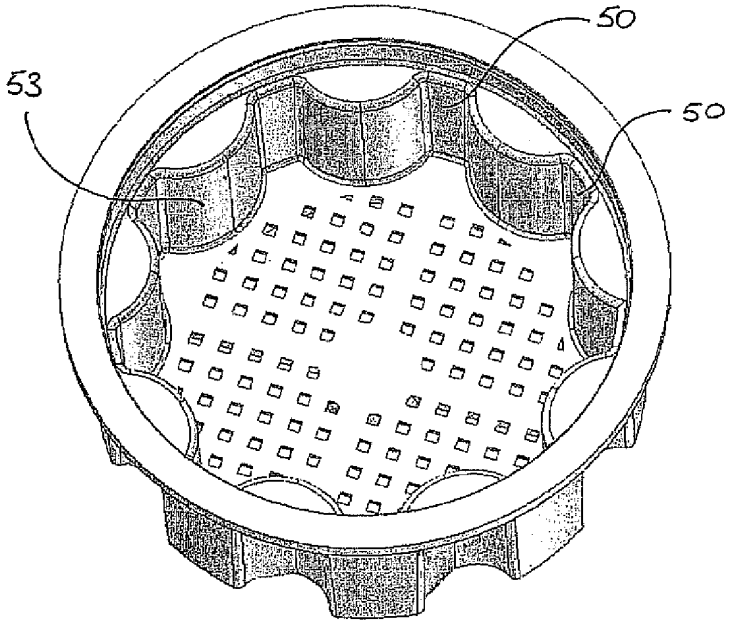


FIG. 8

EP 1 849 718 A1

Printed by Jouve, 75001 PARIS (FR)

K-FEE SYSTEM GMBH, EX2009, page 3368
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Description

[0001] The present invention refers to a single-dose capsule containing a substantially granular infusion for making beverages such as coffee and the like.

[0002] In the last few years, machines for making hot beverages such as coffee, tea, chocolate and the like from a pre-metered single-dose and single-use capsule containing a preparation in the form of a substantially granular infusion have become ever more widespread. Said machines envisage the capsule to be passed through by a liquid, typically water and/or milk, at a certain temperature and pressure, thereby obtaining, out of the capsule, the end beverage. This making process is commonly indicated as 'extraction' of the beverage from the capsule.

[0003] Said machines are typically used at offices and workplaces in general.

[0004] As to the capsules, several embodiments thereof do exist, both in terms of shape and materials used. However, one of the problems still unsolved of the capsules at issue is represented by the optimization of brewing conditions, and in particular by the option of obtaining, through the capsule, a liquid flow even and optimal from the standpoint of the resulting beverage. For this purpose, a drawback often found is represented by the fact that the liquid passes through privileged portions of the capsule only, instead of throughout the internal housing receiving the infusion. Moreover, the significant parameters of the flow passing through the capsule, like, e.g., speed and direction, may variously be affected by its shape, often even in a way and to an extent *a priori* unforeseeable, to the detriment of the quality of the end beverage and of the repeatability of its features, e.g. in terms of taste and density.

[0005] Hence, the technical problem set and solved by the present invention is to provide a capsule for making beverages of the above-mentioned type, allowing to overcome the drawbacks hereto-mentioned with reference to the known art.

[0006] Such a problem is solved by a capsule according to claim 1.

[0007] Preferred features of the present invention are present in the dependent claims thereof.

[0008] In the present context, the term 'capsule' is used in its most general meaning, encompassing also pods or cartridges and generally any member containing a preparation for beverages in the form of infusion.

[0009] The present invention provides several relevant advantages. The main advantage lies in the fact that the internal grooves of the capsule attain optimal flow conditions for the liquid passing through the capsule itself, to the advantage of the quality and repeatability of the end beverage and also of the correct operation of the associated machines, which are not subject to unforeseeably variable flow conditions.

[0010] Other advantages, features and the operation steps of the present invention will be made apparent in the following detailed description of some embodiments thereof, given by way of example and not for limitative purposes. Reference will be made to the figures of the annexed drawings, wherein:

- Figure 1 shows a front perspective view of a capsule according to an embodiment of the invention;
- Figure 2 shows a bottom perspective view of the capsule of Figure 1;
- Figure 3 shows a side perspective view from the top of the capsule of Figure 1;
- Figure 4 shows a side perspective view from the bottom of the capsule of Figure 1;
- Figure 5 shows a front perspective view from the top of a top portion of the capsule of Figure 1;
- Figure 6 shows a front perspective view from the bottom of said top portion of the capsule of Figure 1;
- Figure 7 shows a sectional view of the capsule of Figure 1 without the powder infusion contained therein; and
- Figure 8 shows a top perspective view of the capsule of Figure 1, in which the infusion contained therein and said top portion have been removed.

[0011] Referring to the above-introduced figures, a single-dose and single-use capsule containing a substantially granular infusion and apt to be used for making a beverage by extraction process is generally denoted by 1. In the present embodiment the capsule 1 contains ground coffee (not depicted for simplicity's sake).

[0012] The capsule 1 comprises a main body of substantially cylindrical overall geometry, which has just a longitudinal axis of symmetry A. In particular, the main body is comprised of a top face 2 and a bottom face 3 having a substantially circular contour, and of a lateral surface or skirt 4 bearing a plurality of grooves that will be detailed hereinafter. Such top and bottom faces 2 and 3 and lateral skirt 4 define an internal housing 10 of the capsule 1, better seen in Figures 7 and 8, receiving the ground coffee.

[0013] In correspondence of the top face 2 the main body of the capsule 1 has a peripheral edge 6 having annular contour, projecting with respect to the lateral surface 4, a raised band 7, it also of annular contour and arranged internally with respect to the peripheral edge 6, and a substantially disc-like central portion 8. The latter is of rigid or semirigid type, and preferably made of plastics material. The extraction fluid fed by the machine for making the beverage should just enter the internal housing 10 through said disc-like portion 8, which to this end bears small holes 81 distributed according to a substan-

K-FEE SYSTEM GMBH, EX2009, page 3369
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

tially radial symmetry.

[0014] According to a variant embodiment, said top face may be made, e.g., of a porous filtering material, e.g. a paper material peripherally adhered on a peripheral edge having an annular contour alike the hereto-introduced one. In that case, no raised band is envisaged.

[0015] Depending on the specific implementation, the disc-like portion 8 may be piece-formed with the remainder of the main body, and in particular with said edges 6 and 7, or made integral to the peripheral edge 6, e.g. by heat-resistant glues, as already mentioned hereto.

[0016] In correspondence of the bottom face 3, better seen in Figure 2, the main body of the capsule 1 provides a central disc-like portion 9 through which the beverage has to come out, and that therefore may have an embodiment alike that of the above-described top portion 8.

[0017] The disc-like portion 9 is inscribed in a projecting annular band 11, indented with respect to the lateral skirt 4.

[0018] As mentioned above, in correspondence of its lateral skirt 4 the main body of the capsule 1 has a plurality of concave external grooves 5, identical the one to the other and equally distributed over the entire lateral extension of the skirt 4 itself according to an axial geometry. The grooves 5 develop in a direction substantially parallel to axis A of the capsule 1 and are partitioned by external longitudinal ribs 52. Also the latter are identical the one to the other, equally distributed over the entire lateral extension of the skirt 4, and develop along a direction substantially parallel to the axis A of the capsule 1.

[0019] As it is better seen in Figure 8, the external ribs 52 are internally hollow, thereby producing in correspondence of the housing 10 a plurality of grooves or internal notches 50 of the capsule itself. Therefore, said internal notches 50 define longitudinal portions of the housing 10 inside which part of the ground coffee is received. The presence and arrangement of the notches 50 allows, as already mentioned above, optimal conveyance of the extraction fluid within the capsule 1, preventing stagnation, allowing to accurately control and foresee the properties of said flow and generally to optimize the extraction process.

[0020] Said advantages are enhanced by the specific configuration selected for the internal 50 and external 5 grooves, providing each of the former ones to have a development with a substantially plane bottom wall, wherein adjacent external grooves 5 have a convex internal contour substantially arched, following in particular substantially an arc of circumference. Internally to the housing 10 the external grooves 5 define a plurality of corresponding bulges 53.

[0021] Moreover, in the present embodiment the external 5 and internal 50 grooves involve only the bottom portion of the lateral skirt 5. Above the portion involved by said grooves, the lateral skirt 4 has instead a portion 41 with a substantially annular and continuous development 41 adjacent to the top face 2. Such a contrivance further improves the above-disclosed abilities to convey the extraction fluid.

[0022] It will be understood that the invention further refers to an automatic machine for making coffee or other beverages, comprising a housing specifically shaped for receiving the hereto-described capsule of the invention. In particular, said housing will bear a configuration complementary to the above-illustrated one of the grooves 5 and ribs 52.

[0023] The present invention has been hereto described with reference to preferred embodiments thereof. It is understood that other embodiments might exist, all falling within the concept of the same invention, and all comprised within the protective scope of the claims hereinafter.

Claims

1. A capsule (1) of the type containing or apt to contain a substantially granular infusion for making beverages such as coffee and the like in an extraction process providing the passing through the capsule itself by an extraction fluid, said capsule (1) comprising a main body (2, 3, 4) defining an internal housing (10) apt to receive said infusion (C), **characterized in that** said main body (2, 3, 4) has, in correspondence of at least part of the lateral wall (4) of said housing (10), a plurality of internal longitudinal grooves (50) arranged substantially in the direction of the extraction fluid flow and apt to convey such a fluid through the capsule (1) itself.

2. The capsule (1) according to claim 1, wherein said internal grooves (50) involve the entire transversal extension of the lateral wall (4) of said housing (10).

3. The capsule (1) according to claim 1 or 2, wherein said internal grooves (50) are equally distributed over said lateral wall (4).

4. The capsule (1) according to any one of the preceding claims, wherein said housing (10) is defined by a top wall (2) in correspondence of which the extraction fluid enters the capsule (1) and wherein said lateral wall (4) has a top portion (41) adjacent to said top wall (2) and void of said internal grooves (50).

5. The capsule (1) according to any one of the preceding claims, wherein said internal grooves (50) have a substantially plane bottom contour.

6. The capsule (1) according to any one of the preceding claims, wherein said main body (2, 3, 4) has, in correspondence of at least part of the lateral wall (4) of said housing (10), a plurality of longitudinal bulges (53) alternating with said internal grooves (50).

7. The capsule (1) according to the preceding claim,

K-FEE SYSTEM GMBH, EX2009, page 3370
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

wherein said internal bulges (53) have a substantially arched contour.

8. The capsule (1) according to the preceding claim, wherein said internal bulges (53) have a contour substantially like an arc of circumference.

9. The capsule (1) according to any one of the preceding claims, wherein said main body (2, 3, 4) has a substantially cylindrical geometry and said lateral wall (4) represents the lateral skirt of the cylinder.

10. The capsule (1) according to any one of the preceding claims, wherein said main body (2, 3, 4) has a top face (2) is at least partly made of a substantially porous material.

11. The capsule (1) according to the preceding claim, wherein said main body (2, 3, 4) has a top face (2) at least partly made of a paper material.

12. The capsule (1) according to any one of the claims 1 to 9, wherein said main body (2, 3, 4) has a top face (2) at least partly made of a substantially impermeable material provided with small holes (81) to allow the entering of the extraction fluid into the capsule (1) itself.

13. The capsule (1) according to the preceding claim, wherein said main body (2, 3, 4) has a top face (2) at least partly made of a plastic material.

14. The capsule (1) according to any one of the preceding claims, wherein said main body (2, 3, 4) has a bottom face (3) at least partly made of a substantially porous material.

15. The capsule (1) according to the preceding claim, wherein said main body (2, 3, 4) has a bottom face (3) at least partly made of a paper material.

16. The capsule (1) according to any one of the claims 1 to 13, wherein said main body (2, 3, 4) has a bottom face (3) at least partly made of a substantially impermeable material provided with small holes to allow the exiting of the extraction fluid from the capsule (1) itself.

17. The capsule (1) according to the preceding claim, wherein said main body (2, 3, 4) has a bottom face (3) at least partly made of a plastic material.

18. The capsule (1) according to any one of the preceding claims, which is a single-dose capsule (1).

19. The capsule (1) according to any one of the preceding claims, containing ground coffee (C) received in said housing (10).

20. The capsule (1) according to any one of the preceding claims, having an external lateral skirt (4) bearing a shaped external contour complementarily reproducing said internal grooves (50), such a contour being provided with longitudinal ribs (52) in correspondence of said internal grooves (50).

21. An automatic machine for making beverages such as coffee and the like from a capsule (1) according to the preceding claim and containing a substantially granular infusion, said machine comprising: extraction means apt to cause the passing through the capsule itself by an extraction fluid; and a housing apt to receive said capsule (1) and having a contour of shape substantially complementary to that of the shaped external contour of the capsule itself.

K-FEE SYSTEM GMBH, EX2009, page 3371
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

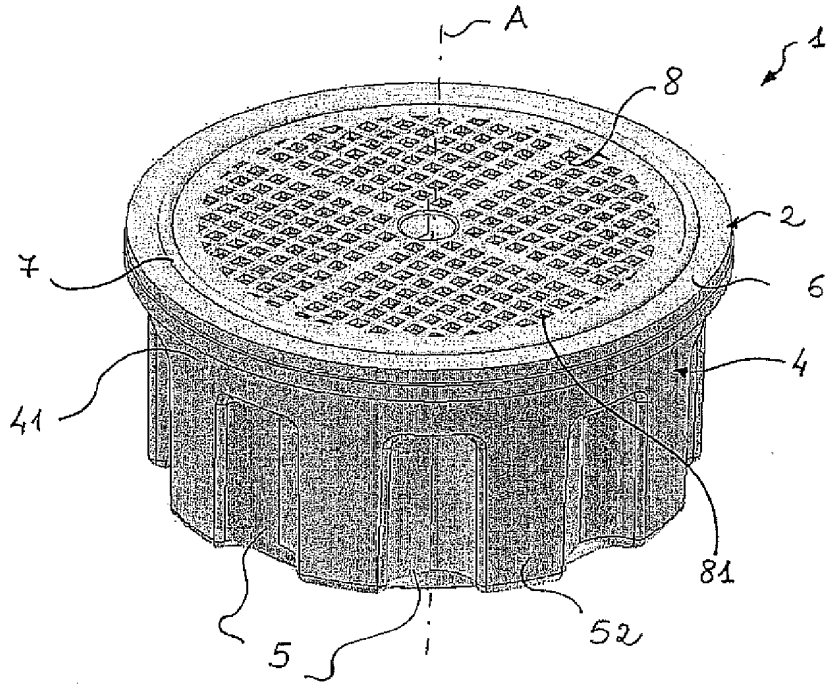


FIG. 1

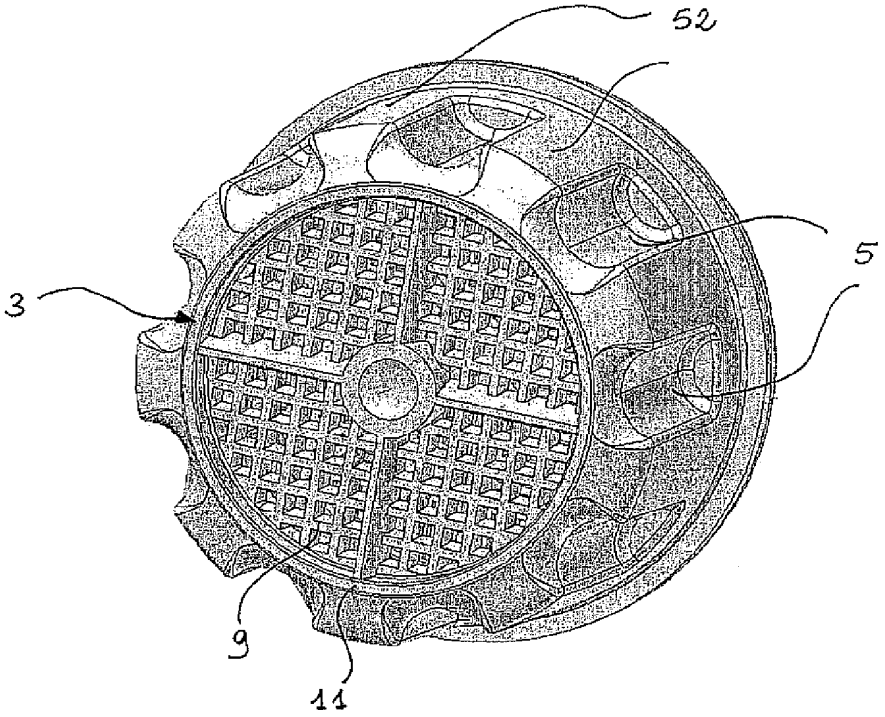


FIG. 2

K-FEE SYSTEM GMBH, EX2009, page 3372
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

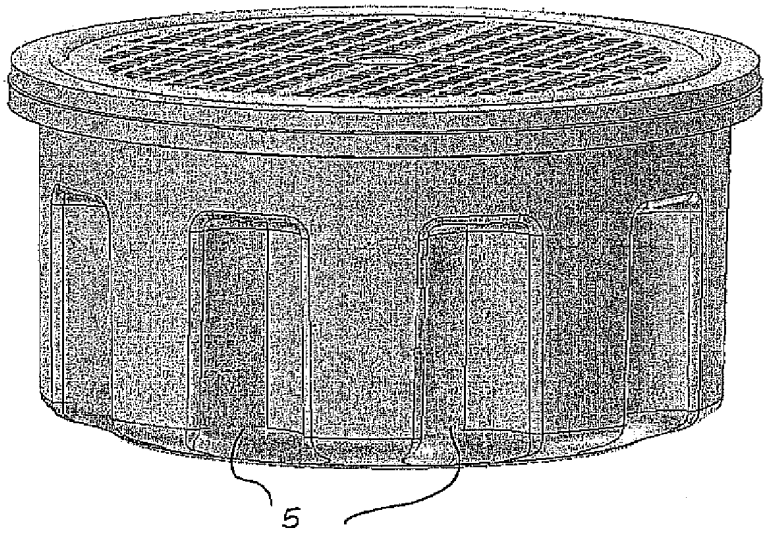


FIG. 3

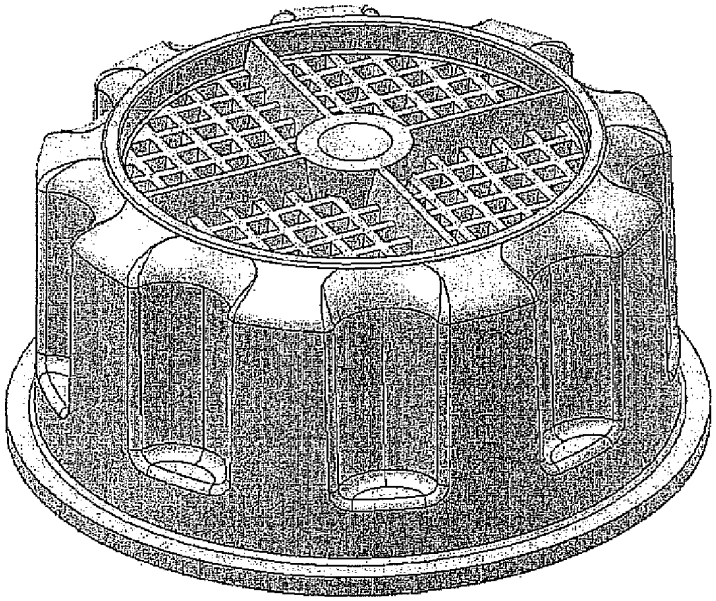


FIG. 4

K-FEE SYSTEM GMBH, EX2009, page 3373
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

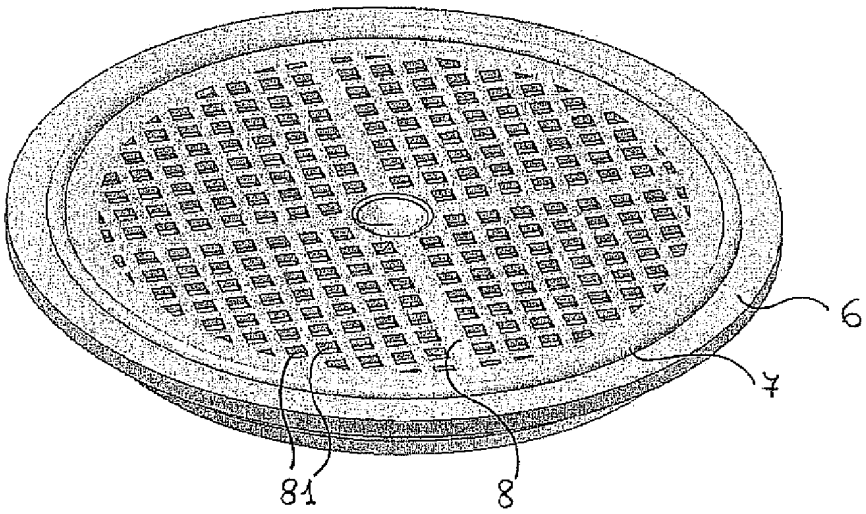


FIG. 5

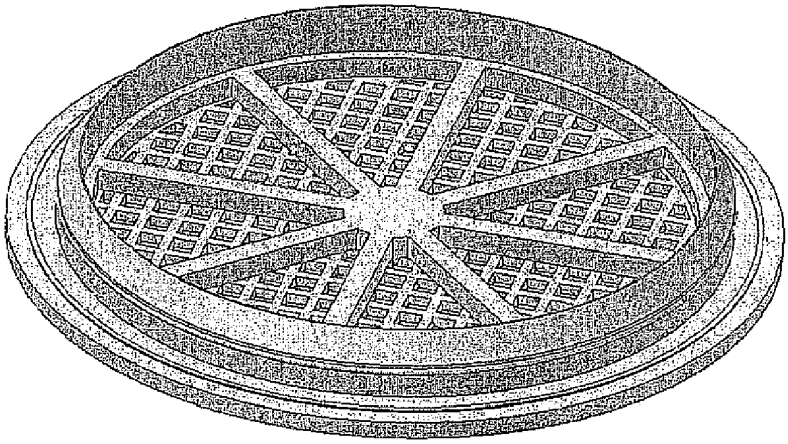


FIG. 6

K-FEE SYSTEM GMBH, EX2009, page 3374
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

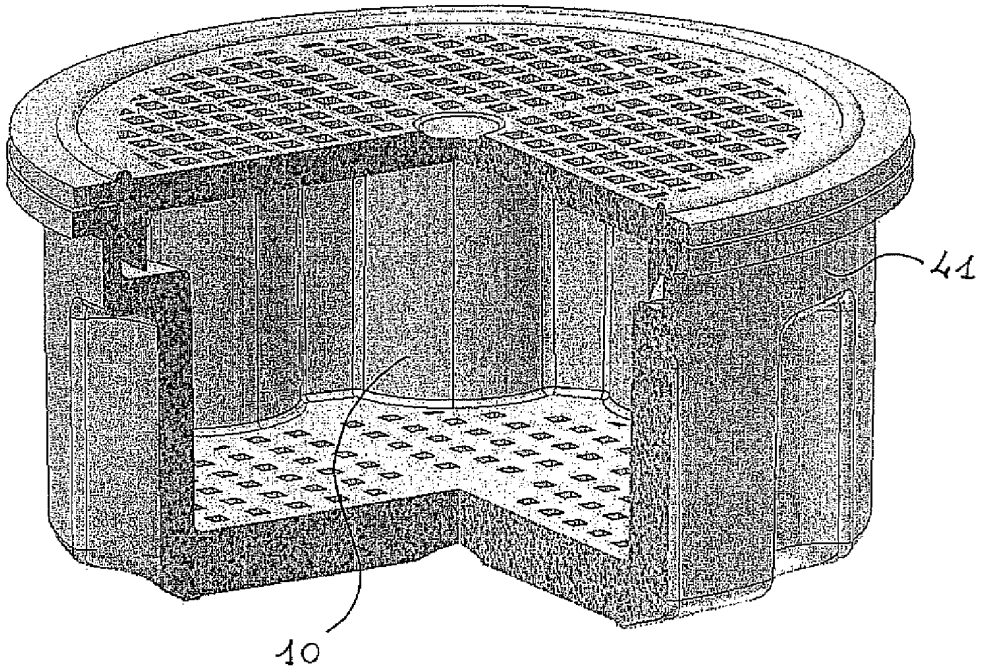


FIG. 7

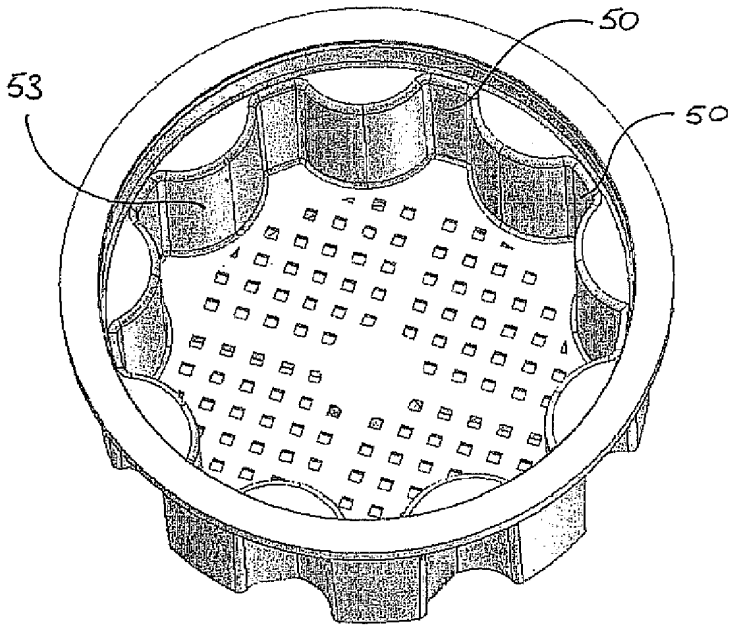


FIG. 8

K-FEE SYSTEM GMBH, EX2009, page 3375
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 10 6724

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 800 089 A (SCOTT GEORGE W [US]) 24 January 1989 (1989-01-24) * column 1, line 58 - column 2, line 42; figure 4 * -----	1-3,5, 9-11,14, 15,18-21	INV. B65D85/804
X	US 3 309 980 A (BOZEK JOHN S) 21 March 1967 (1967-03-21) * the whole document * -----	1-3,6-9, 12,13, 16-21	
A	DE 34 32 339 A1 (GESEN WOLFGANG; SCHULTE WILHELM) 13 March 1986 (1986-03-13) * the whole document * -----	1	
			TECHNICAL FIELDS SEARCHED (IPC) B65D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 July 2007	Balz, Oliver

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

2

EPO FORM 1503 03.82 (P04C01)

K-FEE SYSTEM GMBH, EX2009, page 3376
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 10 6724

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

30-07-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4800089 A	24-01-1989	NONE	
US 3309980 A	21-03-1967	NONE	
DE 3432339 A1	13-03-1986	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

K-FEE SYSTEM GMBH, EX2009, page 3377
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 March 2010 (11.03.2010)

PCT

(10) International Publication Number
WO 2010/026053 A1

(51) International Patent Classification:
A47J 31/22 (2006.01)

(21) International Application Number:
PCT/EP2009/060771

(22) International Filing Date:
20 August 2009 (20.08.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
08163530.2 2 September 2008 (02.09.2008) EP
08167584.5 27 October 2008 (27.10.2008) EP

(71) Applicant *(for all designated States except US)*: **NESTEC S.A.** [CH/CH]; Avenue Nestlé 55, CH-1800 Vevey (CH).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **DENISART, Jean-Paul** [FR/CH]; Ch. de la Jaque 15, CH-1093 La Conversion (CH). **RYSER, Antoine** [CH/CH]; Rue du Simplon 19, CH-1006 Lausanne (CH).

(74) Agent: **BORNE, Patrice**; Ave Nestlé 55, CH-1800 Vevey (CH).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

[Continued on next page]

(54) **Title**: CONTROLLED BEVERAGE PRODUCTION DEVICE USING CENTRIFUGAL FORCES

(57) **Abstract**: The present invention relates to a beverage production device for preparing a liquid comestible from a portioned food substance contained in a sealed capsule (3), comprising a centrifugal unit (2) for receiving the sealed capsule (3), driving means (5) connected to the centrifugal unit (2) for enabling a rotational motion of the centrifugal unit (2), liquid supply means (4,6,7) being connected to the centrifugal unit (2), means (8) for measuring the flow rate or the pressure of the supplied liquid and control means (9) for controlling the rotational speed of the driving means dependent on the measured flow rate or the measured pressure of the liquid.

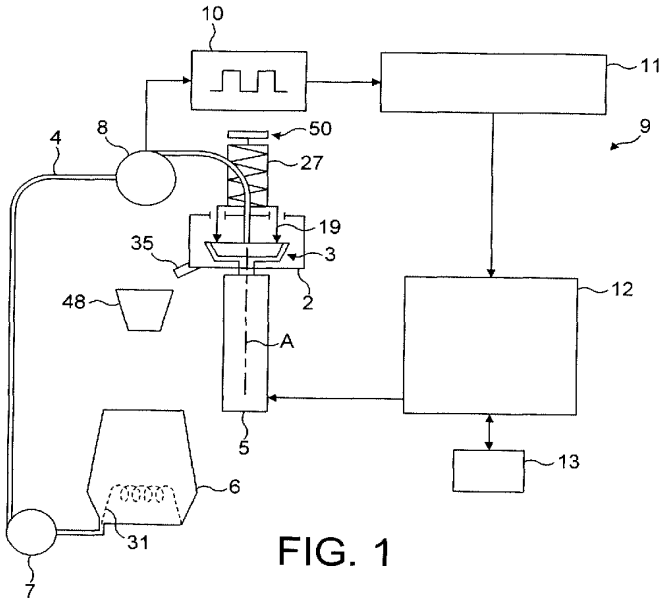


FIG. 1

WO 2010/026053 A1

K-FEE SYSTEM GMBH, EX2009, page 3378
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

Controlled beverage production device using centrifugal forces

Field of the invention

The present invention relates to a device and a capsule system for preparing a liquid comestible from a food substance contained in a receptacle by passing liquid through the food substance using centrifugal forces. In particular, the invention relates to a device and a method for controlling the flow rate of a liquid during the beverage preparation.

Background of the invention

It is known to prepare beverages by separating a mixture consisting of brewed coffee and coffee powder with centrifugal forces. Such a mixture is obtained by the interaction of hot water and coffee powder for a defined time. The water is then forced through a screen, on which screen powder material is present.

The existing centrifugal systems suffer the inconvenience that the strength of coffee cannot be regulated properly.

For instance, GB1506074 relates to a centrifugal device comprising a filter for filtering coffee. However, the contact time between coffee and hot water is not controllable. For example, the coffee granulometry can influence the residence time of liquid in the coffee and so the extraction quality.

On the other hand, solutions are known for increasing the pressure in the cell such as by a fixed or pressure-responsive restriction means.

It is known to increase the pressure in the centrifugal cell by increasing the rotational speed such as in EP651963. In this document, the pressure increase is obtained by a rubber-elastic element interposed at the interface between the lid and the cup of the centrifugal cell. Such an element deforms elastically to leave a filtering passage for the liquid when a certain pressure is attained at the interface.

FR2487661, US4545296 and WO2006/112691 relate to centrifugal systems wherein a fixed restriction is placed downstream of the filter to increase the pressure. However, in these systems, the contact time of the coffee and water is not truly controlled. As in EP651963, the taste of the coffee can be modified by changing the speed consequently the pressure in the cell.

GB2227405 discloses an apparatus for preparing a coffee infusion wherein the speed and/or duration of rotation is set to give a predetermined strength of infusion.

WO2007/041954 relates to a coffee maker with combined milling stage and brewing stage. Different approaches can be used to control the flavours of the brewed coffee. A first approach is to control the grain size of coffee powder during milling stage. A second approach is to control the speed of water penetration through the milled coffee powder. Therefore, different rotational speeds of the brewing basket are set up by the controller. A

disadvantage is that depending on the flow characteristics in the ground coffee taking into account the powder characteristics, coffee compaction, water quality, temperatures, etc., the strength and other quality attributes (e.g., crema) of the coffee can fluctuate a lot.

In PCT/EP08/056310, a solution is proposed into which a flow restriction is placed in or outside the centrifugal cell, e.g., a capsule containing coffee powder. The flow restriction can comprise a regulating valve offering a back-pressure. The valve opens under the effect of pressure in the cell. The valve can be preloaded by a resilient element (rubber or spring). A control unit can be provided in the device for setting the rotational speed according to the nature of the liquid to be brewed and/or the substance of the capsule.

Based on the prior art, the present invention aims at providing a device and a method for allowing an efficient control of the strength of a liquid comestible such as a coffee or tea beverage in a centrifugal beverage production device which takes into account the flow attributes through the ingredients.

The present invention also aims at providing a device and a method for allowing the production of different levels of foam or "crema" of the liquid comestible, in particular for coffee beverages.

In particular, one aspect of the invention, is to ensure that the key quality attributes of the beverage can be controlled properly. In particular, one aspect of the invention is to ensure that the strength or concentration

of the beverage is reproducible, i.e., that this characteristic does not fluctuate much for a same desired beverage. Still an aspect of the invention is to ensure the key quality attributes (i.e., concentration, coffee crema level) as well as the volume of the beverage can be produced and selected in a controllable manner depending on the type of beverages desired.

Object and summary of the invention

In a first aspect, the present invention relates to a beverage production device for preparing a liquid comestible from a portioned food substance contained in a capsule or cell, comprising a centrifugal unit for receiving the capsule or cell, driving means connected to the centrifugal unit for enabling a rotational motion of the capsule or cell in the unit, liquid supply means being connected to the centrifugal unit to supply liquid in the capsule or cell, means for measuring the flow rate, or respectively the pressure, of the liquid, and a control unit for controlling the flow rate of liquid, or respectively the pressure of liquid, to match a flow rate reference, or respectively a pressure reference, in a control loop by automatically adjusting the rotational speed of the driving means during the extraction phase of the beverage production depending on the measured flow rate, or respectively the measured pressure, of the liquid.

With a device according to the present invention it is possible to enable a controlled interaction between a preferably portioned food substance provided in a capsule or cell and a liquid such as water. Thereby, the interaction is particularly enabled due to the

centrifugal forces exerted on the capsule or cell during and after liquid has been provided thereto and, the substance:liquid interaction control is particularly obtained by monitoring and adjusting the flow rate of liquid that feeds the capsule or cell.

In a preferred embodiment, the capsule is removably insertable into the centrifugal unit of the device. The centrifugal unit of the device preferably comprises two enclosing members which are movably arranged relatively to each other and which are designed to enclose the capsule within the device.

One enclosing member is preferably equipped with a liquid injection assembly which enables the provision of liquid to the capsule enclosed within the centrifugal unit of the device. Preferably, the injection assembly is arranged centrically with respect to a rotational axis of the centrifugal unit. The injection assembly preferably comprises a tubular member for providing liquid to a central inlet port of the capsule. In a possible embodiment, the injection assembly comprises a piercing member designed to pierce the inlet port in a face of the capsule. The injection assembly is connected to the liquid supply means of the device.

A second enclosing member of the centrifugal unit is preferably a rotary drum which is of complementary shape to the capsule. Hence, a user may insert the capsule into said rotary drum which is held in the drum a stable manner.

The driving means for driving the centrifugal unit is preferably a motor such as an electric motor which is

connected to the control means of the device. Thereby, the driving means are connected to the rotary drum by means of a motor axle which thus enables a rotational movement of the rotary drum and the capsule housed by the rotary drum.

The liquid supply means of the device comprise a reservoir for storing liquid. Preferably, the reservoir is a boiler which comprises heating means in order to heat the liquid therein. However, the liquid supply means may as well comprise a liquid reservoir and an in-line heating element such as a thermoblock or an instant heater placed downstream of the reservoir in the fluid circuit.

Moreover, the liquid supply means preferably comprise a pump for providing liquid from the reservoir to the injection assembly and thus, to the centrifugal unit of the device. The pump is preferably connected to the control means of the device.

The means for measuring the flow rate of the liquid are preferably arranged in the fluid circuit between the liquid supply means and the centrifugal unit of the device.

The control unit preferably comprises an event-triggered state machine connected to the driving means and the means for measuring the flow rate of the liquid provided to the centrifugal unit. Moreover, the control unit is preferably connected to a manual interface which can be operated by a user.

In particular, the flow rate reference can be a flow rate set point which is set as a constant during an extraction phase. The extraction phase is here defined as the main phase during which liquid is supplied by the supply means to the capsule and said liquid passes through the ingredients in the capsule and beverage liquid is thus dispensed from the capsule.

In a possible alternative, the flow rate reference represents a variable profile of flow rate, i.e., set points varying in function of time. Indeed, it might be advantageous in some case to vary the flow rate set point during the extraction phase in order to achieve particular extraction profiles. In this case, the control unit can store a variable profile of flow rate which corresponds to a particular selected beverage. However, for avoiding too much control complexity, preference is given to a constant flow rate set point for a same desired beverage.

In a preferred mode, the control unit is preferably configured for selecting or calculating different preset flow rates corresponding to respectively different beverage (e.g., coffee) strengths. The control unit is preferably connected to a user's interface for a selection of the different beverages by the user.

Therefore, the control unit enables the regulation of the flow rate (as a constant or variable profile) by adjusting the speed of the driving means during at least one essential phase of the beverage preparation in order to set the strength (i.e., the concentration) of the beverage to be prepared. Thereby, the strength can be

selected by a user of the device by means of the manual interface.

Moreover, the control unit is configured for controlling the volume of the beverage by receiving data from the flow measuring means and controlling accordingly the volume of liquid supplied by the liquid supply means, in particular, the pump, to the capsule or cell.

However, it may as well be possible that the strength and/or volume are set by identification means arranged within the device which interact with the capsule provided to the device. Such identifications means may be a barcode scanner for example which reads a barcode provided on an outside face of the capsule and which enables a detection of the type of capsule and/or the nature of ingredients provided within the capsule in order to apply a predefined extraction profile for the beverage to be prepared.

During the beverage extraction phase of a beverage preparation cycle, the speed of the driving means is thus regulated in control loop to correct the flow rate at a substantially constant value or, eventually to follow a predefined flow rate profile. Hence, a preset nominal flow rate is obtained during the extraction phase of the beverage production. Since the flow rate is directly linked to the contact time of the liquid with the ingredient in the capsule, the strength of the beverage is thus essentially determined by maintaining the flow rate to said predefined set point or profile corresponding to the selected strength of the beverage.

During the extraction phase, a centrifugal cell which is placed within the centrifugal unit acts as a centrifugal pump by drawing liquid such as water from the liquid supply. Accordingly, the rotational speed of the motor driving the centrifugal unit in rotation compensates for the flow rate fluctuation to the set point. In particular, when the measured flow rate becomes lower than the set point, the rotational speed is increased by the control unit to raise the flow rate up to the set point and, inversely, when the measured flow rate becomes higher than the set point, the rotational speed is decreased by the control unit to lower the flow rate down to the set point. Obviously, the lowest possible fluctuations of flow rates to the set point are preferred.

The centrifugal cell according to the present invention may be a single-use capsule provided to the centrifugal unit. Furthermore, the centrifugal cell may as well be a refillable filter cell.

The single-use capsule to be used with the present invention can be closed before use in a gas impervious manner to maintain freshness of the food ingredients housed therein. The capsule preferably contains a protective atmosphere for the ingredients such as inert gas. The capsule can be closed by a membrane which is pierced or peeled off during the beverage preparation process. The capsule may comprise coding means such as a barcode for example which is read by the machine. Accordingly, corresponding parameters, such as for example the beverage strength, the beverage volume and/or the beverage crema or foam, can be adjusted by the control means.

In case a refillable filter cell is provided to the centrifugal cell, said filter cell is preferably removably arranged within the device. Furthermore, the filter cell is preferably designed to be accessible from the outside of the device. Therefore, removing and loading of food substance from or to the centrifugal cell is enabled.

The pump of the liquid supply means is set to supply a sufficient quantity of water during the beverage preparation cycle to the centrifugal cell whereas the rotational speed of the centrifugal cell actually regulates the flow rate of the dispensed liquid. The pump is preferably a low pressure pump such as a centrifugal pump or any other suitable low pressure pump.

The contact time between the food ingredients and hot water contained in the capsule varies in inverse proportion to the water flow rate which circulates in the liquid supply circuit and thus, through the centrifugal cell. In general, for obtaining a higher concentration or strength of the beverage to be prepared, the water flow rate can be set at a relatively low value, whereas for obtaining a lighter concentration or strength of the beverage, the water flow rate is set at a relatively higher value.

This is in particular advantageous for preparing a hot beverage such as coffee, tea, hot chocolate or the like with a desired concentration respectively a desired strength.

The flow rate is measured by flow rate sensing means which are placed in the liquid flow path of the device.

Such flow metering means provide continuous indications to the control means which, in response, regulate the speed of the motor.

The flow rate sensing means is preferably a pulse-coded flow-metering turbine placed between the water supply, e.g., a water reservoir and the liquid injection assembly of the centrifugal cell. The turbine thus generates electrical impulses which period is proportional to the velocity of the flow. Accordingly, the control means are designed to calculate the flow rate based on the electrical impulses provided by the pulse coded flow-metering turbine.

Preferably, the control means are also configured to control the volume of the delivered beverage. Accordingly, the volume is set up by receiving information of the flow meter such as by counting the number of impulses generated by the flow meter or by measuring the period of the impulses.

The manual interface of the device preferably comprises a selection means for the user to select the strength of the beverage and preferably also the volume of the beverage. The user may thus select the concentration and/or volume of the beverage to be prepared. For example for a coffee beverage, different strength of coffees can be selected (e.g., light, medium, strong) and different volumes (e.g., 25, 40, 110, 250 mL) corresponding to different cup sizes. For example, for simplifying the selection of the user interface but still meeting the larger possible preference of the users, the choices can be made possible amongst a limited number of selectable combinations relative to coffee strengths and volumes,

for example, under coffee selections which are explicit for the user (e.g., ristretto, espresso light/strong, lungo light/strong, Americano, etc.).

When different kinds of beverage are proposed such as coffee, tea, milk, etc., the selection means may also be used to select the kind of beverage to be prepared in such as coffee, tea, herbal tea, soup or hot chocolate for example. Thereby, the selections means may provide information about different liquid comestibles to be prepared for which different extraction profiles are stored.

In a possible embodiment relating to the preparation of a coffee beverage with the present device, the manual interface may be used for selecting a desired kind of coffee, such as a 'ristretto', an 'espresso', a 'lungo' or an 'Americano' which may express a particular combination of coffee strength and volume. Furthermore, the strength of coffee can eventually be further adjusted selectively for one or more of these kinds of coffees.

Moreover, the desired coffee strength is preferably chosen by selection means such as a potentiometer of the manual interface. Accordingly, the strength of a coffee beverage to be prepared can be varied by a continuous or incremental variation of the flow rate set point which has been set initially by the device. In a possible embodiment, the strength of coffee beverage can be set, for instance, after the selection of coffee volume is carried out.

Considering in particular, coffee preparation from ground coffee contained in the cell, i.e., a single-use capsule,

the extraction profile set by the control means of the device preferably comprises at least a pre-wetting phase, an extraction phase and a dry-spinning phase which differ normally in at least the associated rotational speed of the driving means.

The pre-wetting phase of the extraction profile takes place at the beginning of the beverage preparation cycle. Thereby, liquid such as water is supplied to the centrifugal cell, i.e. the capsule, which is maintained static or is rotated at relatively low speed, preferably lower than 200 rpm, most preferably lower than 100 rpm. Accordingly, the pre-wetting phase enables a homogeneous wetting of the dry food ingredients, i.e., ground coffee, housed within the capsule. Hence, the compacting of dry ingredients and a resulting blockage during the beverage preparation cycle can be effectively prevented.

The amount of liquid provided to the centrifugal cell respectively to the capsule during the pre-wetting phase is preferably chosen such that the cell respectively the capsule is full of liquid and gas is essentially expelled out of the capsule. Accordingly, the food ingredients are completely flooded. During this phase, there is essentially no extracted liquid being dispensed from the capsule as the centrifugal pressure at low speed in the capsule remains too low to enable to overcome the pressure losses created in the capsule and the possible restriction means in the flow path (e.g., valve means).

After the pre-wetting phase, the extraction phase of the extraction profile takes place. It preferably comprises a ramp up of the driving means to the extraction speed level which is a higher rotational speed than during the

pre-wetting phase. Preferably, a predefined extraction speed is set to avoid important fluctuation of the flow rate during the ramp-up phase. Once the predefined extraction speed is reached, the rotational speed of the driving means is controlled by the control means in order to provide a relatively constant flow rate of the liquid.

In order to control the contact time between food ingredients and water during the beverage preparation cycle, the value of the liquid flow rate is calculated by the detection of the period of the impulses generated by the flow meter.

Depending on the type of beverage to be delivered, during the extraction phase, the rotational speed can be comprised between 5,000 and 15,000 rpm, preferably 8,000 and 12,000 rpm. In particular, the speed can be influenced by the flow resistance in the capsule and by the restriction means.

After the extraction phase, the spin-drying phase of the extraction profile takes place. Thereby, the water pump of the liquid supply means is stopped by the control means in order to stop supply of water to the centrifugal cell. Moreover, a second ramp-up phase or acceleration of the rotational speed is carried out followed by a phase where the rotational speed is maintained at a relatively elevated constant value to perform spin-drying of the food ingredients in the centrifugal cell respectively within the capsule. The beverage preparation cycle can be ended up by a deceleration phase where the rotational speed is progressively lowered to the zero value.

Accordingly, any residual liquid present in the centrifugal cell or the capsule is eliminated and discharged via a spout of the device. The rotational speed of the spin-drying phase is set higher than the rotational speed controlled during the extraction phase.

Since the concentration of the residual liquid discharged by the centrifugal cell may have a different concentration than the liquid comestible discharged during the extraction phase, the residual liquid may be discharged by purging means which can be selectively connected to a spout of the device. Therefore, the concentration of the beverage to be prepared is not influenced by the residual liquid discharged during the spin-drying phase.

It should be understood that the spin-drying phase can be carried out for a predetermined time (e.g., a few seconds).

The extraction profile and particularly the rotational speed may vary for each kind of beverage to be prepared in order to influence the concentration or strength of the beverage. Accordingly, different extraction profiles may be chosen by means of the manual interface. The predefined extraction profiles are preferably stored in the control means or memory means connected thereto.

Furthermore, the centrifugal unit of the device preferably comprises flow restriction means at a delivery side of the centrifugal unit.

The flow restriction means at the delivery side of the centrifugal unit may comprise a pressure-responsive valve

which opens under the pressure of the liquid coming out of the unit. Such a valve is for example described in PCT/EP08/056310.

In an embodiment, the restriction means is a fixed Venturi duct (eductor) formed of one or more small outlets. The restriction means can be provided at the delivery outlets of the capsule or downstream of the capsule.

The advantage is that a certain pressure is necessary before the liquid can exit the centrifugal unit and therefore, the contact time of liquid is promoted in the cell by creating a delayed release. Accordingly, an improved interaction between water and the substance contained in the capsule is obtained. For coffee, for example, it may be advantageous to optimize interaction of water and the ground coffee particles contained in the centrifugal cell to obtain a good extraction of the coffee and aroma compounds.

Moreover, the restriction such as the valve provides a relatively high pressure drop which promotes the generation of a nice amount of crema or foam of the beverage.

During the extraction phase, the food ingredients within the centrifugal cell are traversed by liquid provided by the liquid supply means. The beverage resulting from the interaction of liquid and food ingredients, which is discharged from the centrifugal cell due to the centrifugal forces acting thereon, forces the flow restriction valve to open when the pressure of liquid exceeds the preload of the valve. The beverage extract is

thus discharged from the centrifugal cell via the spout with a relatively consistent flow.

In a preferred embodiment, the flow restriction valve can be formed by at least one engaging portion of the device which is adapted to move relatively to an engaged portion of the device or, alternatively, of an engaged portion of the capsule under the effect of the pressurized liquid exiting the capsule, for making a thin annular laminating passage for the liquid.

The preload of the flow restriction valve is preferably adjustable. Thus, the preload of the valve can be increased to force the rotational speed to increase for maintaining the same flow rate. Conversely, the preload can be decreased to lower the rotational speed for maintaining the same flow rate. Thereby, the adjustment of the preload of the valve can impact on the level of crema or foam of the beverage which can be created.

Thereby, it has been found that a higher rotational speed of the driving means during the extraction phase provides a higher amount of crema or foam of the beverage. This is particularly advantageous for coffee beverages for which a distinctive crema or foam is desired.

According to the described embodiment, it can be possible to control both the beverage strength (for example the coffee concentration in the coffee liquid extract in the cup) and the amount of foam or crema on the beverage.

It is thus possible to provide for example a 'ristretto' coffee extract with a relatively high concentration of coffee and a high amount of crema by adjusting,

respectively, the volume of 25mL, a relatively low flow rate and a relatively high preload of the flow restriction valve. On the contrary, it is for example also possible to prepare a relatively light 'lungo' coffee extract with a low amount of crema by adjusting the volume to 110mL, a relatively high flow rate and a relatively low preload of the restriction valve.

In a preferred embodiment, the preload on the flow restriction valve is adjustable by mechanical actuation means driven manually or by a motor controllable by the control unit. Hence, the amount of foam or crema of the beverage to be prepared can be adjusted by the user.

In a possible alternative, the speed of the driving means may be controlled in relation to a detected pressure of liquid in the centrifugal cell respectively in the capsule or of the pressure of liquid reigning in the liquid supplying line before the cell. Thereby, the pressure in the cell or before the cell is preferably measured by a pressure sensor positioned within the cell or upstream of the cell, e.g., in the liquid supplying line between the pump and the water injection point in the cell. It should be noted the present invention can be adapted to a control of the pressure of liquid as an alternative to a control of flow rate or as an additional control means to regulate the rotational speed and, consequently, the strength of the beverage.

In a second aspect, the present invention relates to a system for producing a beverage from portioned ingredients provided within a capsule, the system comprising a beverage producing device having a centrifugal unit comprising at least two enclosing

members for enclosing the capsule by a relative movement of the enclosing members,

driving means connected to the centrifugal unit for enabling a rotational motion of the centrifugal unit,

a liquid injection assembly designed to interact with the capsule provided to the device and connected to liquid supply means,

means for measuring the flow rate, or respectively the pressure, of the liquid,

control means for controlling the flow rate, or respectively the pressure, of liquid to match a flow rate reference, or respectively a pressure reference, in a control loop by automatically adjusting the rotational speed of the driving means during the extraction phase of the beverage production depending on the measured flow rate, or respectively the measured pressure,

wherein the capsule is designed to be removably inserted into the centrifugal unit of the device.

The capsule to be used with the device according to the present invention is preferably a single-use capsule sealed in a protective atmosphere before use. The capsule can have a rigid dished body and a lid, wherein the lid of the capsule comprises outlet openings arranged at a peripheral portion of the lid. In a possible alternative, the capsule can be capsule permeable to liquid and gas when inserted in the device such as a filter capsule.

The capsule preferably contains ground coffee, soluble coffee, tea, cocoa, milk and combinations thereof.

For coffee, the amount of coffee can differ in the capsule depending on the type of coffee beverage to be delivered. For instance, a lungo-type coffee can be

prepared from a higher amount of coffee contained in the capsule compared to a ristretto or an espresso-type coffee. The coffee powder may also be prepared from many different blends and origins.

The capsule to be used in the device can be associated to a code containing information relative to one or more of the following parameters: flow rates, beverage volumes, speeds, beverage temperatures, etc.

The injection of the liquid provided by the device preferably takes place at an upper face of the capsule which may already have an inlet port and the injection of liquid can be done by connecting an injection member such as a tube to an inlet port of the capsule. In a possible alternative, a foil of the capsule which covers the lid can be pierced by a piercing member connected to the injection member of the device. The output of the beverage to be prepared takes place at a peripheral section of the lid of the capsule which is provided with a plurality of outlet openings.

It should be understood that the single-use capsule according to the present invention may contain any of a culinary liquid such as soup or sauce, a beverage liquid such as coffee, chocolate, milk, tea, etc., or a nutritional liquid such as an infant formula.

In a third aspect, the present invention relates to a method for preparing a liquid comestible from a portioned food substance contained in a capsule or cell by passing liquid through the substance using centrifugal forces, comprising the steps of

connecting the capsule or cell to a liquid supply,

rotating the capsule or cell about its rotational axis to enable an interaction between the liquid and the portioned ingredients provided within the capsule,

controlling the flow rate, or respectively the pressure, of liquid to match a flow rate reference, or respectively a pressure reference, by automatically adjusting the rotational speed of the driving means during the extraction phase of the beverage production depending on the measured flow rate, or respectively the measured pressure, of liquid.

In particular, the flow rate is controlled in relation to a selection of strength of the beverage carried out by the user.

Furthermore, the level of crema or foam can also be controlled by adjusting the load on the restriction valve at the exit of the capsule or cell.

In order to avoid unnecessary repetitions, the method can be defined as including all the possible operations as aforementioned described in relation to the operations of the device or system of the invention.

Brief description of the drawings

Further features, advantages and objects of the present invention will become apparent for a skilled person when reading the following detailed description of embodiments of the present invention, when taking in conjunction with the figures of the enclosed drawings.

Fig. 1 is a schematic representation of the centrifugal system;

Fig. 2 is a graphical representation of the speed as a function of time during a typical brewing cycle for a concentrated strong coffee beverage and a comparatively lighter coffee beverage;

Fig. 3 is a cross sectional view of the centrifugal unit according to a non-limiting example;

Fig. 4 is an enlarged view of a detail of figure 3.

Fig. 5 is a sectional side view of a capsule according to the present invention.

Fig. 6 is a perspective side view of a capsule according to figure 5 with its top membrane being removed.

Fig. 7 is a sectional side view of a centrifugal unit according to a variant of the invention.

Fig. 8 is an enlarged view of a detail of figure 7 when centrifuged liquid is delivered.

Fig. 9 shows an example of a user's interface of the device of the invention.

Detailed description of the figures

Figure 1 is a schematic drawing of the centrifugal system according to the present invention.

As can be seen in figure 1, the system comprises a centrifugal unit 2 in which a centrifugal cell 3 can be

placed. The centrifugal cell 3 may be a single-use capsule which contains portioned food ingredients. Before its insertion in the unit, the capsule is preferably sealed in a gastight manner to maintain freshness of the food ingredients contained therein. Alternatively, the centrifugal cell 3 may be a re-fillable filter cell removably connectable to the centrifugal unit 2.

The centrifugal unit 2 is connected to driving means 5 which is preferably an electric motor. The driving means 5 is designed to rotate a rotary drum of the centrifugal unit 2 along an axis of rotation A and thus, the centrifugal cell 3 housed within the rotary drum of the centrifugal unit 2 about the same axis A of the centrifugal cell 3. It should be noted that the cell could be part of or all the rotary drum, in particular, when the cell is not specifically a single-use capsule but a refillable part of the device.

The centrifugal unit 2 further comprises a collecting part and an outlet duct 35 through which the beverage to be prepared is discharged into a provided receptacle 48 such as a cup or mug, for example.

The system further comprises liquid supply means which comprise a water reservoir 6 and a fluid circuit 4. The reservoir 6 preferably comprises water heating means 31 for heating the water contained within the reservoir 6. The heating means 31 may be a heating coil. The heating of the water may as well be obtained by a thermoblock in the fluid circuit 4 and placed downstream relatively to the water reservoir 6.

The liquid supply means further comprise a pump 7 connected to the reservoir 6. The pump 7 is preferably a centrifugal pump. Moreover, the pump 7 is connected to the centrifugal unit 2 by means of the fluid circuit 4.

The pump 7 is preferably a low pressure pump which serves the purpose of providing sufficient liquid to the centrifugal unit 2 at low pressure. In addition, during operation of the centrifugal unit 2, the centrifugal cell 3 acts as a centrifugal pump by drawing water from the liquid supply.

In the centrifugal unit 2, a flow restriction means 19 is provided to create a restriction of the flow of the centrifuged liquid which leaves the cell 3 before it is collected in the collecting part of the unit. The flow restriction means 19 enables to increase the dwell time of liquid in the cell and therefore improves the extraction, in particular, for coffee or tea, between the liquid and the ingredients contained in the cell. Furthermore, due to the high rotational forces necessary for the flow to pass through restriction means, the velocity of the flow is significantly high. As a result, a nice amount of foam or crema can be obtained. Preferably, the flow restriction means 19 is a valve which opens or at least provides an increase of a flow opening(s) by pressure of the centrifuged liquid in the cell. For this, the valve 19 comprises elastic biasing means 27 for counter-acting the pressure of the centrifuged liquid up to a given load. Furthermore, the valve's load acting in restriction or closing on the flow can be made adjustable by means of a load actuating means 50. For instance, the load actuating means 50 acts on the elastic biasing means 27 to vary positively or negatively

the pre-load on the valve 19. Therefore, the higher the elastic means are pre-stressed, e.g., by a compressive constraint of the actuating means 50 on the resilient member, the higher the pressure of liquid is necessary for overcoming the restriction means, i.e., for opening the valve, and maintaining the flow rate, therefore, the higher the rotational speed must be. As a result, the level of foam or crema can be controlled by adjusting the load of the valve means 19.

In the fluid circuit 4 between the liquid supply means and the centrifugal unit 2, metering means 8 for the flow rate of the liquid are situated. The metering means 8 is preferably a pulse-coded flow-metering turbine which generates electrical impulse data 10. Thereby, the period of the generated impulses is preferably proportional to the velocity of the liquid flow within the fluid circuit 4.

The system further comprises control means 9 which comprise a counter 11, a central controller 11 such as a PID (proportional-integral-derivative) controller able to provide control loop feedback mechanism, and a manual user interface 13. The control means 9 are preferably connected to the flow-metering turbine 8 to receive the process variable relative to the flow rate and to the driving means 5 of the rotational motor for input of the manipulated variable to the motor, i.e., the rotational speed. Furthermore, the controller 12 is connected to the pump 7 to start and stop the liquid supply in the circuit.

The counter 11 connected to the flow-metering turbine 8 enables an analysis of the generated impulse data 10. The analysed data is then transferred to the central

controller 12. Accordingly, the exact actual flow rate of the liquid within the fluid circuit 4 can be calculated in real-time.

Therefore, the central controller 12 connected to the driving means 5 may adjust the rotational speed of the driving means depending on the measured flow rate of the liquid.

Moreover, the central controller 12 preferably comprises a memory (not shown) in which certain parameters of the extraction profile can be saved such as rotational speeds of the centrifugal cell, initial extraction speed of the cell, calibration of the flow meter, prewetting time, dry spinning time, acceleration and deceleration speed ramps, etc. In particular, the controller 12 may contain the set points and values of the rotational speed of the driving means 5 at different phases of the beverage preparation cycle. These parameters serve as part of different predetermined beverage preparation profiles in relation to control algorithms for processing the different profiles on demand.

In addition, a manual interface 13 is connected to the central controller 12 which enables a user of the device of the invention to choose at least the strength of the beverage and, preferably also, the dispensing volume of the beverage to be prepared. Thus, the central controller 12 controls the flow rate during the extraction phase which corresponds to the selected beverage strength in response to an input of the manual interface by varying the rotational speed of the driving means accordingly. The manual interface can be any mechanical, interactive or multimedia user: machine interfacing means which is

associated to the device or remote. Thus, the manual interface can be a keyboard, touch screen, cellular phone, personal computer, laptop, palm, etc.

Figure 2 is a graph showing examples of variation of the rotational speeds of the driving means as a function of time during typical beverage preparation cycles for a highly concentrated beverage and for a comparatively lighter beverage.

The characteristic curve 14 of figure 2 may for example represent an extraction profile for a strong short coffee, such as an 'espresso' or ristretto' type coffee. By contrast, the characteristic curve 15 of figure 2 may for example represent an extraction profile for a lighter 'lungo' type coffee.

Next, a beverage preparation cycle according to the present invention will be described with reference to figure 1 and the characteristic curves 14 and 15 of figure 2.

At the beginning of the beverage preparation cycle, and after the user's selection, the centrifugal pump 7 is switched on by the controller 12 and thus, hot water is pumped from the reservoir 6 to the centrifugal cell 3 through the flow-metering turbine 8.

Simultaneously or shortly after, the motor speed is started at a low speed to ensure a pre-wetting of the dry food ingredients, e.g., roast and ground coffee, provided within the centrifugal cell respectively the capsule 3. Preferably, said pre-wetting phase A lasts for a given time t_1 between 3 and 10 seconds. The prewetting time is

preferably a time as determined by a count of impulse data generated by the flow sensing means, which is already stored or storable such as by transfer from a code on the capsule or cell in the memory of the controller 12.

During said pre-wetting phase A, the motor speed S_A is preferably as low as 10-200 rpm (round-per-minute) to ensure a homogeneous distribution of water in the ingredients. Normally, the speed is too low to enable the liquid to overcome the restriction valve 19. Therefore, during this phase, the liquid remains in the cell and simply fills the volume non-occupied by the ingredients.

Thereby, the counter 11 analyses the impulse data 10 generated by the flow-metering turbine 8. For example, the counter 11 counts the amount of impulses for a pre-defined period of time. At a predefined count N_1, the end of the pre-wetting phase A is reached. Thereby, the count N1 can be adjusted by software loaded in the memory of the control means. Moreover, it may be possible to define the time of the pre-wetting phase A and/or the volume to be provided to the centrifugal cell 3 during the pre-wetting phase by means of the manual interface 13.

The parameters regarding the rotational speed S_A, the volume of the provided liquid and the time t_1 of the pre-wetting phase A are preferably equal for all different kinds of beverages to be prepared. For example, for different types of coffee beverages such as e.g. 'ristretto', 'espresso' or 'lungo', N_1 or t_1 may be the same. However, the parameters of the pre-wetting phase A may as well be set different for different kinds of beverages to provide different wetting profiles.

After the pre-wetting phase A, the extraction phase B of the beverage preparation cycle takes place. Hence, when the number N_1 of counted impulses is reached, the control means 12 accelerate the driving means 5 in a ramp-up phase B' to the extraction phase B to reach a predetermined speed set-point S_1 respectively S_2 for the rotational speed of the driving means 5.

It should be understood that the time for the described ramp up B' may differ for different kinds of beverages to be prepared.

The set point S_1,S_2 is the initial speed value for the extraction phase which can be determined in relation to the selection made at the manual interface. The set point S_1,S_2 preferably differs for different beverages such as different coffee beverages for example. As can be seen in figure 2, the set point S_2 of the lighter beverage 15 relates to a higher rotational speed of the driving means 5 than the set point S_1 of the comparatively strong beverage 14, as the contact time between water and the food ingredients within the centrifugal cell 3 is proportionally shorter at a higher rotational speed (at set point S_2).

The increase of the rotational speed from S_A to S_1 or S_2, provides the liquid a sufficient momentum to traverse the ingredients in the cell and forces the valve means 19 to open under the pressure of the centrifuged liquid. Therefore, the ramp-up phase causes the opening of the valve or enlargement of the valve's opening and, thereby, the centrifuged liquid starts being discharged through the duct 35.

At the beginning of the extraction phase B, the distinctive flow rate at the set point S_1,S_2 is calibrated by the impulse data 10 received from the flow meter 8. Accordingly, the flow rate at the beginning of the extraction phase B is linked to a predefined rotational speed of the driving means.

It should be understood that the initial flow rate through the centrifugal cell 3 during the centrifugal beverage preparation process can be affected due to progressive compaction of the food ingredients within the centrifugal cell 3 for example. Accordingly, the pressure drop at the centrifugal cell 3 changes and thus, the flow rate through the centrifugal cell 3 diverges. Therefore, in order to maintain a substantially constant flow rate through the centrifugal cell 3, the rotational speed of the driving means 5 is varied such as being increased or decreased in order to compensate for the changes of the flow rate.

Hence, after the above described calibration of the flow rate at the set point S_1,S_2, the control means 9 may vary the rotational speed of the driving means 5 continuously or at small intervals to maintain a relatively constant nominal flow rate during the extraction phase B. In order to provide a relatively stable flow rate and avoid too much oscillation, the correction of flow rate can be typically controlled by using a PID control algorithm implemented in the controller wherein the process value (PV) is the measured flow rate, the desired flow rate is the set point (ST) and the manipulated variable (MV) is the speed output from the controller to the rotational motor.

More precisely, the counter 11 particularly measures the periods of the impulses generated by the flow meter 8. Hence, if the measured period is higher than a set reference value, which was calibrated before, an acceleration of the speed is necessary and vice versa. The speed can be varied stepwise or continuously. In a stepwise speed control, the flow rate correction can be made by the control unit varying the speed of + or – 200 rpm, for instance.

Accordingly, during the extraction phase B, the rotational speed of the driving means 5 is constantly adjusted by the control means 9 in response to the sensed flow rate data 10.

Accordingly, a substantial constant value of the flow rate which differs only by a certain tolerance of, for instance, +/- 10% can be obtained. The rotational speed of the driving means 5 is adjusted preferably at intervals of less than 1 second, for instance, in the order of a few milliseconds.

After a second count N_2 of the flow-metering means 8 is reached, the water pump 7 is stopped by the control means 9. Thereby, the count N_2 of the flow-metering means 8 determines the total volume of the beverage to be dispensed.

It should be understood that the count N_2, N'_2 may vary for different kinds of beverages.

Preferred volumes of different types of coffee beverages are for example 25mL for a 'ristretto', 40mL for an

'espresso', 110mL for a 'lungo', and 250mL for an 'Americano' type coffee beverage.

Accordingly, the indicated reference numeral N_2 may refer to a short beverage such as a 'ristretto' or 'espresso' type coffee for example, whereas the reference numeral $N_{2'}$ which relates to a greater number of counted impulses and thus, to a greater liquid volume may refer to a 'lungo' type coffee beverage for example.

After the pump 7 is stopped, a dry-spinning phase C of the beverage preparation cycle takes place in order to empty the cell from residual liquid. The rotational speed of the driving means 5 is preferably higher than during the extraction phase B. Hence, at second count N_2, an acceleration ramp up C' takes place until a predefined set point S_C of rotational speed is reached. Then, spin-drying of the ingredients within the centrifugal cell 3 is carried out for a predefined period of time t_C. Thereby, said predefined time t_C for the spin-drying phase C can be predetermined in the software of the control means, e.g., 5-10 seconds.

After the spin-drying phase C, the rotational speed of the driving means 5 is decelerated as indicated by the deceleration phase D in figure 2. Accordingly, the beverage preparation cycle is finished.

Of course, the spin-drying phase C could be run at the same rotational speed as the extraction phase or at a lower speed.

Before the start of each beverage preparation cycle, the manual interface 13 of the system preferably comprises a

pre-selection for enabling a user to choose preferably two parameters:

- the volume of beverage (e.g., 25, 40, 110, 250 mL) and,
- the coffee concentration (e.g., from light to strong).

The selection is then received by the control means 9 which calculates the corresponding flow rate by measuring the periodicity of the impulses which then serves as a reference for controlling the rotational speed of the driving means 5. Thereby, in order to avoid a too big oscillation of the control loop at the start of the extraction phase B according to the selection made, the system is first set up around the set point value of speed S_1,S_2.

In a preferred embodiment, the following data is saved in the memory of the control means 9 and can be adjusted by means of dedicated software:

- The motor speed S_A at the pre-wetting phase (i.e., a few rpm),
- The calibration of the flow meter in volume unit per impulse (e.g., mL/Impulse),
- The number N of impulsions during prewetting,
- The acceleration ramp up to the extraction phase B',
- The acceleration phase to the spin-drying phase C',
- The spin-drying speed S_C,
- The spin-drying time t_C,
- The deceleration rate D.

Of course, these functions can be assured by an integrated circuit.

Figure 3 is a cross sectional view of an embodiment of the centrifugal unit 2 according to the present invention.

The centrifugal unit 2 of the device comprises an upper enclosing member 20 and a lower enclosing member 32 which can be moved relative to each other.

The capsule 3 to be used with the device or the system according to the present invention may be any of the capsules described in PCT/EP08/056310 (WO 2008/148646).

The capsule 3 as shown in figure 3 is pre-opened before it is inserted in the device, i.e., a sealing foil arranged at an upper face of the capsule is removed by peeling, or a central hole is perforated in the foil of the capsule when the capsule is inserted in the device .

The capsule 3 optionally comprises an inner member forming a lid 17 which is inserted in the dished body of the capsule. The lid 17 and body 42 delimit together an internal enclosure 33 for receiving a portioned food substance. The lid 17 comprises outlet openings 34 (see figure 4) at a peripheral section 47 of the lid 17 for filtering the beverage and maintaining the food (coffee) particles within the capsule 3 during the beverage preparation. Accordingly, only the liquid comestible to be prepared is discharged through the outlet openings 34.

The lower enclosing member 32 of the centrifugal unit 2 is a receiving assembly which comprises a liquid duct 35, for example, protruding on a side of the assembly 32 for guiding the centrifuged liquid coming out of the capsule 3 to a receptacle 48 such as a cup or glass (see figure 1).

The liquid outlet 35 is in communication with a liquid receiver 36 forming a cylindrical wall placed at a short distance about a rotating drum 16 into which the capsule is inserted as illustrated in figure 3. Thereby, the rotary drum 16 is preferably a hollow capsule holder with an internal cavity complementary shaped to receive the capsule. The liquid receiver 36 defines with the drum 16 an intermediate cavity 37 for collecting the liquid.

Below the liquid receiving assembly 32, are placed means for driving the capsule receiving drum 16 in rotation inside the receiving assembly 32. The driving means 5 comprise preferably a rotary motor which can be supplied by electricity or gas power. The drum 16 and the driving means 5 are connected by a motor axle 23 which preferably protrudes through an aperture in the bottom of the liquid receiver 36.

The upper enclosing member of the centrifugal unit 2 is a liquid injection assembly 20 which comprises a water line 22 which is in fluid connection with the pump 7 and the flow meter 8 (see figure 1). Moreover, the water line 22 is connected to a water injector 21 which is arranged co-centrically to the rotational axis A of the capsule 3 within the centrifugal unit 2.

In the shown embodiment, the water injector 21 is designed as a simple water inlet of the capsule. However, the water injector 21 may as well be equipped with puncturing means which are designed to puncture or tear a membrane or foil provided at an upper face of the capsule 3.

About the water injector 21 is mounted a capsule rotary engaging part 39. The engaging part 39 has a central bore 39a for receiving the water injector 21 and rotational guiding means such as a ball or needle bearing 25 inserted between the engaging part 39 and the injector 21.

In order to enable sealing of the water inlet of the capsule, a sealing member 24 is arranged around the water injector 21 at a lower face of the rotary engaging part 39. The sealing member 24 is thus arranged between the rotary engaging part 39 and an upper face of the capsule 3. Thereby, the sealing member 24 applies a certain sealing pressure on the upper lid 17 of the capsule. Hence, water is effectively prevented from leaking along the upper surface of the capsule 3 and from by-passing the capsule to release directly through liquid outlet 35 of the centrifugal unit 2. Furthermore, a venting means (not shown) can be provided through the injection assembly 20 for enabling gas to escape from the capsule as liquid is filled in the capsule.

The liquid receiving assembly 32 and the liquid injection assembly 20 are preferably arranged to encase the capsule or centrifugal cell 3, the receiving drum 16 and the water injector 21. Preferably, the receiving assembly 32 and the injection assembly 20 can be moved relatively to each other such that a user of the device may access the rotary drum 16 in order to exchange the capsule 3 for example. Therefore, a closing mechanism (not shown) may be connected to the receiving and the injection assembly 32,20 in order to enable a relative movement of the receiving and the injection assembly 32,20.

In order to enable a sealing of the receiving assembly 32 and the injection assembly 20 during the operation of the device, sealing means such as an O-ring 49 for example are provided at the contact surfaces of the assemblies.

The water injection assembly 20 further comprises a valve system 19 for controlling the flow of liquid that is discharged from the capsule 3 during operation of the device. The valve system 19 can be arranged on the capsule rotary engaging part 39 in the form of an annular engaging portion 40 which is biased under the force of elastic loading means 27.

As can be seen in figure 4, the annular engaging portion 40 includes a pressing peripheral pinching edge 26 which applies a closing force on the peripheral rim 41 of the capsule 3 to be able to restrict the flow of liquid under the force of the elastic loading means 27.

As can be seen in figure 4, the elastic loading means 27 can be a rubber-elastic ring member which is supported by an upper and a lower annular seat portion 28, 29. Other means such as spring-biased loading means 27 may as well be applied to the device.

It should be understood that the load of the elastic loading means 27 is preferably adjustable. Hence, the pressure of the liquid which has to be exerted on the flow restriction valve 19 in order to enable a discharging of liquid from the capsule 3 to the outlet 35 of the device can be adjusted.

As can be seen in the figure, the pinching edge 26 is preferably 'V'-shaped or cone-shaped. Thus, the sealing

pressure in a localized area is increased. The valve means 19 further comprises an internal base member 30 which is preferably an integral part with the rotary engaging part 39 of the injection assembly 20. The elastic loading means 27 thus are inserted in a space located between the base portion 30 the engaging portion 40.

Therefore, at a rest position, the engaging portion 40 of the valve 19 keeps closing on the rim 41 of the capsule 3 under the compressive effect of the resilient means 27

The operation of the device is described in the following.

The capsule device is opened by moving the two assemblies 20, 32 relatively one another, e.g., by means of a dedicated closing mechanism and separating the two assemblies 20, 32. As a result, a single-use capsule 3 containing a food substance can be inserted in the device, i.e., placed in the cavity of the rotating drum 16. The device is then closed by the assembly 20 being connected back onto the assembly 32 and locked by the closing mechanism. In the locked position, the water injector 21 is connected to a water inlet 44 of the capsule. Water can thus be introduced in the capsule via the central water injector 21. The capsule can be driven in rotation by activating the driving means 5. The centrifugation is carried out by rotating the capsule around the central axis of rotation of the device that is preferably aligned to the central axis Z of the capsule. During the prewetting phase as described, previously, the capsule is filled with water and the ingredients are entirely wetted. The control means control the speed as such a low speed that liquid pressure is insufficient to open the valve 19.

After a sufficient acceleration of the rotational speed is carried out and the extraction phase 'per se' begins, the centrifuged liquid is allowed to pass through the plurality of outlet openings 34 provided in a peripheral portion 47 of the lid 17 of the capsule. Under the effect of high centrifugal forces, the food substance, such as e.g. ground coffee powder, tends to compact itself radially whereas water is forced to flow through the substance. This results in the substance being both compacted and intimately wetted by water. Due to the high rotational movement of the capsule, the centrifugal forces exert themselves uniformly on the mass of the substance. Consequently, the water distribution is also more uniform compared to usual methods using a pressure pump to exert the pressure in the capsule. As a result, there is lower risk of preferential flow path through the substance which could lead to areas which are not properly wetted and so not properly brewed, dispersed or dissolved. As result of the high centrifugal forces during the extraction phase, the valve is forced to open and liquid is so projected as a laminar flow at relatively high velocity in direction of the wall 36.

Figures 5 and 6 relate to a capsule which is preferably used with the device and system according to the present invention. However, it should be understood that the shown embodiment is just an exemplary embodiment and that the capsule according to the invention can take various different embodiments.

The capsule 3 comprises a rigid dished body 42 which comprises an annular rim portion 41. The capsule is preferably design as being rotationally symmetric about

central axis Z. Thereby, it should be noted that the capsule may not necessarily have a circular section around axis Z but may take another form such as a square, rectangle or a polygonal form. Thereby, axis Z is preferably aligned to the axis of rotation A when the capsule is inserted in the device.

Moreover, the capsule 3 comprises a lid 17 which preferably has the form of a disc of plastic comprising a central portion 46 and a peripheral portion 47. The central portion 46 can be substantially flat and may comprise an inlet port 44 for enabling the fitting or introduction of a water injection member 21 of the beverage production device.

It should be noticed that the lid 17 can be a rigid or semi-rigid member made of thermoformed or injected plastic for instance. However, this part could also be made of a flexible membrane which is sealed to the inner surface of the dished body without departing from the scope of the invention.

At the side of the lid 17 which faces the inside of the capsule 3, the inlet port 44 can extend by a tubular inlet portion 43 which serves for ensuring the water is guided toward the direction of the bottom of the body to ensure complete wetting of the substance 38 in the enclosure and so reduced risk of leaving for example "dry powder spots".

The upper surface of the capsule 3 may be equipped with a foil 45 which enables sealing of the capsule 3. The foil preferably covers the lid 17 and is welded or adhesively connected onto the peripheral edge 41 of the body of the

capsule. The foil can be permanently connected to the edge if the foil is intended to be pierced for forming the inlet and outlets or, alternatively, the connection is peelable. Before the capsule is inserted into the rotary drum 16 of the device, said foil 45 needs to be pierced or removed in order to enable a preparation of the beverage.

The lid 17 further comprises a peripheral portion 47 including a collecting recess 18. The collecting recess 18 forms a U-shape in transversal section (figure 6) which opens in the direction of the sealing foil 45. The recess is preferably continuously extending at the periphery of the lid 17 although it can be replaced by several discontinuous recessed portions which may be separated by reinforcing elements or walls, for example.

The collecting recess 18 comprises an inner peripheral portion of wall 47 of the lid 17 into which is provided a series of outlet openings 34 forming a fluid communication between the enclosure 33 and the collecting recess 18.

Furthermore, the outlet openings 34 may be formed by a filter paper, a woven or non-woven portion or another meshed or porous membrane (not shown). Thus, the lid 17 which is inserted in the dished body 42 comprises a circumferential band of a porous material. The porous material provides restriction of the flow, creating a certain pressure drop, e.g., between 0.5 and 4 bar, and leading to a filtering of the solid particles. In particular, the size of the pores of the material can be chosen to retain also the coffee fines, i.e., the particles of particle size as low as 90 microns. The

paper, fabric, meshed or porous material can be formed of a band or bands which can be welded or otherwise combined to the lid.

During operation of the device, the capsule 3 is rotated about its axis Z. Thereby, the liquid which is centrically injected into the capsule 3 will tend to be guided along the inner surface of the side wall of the body, up to the inner side of the lid, and then through the outlet openings 34. Due to the centrifugation of the liquid provided centrically to the capsule 3, the liquid and the ingredients 38 provided within the capsule are made to interact in order to form a liquid comestible.

Figs. 7 and 8 provide a variant of the beverage preparation system of the invention in which the load of the valve means is adjustable for enabling a control of the opening pressure in order to control the foam or crema level. For simplifying the present description and avoid repetitions, the same numerical references have been used to refer to similar technical means as in the previous embodiments. The novel aspects of the present embodiment essentially lie in piercing means of the device for piercing inlet/outlets in the capsule and in a different configuration of the flow restriction valve 19 compared to the other embodiments.

As illustrated, the water injector 21 extends coaxially in the capsule 3 by a hollow piercing member 51. The piercing member extends below the upper surface of the capsule 3, in the cavity 33. The piercing member is formed as a hollow tube to supply liquid in the capsule at its tip. The piercing member can so be used to pierce a sealing membrane 52 of the capsule which closes the lid

in a gastight manner before the capsule is inserted in the device.

The capsule rotary engaging member 39 can further comprise outlet piercing members 53 placed in axial alignment with the liquid collector of the capsule when the member 39 is engaged in closure on the capsule. The outlet piercing members 53 serve to pierce the membrane 52 of the capsule to define a plurality of outlets at the periphery of the capsule from which liquid collected in the collector can leave the capsule. The outlet piercing members are introduced in the collecting recess 18 of the capsule which is sized in such a way that the peripheral portion 47 of the lid cannot be perforated. The centrifuged liquid can thus be discharged from the collecting recess 18 via the holes which are formed in the sealing foil 52 by the piercing members.

The device further comprises a flow restriction means forming a valve assembly 19 which operates in opening when the pressure of centrifuged liquid has reached a certain threshold. For this, the rotary engaging member 39 has a protruding peripheral edge 40 which engages on the peripheral edge 41 of the capsule. The engagement is forced by an elastic biasing mechanism 27 which provides elastic compressive forces onto the rotary engagement member 39. In this particular embodiment, the elastic biasing mechanism 27 comprises a base 54 at one end into which is fitted a compression spring 55 and an abutting member 56 at the opposite end. The base 54, spring 55 and abutting member 56 are housed into a tubular frame 57. The abutting member 56 is further connected to a screw element 58 which protrudes externally from the frame. The screw element and tubular frame 57 form together an

actuating means 50. They comprise a complementary thread 80 assembly enabling to tune the compressive load of the elastic member on the engagement member 39.

As illustrated in Fig. 8, the engagement member 39 which normally applies a closing force onto the edge 41 of the capsule by pressing edge 81, is pushed upwards by the pressure exerted by the centrifuged liquid during the extraction phase, as soon as the rotational speed has reached a sufficient value. The annular gap 59 which is formed between the protruding peripheral edge 41 of the capsule and the pressing edge 81 of the valve determines the laminar flow of liquid. A very thin gap of about 0.1 to 1 mm is maintained opened by the pressure of the centrifuged liquid, thus enabling the liquid to be released at a high velocity in the direction of the impact wall 61 of the receiver. Therefore, as the flow rate of liquid increases during the ramp up phase B', the flow gap 59 increases proportionally. When the flow rate is stabilized during extraction phase B as controlled by the controller, a relatively consistent jet of liquid 60 is projected onto the impact wall 61 of the receiver. This results in a reproducible level of crema, extraction after extraction. When the load of the elastic member is increased by forcing the spring in compression, this results in an increase of the speed by the controller to maintain the flow rate at the set point. For coffee, it is noticed that a higher amount of coffee crema can be obtained accordingly. If a lower amount of crema is desired, the user can reduce the compression on the elastic member by the actuating means, which results in an automatic reduction of the speed for maintaining the same flow rate. Therefore, it is possible to control simply the level of foam of the beverage by adjusting the

load on the flow restriction valve. Of course, the screw element can be actuated manually by the user or by use of a motor. If a motor is utilized, it is also possible to automatically control the actuation by the controller which can send input command to the motor. In such case, it is also offered the possibility to use the valve compressive load as a manipulated variable to control the speed and/or flow rate in a control loop scheme.

It should also be noted that the valve 19 can leave one or more minimal outlets in its closed state and that the opening of the valve by the pressure of liquid causes the enlargement of the one or more outlets. For example, a few radial channels forming minimal oulets can be provided in the edge 81 pressing on the surface of the capsule. Channels forming outlets may also be provided within the surface of the edge 41 of the capsule or both in the edges 81 or 41.

It should also be noted that the flow restriction valve could also be made downstream of the capsule without necessarily engaging a part of the capsule but it could be entirely designed in the device itself.

As illustrated in Fig. 9, a user's manual interface 13 can provide a choice of beverages, such as coffee, regarding a volume selection area 70, a strength selection area 71 and, optionally, a selection area 72 for a "crema" or foam level. The volume selection area 70 can present a plurality of discrete selecting keys 700, 701, 702 such pressure-sensitive switches, each one prompting for a user to select a predetermined volume of the beverage. For instance, key 700 represents the shortest cup, e.g., for a ristretto coffee volume of

about 25 mL; key 701 represents a short espresso coffee cup of about 40 mL and key 702 represents a lungo coffee cup of about 110 mL. The strength selection area 71 can so be actuated independently to set the desired concentration for each desired volume, e.g., amongst low, medium or high strength levels. The actuation of this strength selection key 710, e.g., a potentiometer, will fix the flow rate set point in the controller, as aforementioned, which finally determine the interaction time of the liquid with the ingredients in the capsule. The crema or foam selection area 72 may also comprise a selection key 720, e.g., a potentiometer, for adjusting the level of crema desired. The different levels, e.g., low, medium, high, will be obtained by varying, e.g., continuously or stepwise, the load constraint applied on the restriction valve and, consequently, will have a direct influence on the rotational speed necessary to open the restriction valve during beverage extraction for regulating the flow rate at the set point as fixed by the strength selection. It should be noted that the selection key 720 for crema can be the mechanical actuation means 50 of Fig. 7 if the adjustment system is not automated. Of course the user interface may include a touch screen or an array of membranes or mechanical buttons for receiving input from the user. Additionally, the user interface 112 may include a graphical or character display, such as in the form of a color, monochrome, or LCD display. The user interface may also include a voice prompt interface, wherein the local food waste monitoring device includes a speaker and provides audio instructions, data, and prompts to a user. The user may then press buttons to provide input in response. Alternatively, the user may speak instructions in response to the prompts, and the instructions may be collected via a microphone

and interpreted to commands through voice recognition software installed on the controller or interface.

Although the present invention has been described with reference to preferred embodiments thereof, many modifications and alternations may be made by a person having ordinary skill in the art without departing from the scope of this invention which is defined by the appended claims.

Claims

1. A beverage production device for preparing a liquid comestible from a portioned food substance contained in a capsule or cell, comprising

a centrifugal unit (2) for receiving the capsule or cell (3),

driving means (5) connected to the centrifugal unit (2) for enabling a rotational motion of the capsule or cell in the centrifugal unit,

liquid supply means (4,6,7) being connected to the centrifugal unit to supply liquid in the capsule or cell,

means (8) for measuring the flow rate, or respectively the pressure, of the liquid,

and

a control unit (9) for controlling the flow rate, or respectively the pressure, to match a flow rate reference, or respectively a pressure reference, in a control loop by automatically adjusting the rotational speed of the driving means during an extraction phase of the beverage production depending on the measured flow rate, or respectively the measured pressure.

2. A beverage production device according to claim 1, wherein the reference flow rate is a constant set point or a variable profile of flow rates stored in or calculated by the control unit (9).

3. A beverage production device according to claim 2,

wherein the control unit is arranged for selecting or calculating different flow rate set points

corresponding to respectively different beverage strengths.

4. A beverage production device according to claim 3,

wherein it comprises a manual interface (13) configured to enable at least a selection of the strength of the beverage during the beverage production process and the volume of the beverage to be prepared.

5. A beverage production device according to claim 3,

wherein it comprises an identification means for receiving information from a capsule code as to the strength and/or volume of the beverage to be prepared.

6. A beverage production device according to any of claims 1 to 5,

wherein the liquid supply means comprise a pump (7) which is designed for supplying fluid to the centrifugal unit (2) and which is operated by the control means (9).

7. A beverage production device according to any of claims 1 to 6,

wherein the centrifugal unit (2) is designed to act as a centrifugal pump by drawing water from the liquid supply means (4,6,7).

8. A beverage production device according to any of claims 1 to 7,

wherein the control means (9) are designed to detect the electrical impulses (10) of the flow meter in order to calculate the flow rate and the dispensing volume during the beverage production.

9. A beverage production device according to claim 8,

wherein the means for measuring the flow rate is a pulse-coded flow metering turbine (8).

10. A beverage production device according to any of claims 1 to 9,

wherein the control unit is arranged to control extraction profile comprises at least a pre-wetting phase (A) and an extraction phase (B) which differ in at least the associated rotational speeds (S_A,S_1,S_2) of the driving means (5).

11. A beverage production device according to any of claims 1 to 10,

wherein device further comprises flow restriction means (19) at a delivery side of the centrifugal unit (2).

12. A beverage production device according to claim 11, wherein the flow restriction means comprises a valve (19).

13. A beverage production device according to claim 12, wherein the valve (19) is adjustable.

14. A system for producing a beverage from portioned ingredients provided within a capsule, the system comprising a beverage producing device having a centrifugal unit (2) comprising at least two enclosing members (20,32) for enclosing the capsule by a relative movement of the enclosing members (20,32),

driving means (5) connected to the centrifugal unit (2) for enabling a rotational motion of the centrifugal unit (2),

a liquid injection assembly (20) designed to interact with the capsule (3) provided to the device and connected to liquid supply means (4,6,7),

means (8) for measuring the flow rate, or respectively the pressure, of the liquid,

control means (9) for controlling the flow rate, or respectively the pressure, to match a flow rate reference, or respectively a pressure of reference, in a control loop by automatically adjusting the rotational speed of the driving means during the extraction phase of the beverage production depending on the measured flow rate, or respectively the measured pressure,

wherein the capsule (3) is designed to be removably inserted into the centrifugal unit (2) of the device.

15. A system according to claim 14,

wherein the capsule (3) is a single-use capsule sealed in a protective atmosphere before use.

16. A system according to claims 14 or 15,

wherein the capsule (3) contains ground coffee, soluble coffee, tea, cocoa and/or milk.

17. A method for preparing a liquid comestible from a portioned food substance contained in a capsule or cell (3) by passing liquid through the substance (38) using centrifugal forces, comprising the steps of

connecting the capsule or cell (3) to a liquid supply (4,6,7),

rotating the capsule or cell (3) about its rotational axis (Z) to enable an interaction between the liquid and the portioned ingredients (38) provided within the capsule (3),

controlling the flow rate, or respectively the pressure of supplied liquid, to match a flow rate reference, or respectively a pressure of reference, in a control loop by automatically adjusting the rotational speed of the driving means during the extraction phase of the beverage production depending on the measured flow rate, or respectively the measured pressure.

18. The method according to claim 17,

wherein controlling the flow rate is carried out in relation to a selection of the strength of the beverage.

19. The method according to claims 17 or 18,

wherein the level of crema or foam can be controlled by adjusting the load on a flow restriction valve (19) at the exit of the capsule or cell.

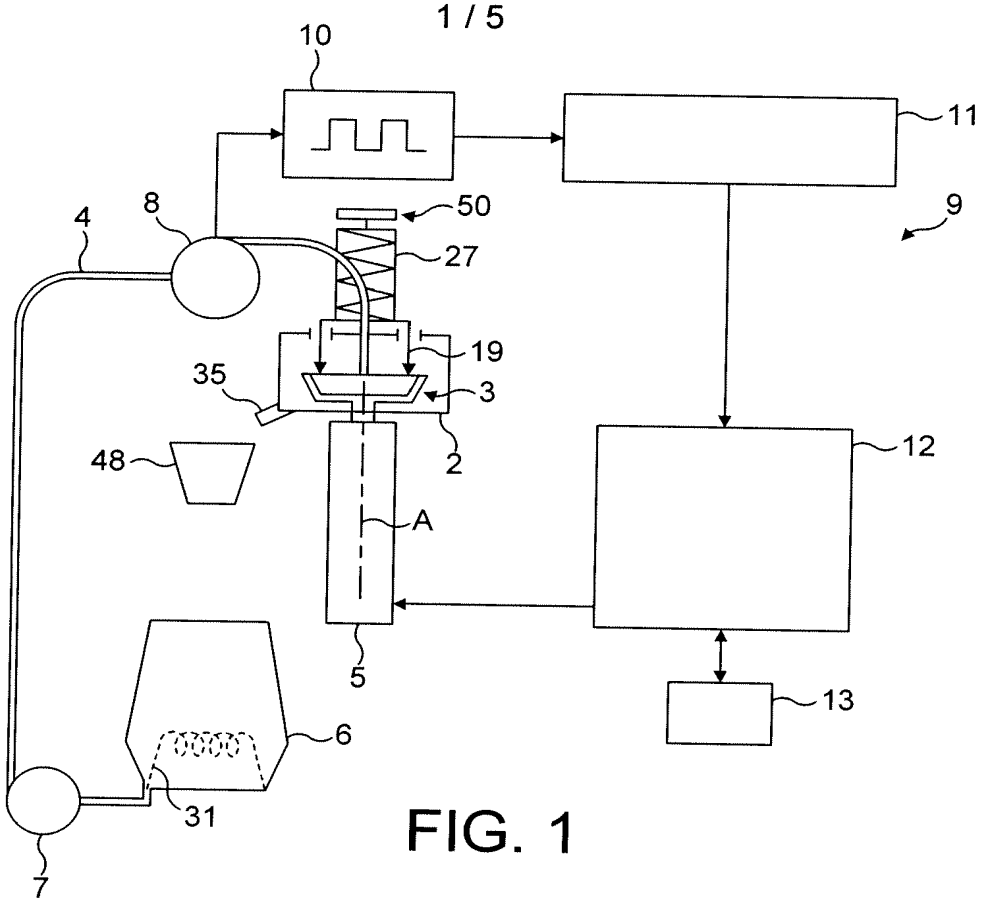

10
11
9
8
4
50
27
19
35
3
2
48
12
A
5
13
6
31
7

FIG. 1

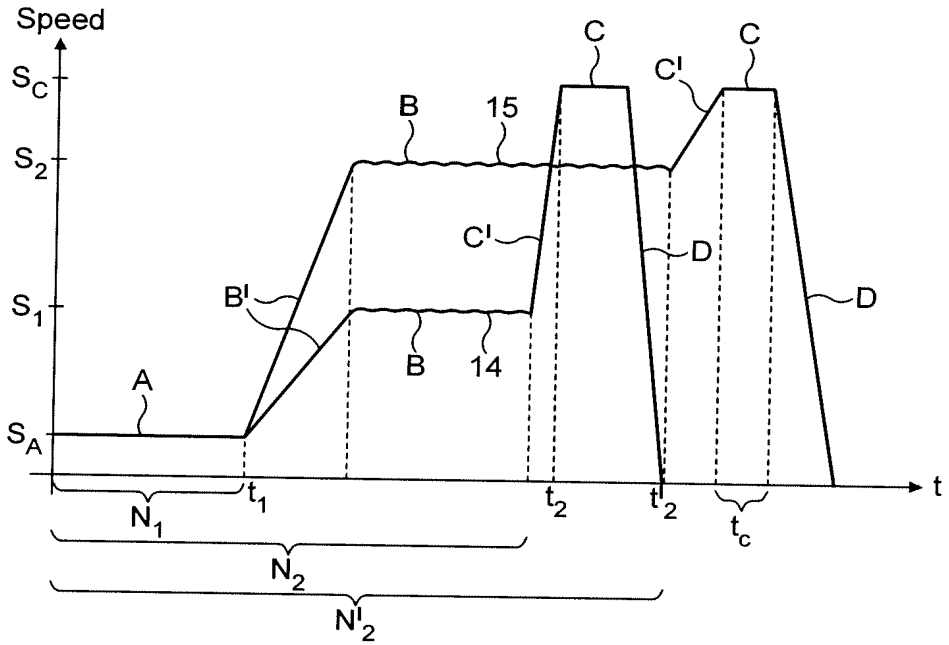

Speed
S_C
S_2
S_1
S_A
A
B
15
C
C'
C
B'
C'
D
D
B
14
t
t_1
t_2
t'_2
t_c
N_1
N_2
N'_2

FIG. 2

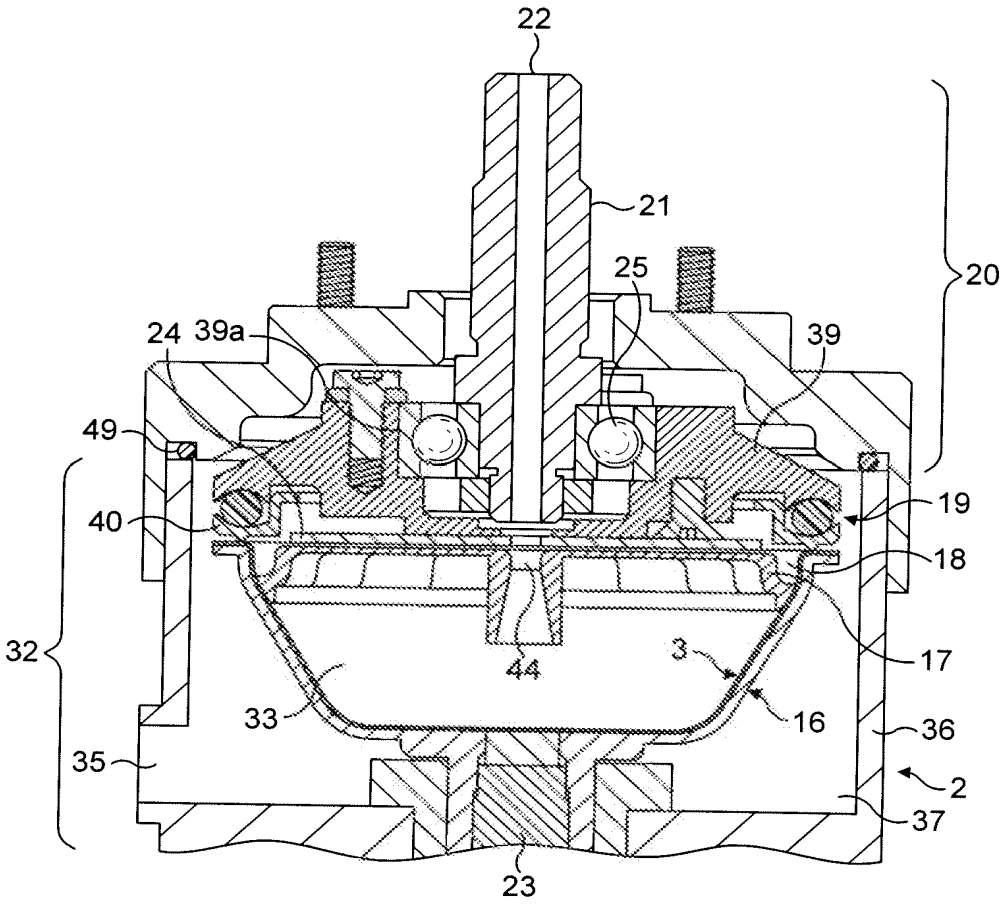

22
21
20
25
24
39a
39
49
40
19
18
32
44
3
17
33
16
36
35
2
37
23

FIG. 3

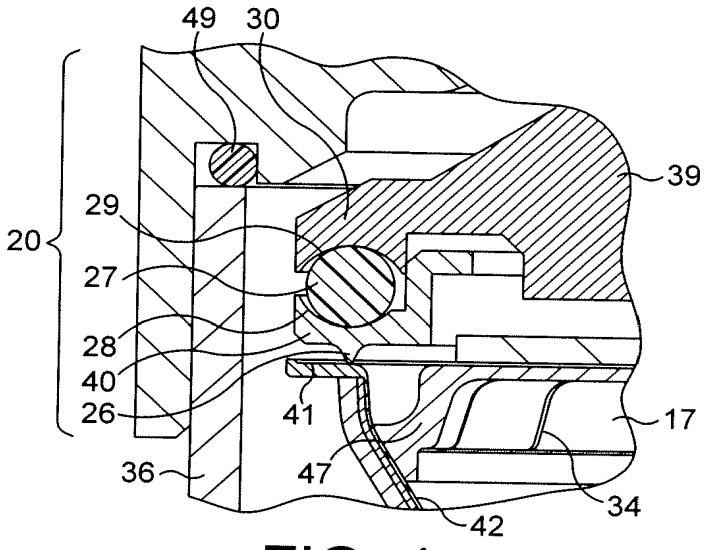

49
30
39
29
20
27
28
40
26
41
17
36
47
34
42

FIG. 4

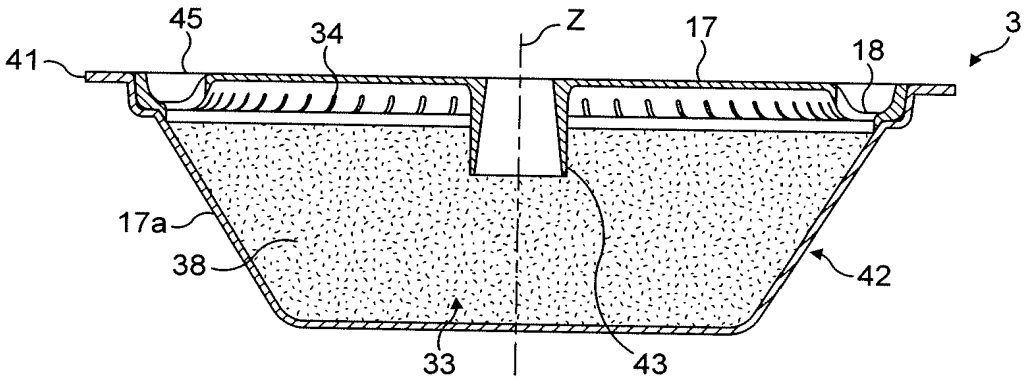


FIG. 5

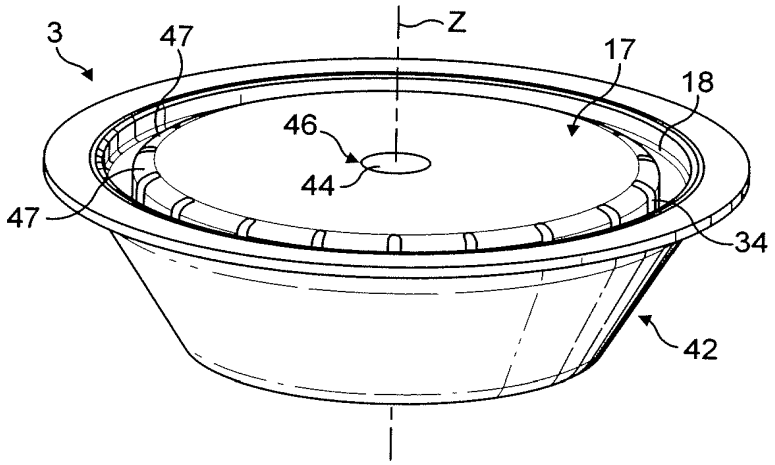


FIG. 6

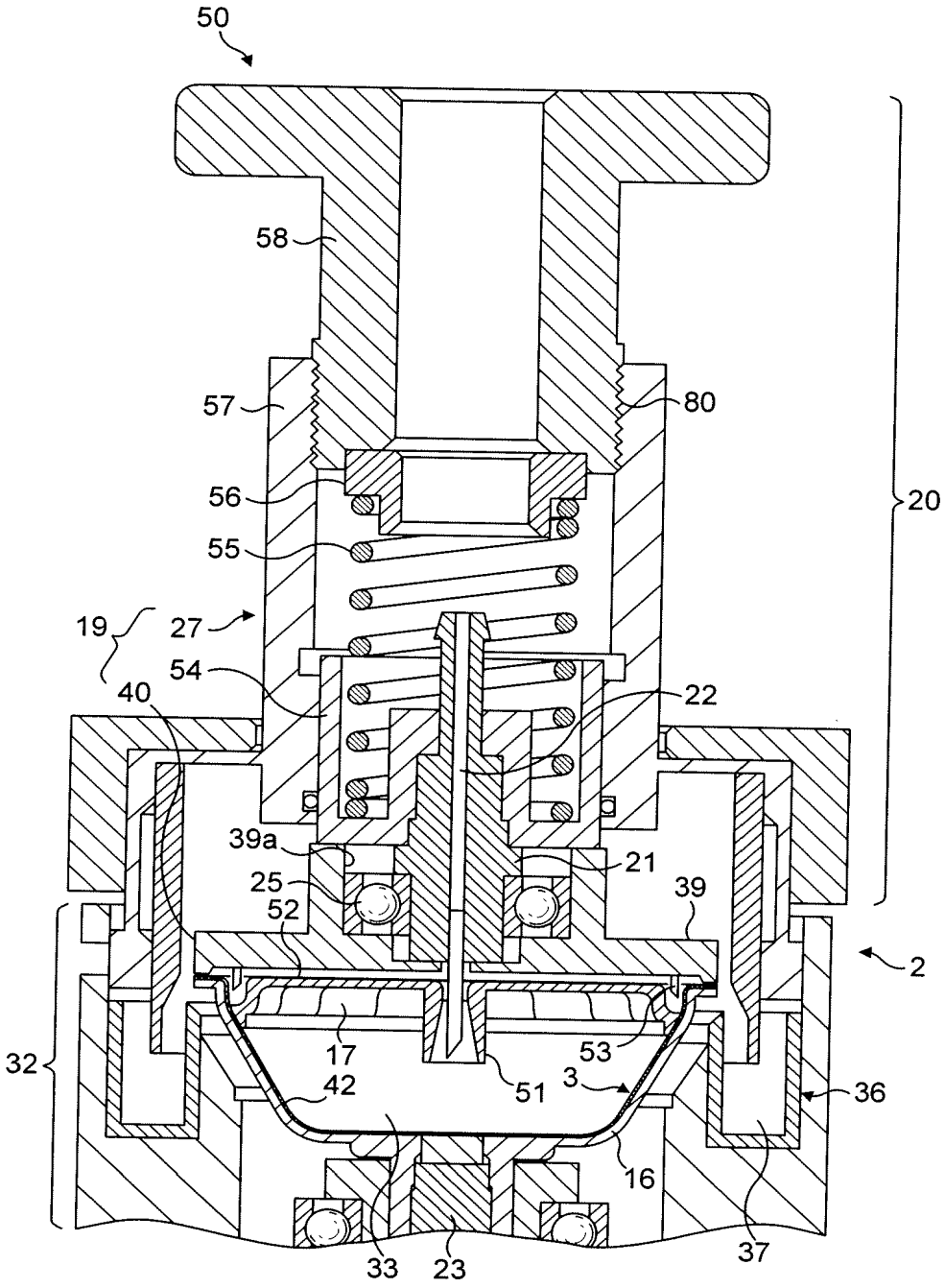

50
58
57
80
56
55
20
19
27
54
40
22
39a
21
25
39
52
2
32
17
53
42
51
3
36
16
33
23
37

FIG. 7

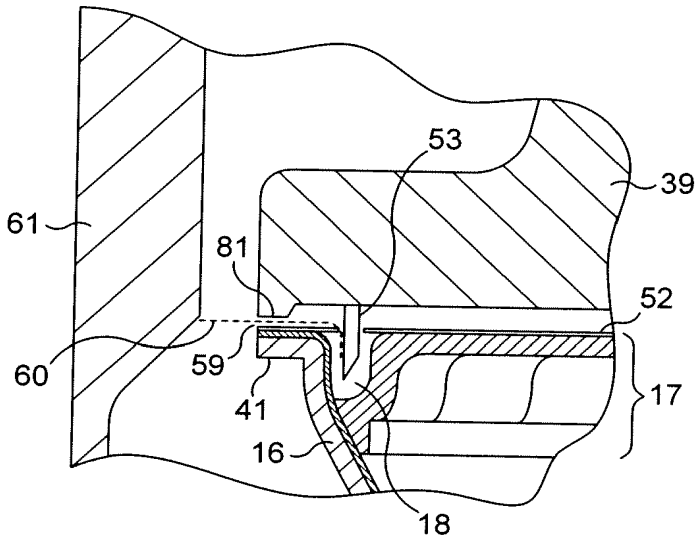

53
39
61
81
52
60
59
17
41
16
18

FIG. 8

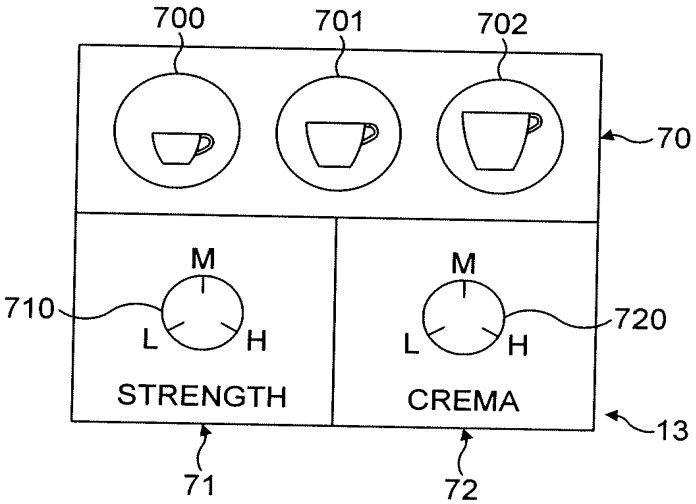

700
701
702
70
M
710
L
H
STRENGTH
M
720
L
H
CREMA
13
71
72

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/060771

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47J31/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 367 600 A (TOKYO SHIBAURA ELECTRIC CO [JP]) 9 May 1990 (1990-05-09) column 7, line 23 - line 31 column 10, line 33 - column 11, line 28 figure 1	1,14,17
A	WO 2007/041954 A (LI ZHIPING [CN]) 19 April 2007 (2007-04-19) page 13, paragraph 3 figure 1a	1,14,17
A	BE 894 031 A1 (GUERIN A) 4 February 1983 (1983-02-04) the whole document	14

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 February 2010	08/02/2010

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Fax: (+31–70) 340–3016	Kempeneers, Johanna

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/060771

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 545 296 A (BEN-SHMUEL SONJA [US]) 8 October 1985 (1985-10-08) column 7, line 36 - line 59 figures 1,2	1,14,17
A	WO 2007/110768 A2 (TUTTOESPRESSO SPA [IT]; DOGLIONI MAJER LUCA [IT]) 4 October 2007 (2007-10-04) page 4, line 8 - line 10 page 4, line 17 - line 29 page 9, line 3 - page 11, line 27 figures 1,4,5	1,14,17
A	EP 0 651 963 A1 (SEB SA [FR]) 10 May 1995 (1995-05-10) column 3, line 52 - column 6, line 53 figures 1,4,5	1,14,17
E	WO 2009/106598 A1 (NESTEC SA [CH]; COLANTONIO JEAN-LUC [CH]; BONACCI ENZO [CH]; DENISART) 3 September 2009 (2009-09-03) page 4, paragraph 3 page 19, line 17, paragraph 2 - page 20, last line, paragraph 2 page 23, paragraph 2 page 24, line 4 - line 10 page 25, line 4 - line 7 figure 1	1-2,6, 8-17,19

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2009/060771

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0367600 A	09-05-1990	DE 68906509 D1	17-06-1993
		DE 68906509 T2	30-09-1993
		US 4962693 A	16-10-1990
WO 2007041954 A	19-04-2007	CN 101374442 A	25-02-2009
BE 894031 A1	04-02-1983	NONE	
US 4545296 A	08-10-1985	NONE	
WO 2007110768 A2	04-10-2007	AR 060176 A1	28-05-2008
		AU 2007231019 A1	04-10-2007
		CA 2646718 A1	04-10-2007
		CL 8452007 A1	08-02-2008
		EP 2001343 A2	17-12-2008
		JP 2009531106 T	03-09-2009
		US 2009136639 A1	28-05-2009
EP 0651963 A1	10-05-1995	DE 69408088 D1	26-02-1998
		DE 69408088 T2	10-06-1998
		ES 2114155 T3	16-05-1998
		FR 2712163 A1	19-05-1995
WO 2009106598 A1	03-09-2009	NONE	

REMARKS

This Response and the enclosed IDS are respectfully submitted in reply to the Final Office Action dated November 27, 2019. The Director is authorized to charge any fee that may be required or to credit any overpayment to Deposit Account No. 02-1818. If such a withdrawal is made, please indicate the Attorney Docket No. 3712036-01693 on the account statement.

Claims 1, 2, 5-10 and 19-34 are currently pending and under consideration. Claims 3, 4 and 11-18 were previously canceled without prejudice or disclaimer. Claims 1, 2, 5-10, 19-21, 24-30 and 32-34 are allowed; and Claims 22, 23 and 31 are rejected under 35 U.S.C. § 112. For at least the reasons set forth below, Applicant respectfully requests that the rejections be reconsidered and withdrawn.

A. Claims 22 and 31 Satisfy Written Description Requirements of 35 U.S.C. §112, First Paragraph

Claim 22 recites "The single-serve capsule according to Claim 20, wherein the base element is made of metal." Claim 31 recites "The single-serve capsule according to Claim 20, wherein the base element is made of aluminum." Although the Examiner maintained his rejection of Claims 22 and 31 under 35 U.S.C. §112, first paragraph, in the November 27, 2019 Final Rejection, Applicant respectfully submits that the Examiner did not fully consider Applicant's argument and explanation set forth in the September 30, 2019 Office Action Response. Accordingly, and as explained herein, the Present Application provides ample written description support for a capsule with a base element made of metal—specifically aluminum.

The Examiner argued that the 35 U.S.C. §112, first paragraph, rejection is appropriate because "Applicant's specification does not further define what material would constitute said foil" and that "there is no support found for other portions of the capsule to be made of metal." (Final Rej. at 2.) However, Applicant respectfully submits that the Examiner is incorrect.

The Present Application explicitly discloses embodiments where the capsule (including its base element) is manufactured out of metal—specifically aluminum. Indeed, the Present Application explicitly discloses (emphasis added): "The codes described in the previous examples can be applied by different methods onto a capsule such as by [...] Printing on the inner surface of a capsule container, using the curl as information support (***Aluminum capsule***

K-FEE SYSTEM GMBH, EX2009, page 3440
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

technology)."[1] ***A person of ordinary skill in the art would understand the statement "aluminum capsule technology," in the context of single-serve beverage capsules, to be an express disclosure of a capsule—including the base element—made of the metal aluminum.*** Moreover, the Present Application expressly discloses a capsule with a "***metallic surface***."[2]

The test for whether written description is satisfied "is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date."[3] This includes considering "the existing knowledge in the particular field, the extent and content of the prior art, the maturity of the science or technology, [and] the predictability of the aspect at issue."[4] Importantly, information that is well known in the art need not be described in detail in the specification.[5] Instead, if a skilled artisan would have understood the inventor to be in possession of the claimed invention at the time of filing, even if every nuance of the claims is not explicitly described in the specification, then the adequate description requirement is met.[6] Accordingly, the express disclosures of "***aluminum capsule technology***" and "***metallic surface of the capsule"*** provide written description support for claims directed to a capsule body made of the metal aluminum.

First, at the time of the invention, it was well-known in the art that "aluminum capsules" involve manufacturing the body of the capsule from aluminum. For example, U.S. Pat. No. 4,136,202, filed December 7, 1977, discloses an aluminum capsule comprising "a body 1 composed of sheet aluminium. . . ." (1:40-44.) As another example, PCT publication WO

---

[1] PCT/EP2011/057657: page 9, lines 25-page 10, line 2; see also European Patent App. No. EP 10169374.5, 2010 at page 8, lines 7-14.

[2] *See* [0095].

[3] *Ariad Pharm., Inc. v. Eli Lilly and Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010).

[4] *Id.* (citing *Capon v. Eshhar*, 418 F.3d 1349, 1359 (Fed. Cir. 2005)).

[5] See, e.g., *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1379-80 (Fed. Cir. 1986).

[6] See, e.g., *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555,1563 (CAFC 1991); *Martin v. Johnson*, 454 F.2d 746, 751 (C.C.P.A. 1972) (stating "the description need not be in *ipsis verbis* [i.e., "in the same words"] to be sufficient"); see also *In re Wertheim*, 541 F.2d 257 (C.C.P.A. 1976) (the specification need not provide *ipsis verbis* (word for word) support for all claim elements; rather, support for the claim elements may be found in the express, implicit, and inherent disclosure of the as-filed specification and claims).

K-FEE SYSTEM GMBH, EX2009, page 3441
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

2010/034663 filed September 17, 2009 discloses an aluminium container "made of an aluminium foil that has been stamped in order to form a container body 7." (p. 5, l. 15-17.) Accordingly, manufacturing capsules out of aluminum was well-known long before the present invention, and a person of ordinary skill in the art would have understood the disclosure of "aluminum capsule technology" to include a capsule whose container body was made of the metal aluminum.

Although the Examiner criticized the above-mentioned prior art references for not being incorporated by reference into the Present Application (Final Rej. at 4-5), Applicant relies on these prior art references to demonstrate the state of prior art and the knowledge of a person of ordinary skill in the art. Applicant respectfully submits that such references need not be incorporated by reference in order to demonstrate the state of the art.

Second, the Present Application expressly defines the "capsule" as including the "base element" such that an aluminum capsule would be understood to include a base element made of the metal aluminum. The Present Application states that "[t]he term "capsule" refers to any flexible, rigid or semi-rigid container containing beverage ingredient"[7] and "***the capsule comprises a cup-shaped body***."[8] The Present Application goes on to indicate that the capsule can have a "***metallic surface***." Here, a person of ordinary skill in the art, in view of the knowledge of the prior art at the time of the invention, would understand disclosures of an aluminum capsule and capsule with a metallic surface to include expressly disclose a capsule with a metal or aluminum body.

In response, the Examiner alleges that "[n]owhere in the present specification is it found that the entire capsule would be made of metal, much less aluminum."[9] However, contrary to this assertion, Claims 22 and 31 do not require that the entire capsule is made of metal or aluminum. Instead, Claims 22 and 31 merely require that the base element is made of metal or aluminum, and Applicant again emphasizes the specification's explicit disclosure of "**aluminum capsule technology**" and "***metallic surface of the capsule"*** which would result in the base element being made of the metal aluminum. Applicant cites the above-noted disclosures regarding the structure of the "capsule" in the specification to show that the skilled artisan

---

[7] PCT/EP2011/057657: page 1, lines 19-22; see also European Patent App. No. EP 10169374.5, 2010 at page 1, lines 19-22.

[8] *See* Present Application at [0036].

[9] Office Action, pages 4-5 (paragraph 12).

K-FEE SYSTEM GMBH, EX2009, page 3442
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

reading the explicit disclosure of "aluminum capsule technology," in combination with the disclosures regarding the structure of the "capsule," would understand that Applicant had possession of an embodiment in which the base element is made of metal such as aluminum.

Therefore, the specification provides written description to a person of ordinary skill in the art for the subject matter of Claims 22 and 31, namely, that the base element is made of metal or aluminum respectively. Notably, nowhere does the Examiner address Applicant's previous comments regarding the specification's explicit disclosure of "aluminum capsule technology." MPEP 2163(II)(A)(2) mandates that a written description rejection must be based on a review of the **entire** specification; and thus the rejection is improper for at least this reason.

Accordingly, Claims 22 and 31 fully comply with 35 U.S.C. § 112, first paragraph, and Applicant respectfully requests withdrawal of the present written description rejection.

B. Claim 23 Satisfies Written Description Requirements of 35 U.S.C. §112, First Paragraph

Claim 23 recites "The single-serve capsule according to Claim 20, wherein the base element comprises a bottom and a wall region that extends between the flange and the bottom, the side wall has an electrically conductive section." On page 3 of the Office Action, the Examiner alleges:

> Claim 23 recites that "the base element comprises a bottom and a wall region that extends between the flange and the bottom, the side wall has an electrically conductive section". While it is seen that **applicant discusses one or more electrically conductive areas formed on the body of the package which can be sensed electrically this is not disclosed as a feature of the claimed invention but in reference to a prior art package containing comestibles for the preparation of beverages**. Thus, as above since applicant's disclosure does not define what material the sidewall of the base element would be made of no support is found in applicant's specification for the sidewall having an electrically conductive section and said recitation is seen to constitute an issue of new matter and as such must be deleted.

(emphasis added.) Applicant respectfully submits that the Examiner's statements above are incorrect.

As an initial matter, for at least the reasons set forth above in discussion of Claims 22 and 31, the present application discloses a capsule body made of metal, which is an explicit disclosure of a capsule wall having electrically conductive sections. Moreover, in addition to the disclosure in the background that is cited by the Patent Office, the specification also includes the

K-FEE SYSTEM GMBH, EX2009, page 3443
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

above-noted disclosure, "The codes described in the previous examples can be applied by different methods onto a capsule such as by [...] Printing on the inner surface of a capsule container, using the curl as information support (**Aluminum capsule technology**)."[10]

After disclosing application of codes onto a capsule, the specification discloses inductive code reading for such codes:

> Another mode consists in sensing a code provided on **a metallic surface of the capsule using an inductive sensor**. The code is formed by reliefs or recesses in the metallic surface. For instance, the capsule comprises a circumferential metal rim which comprises a succession of discrete slots and/or bumps. When the capsule is rotated about its central axis, the rim is moved relative to the sensor such that the slots and/or bumps are detected. The code can be read on a time base of a CPU of the beverage preparation device. The maximum rotational speed to read the code depends on the used sensor and the internal CPU of the device.[11]

In view of these disclosures, the recitation "the base element comprises a bottom and a wall region that extends between the flange and the bottom, the side wall has an electrically conductive section" in Claim 23 has written description in the specification.

Further in this regard, as noted above, written description of a claim limitation does not require a verbatim disclosure in the specification. Instead, if a skilled artisan would have understood the inventor to be in possession of the claimed invention at the time of filing, even if every nuance of the claims is not explicitly described in the specification, then the adequate description requirement is met.[12] Therefore, the subject matter recited by dependent Claim 23 has written description.

Accordingly, Claim 23 fully complies with 35 U.S.C. § 112, first paragraph, and Applicant respectfully requests withdrawal of the written description rejection.

---

[10] PCT/EP2011/057657: page 9, lines 25-page 10, line 2; see also European Patent App. No. EP 10169374.5, 2010 at page 8, lines 7-14.

[11] PCT/EP2011/057657: page 10, lines 4-10; see also European Patent App. No. EP 10169374.5, 2010 at page 8, lines 15-22.

[12] See, e.g., *Vas-Cath Inc. v. Mahurkar*, 935 F.2d at 1563; *Martin v. Johnson*, 454 F.2d at 751 (stating "the description need not be in *ipsis verbis* [i.e., "in the same words"] to be sufficient"); see also *In re Wertheim*, 541 F.2d at 257(the specification need not provide *ipsis verbis* (word for word) support for all claim elements; rather, support for the claim elements may be found in the express, implicit, and inherent disclosure of the as-filed specification and claims).

K-FEE SYSTEM GMBH, EX2009, page 3444
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Conclusion

For the reasons set forth herein, Applicant respectfully submits that all pending claims are in condition for allowance, and respectfully requests that the Examiner enter an early allowance of the application. If any impediment to allowance could be clarified in a telephonic interview, the Examiner is respectfully requested to initiate such an interview with the undersigned.

Respectfully submitted,

K&L GATES LLP

BY /Aaron J. Morrow/
Aaron J. Morrow
Reg. No. 55,819
Customer No.: 29157
Telephone No. 312-781-6043

Dated: January 24, 2020

K-FEE SYSTEM GMBH, EX2009, page 3445
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors:	Jarisch et al.
Applicant:	Société des Produits Nestlé S.A.
Appl. No.:	13/697,297
Conf. No.:	1065
Filed:	November 9, 2012
Title:	CAPSULE, SYSTEM AND METHOD FOR PREPARING A BEVERAGE BY CENTRIFUGATION
Art Unit:	1792
Examiner:	Chaim A. Smith
Docket No.:	3712036-01693

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO FINAL OFFICE ACTION

Examiner:

This Response and the enclosed Information Disclosure Statement (IDS) are respectfully submitted in reply to the Final Office Action dated November 27, 2019. A **Listing of Claims** begins on page 2 of this paper. **Remarks** begin on page 6 of this paper.

K-FEE SYSTEM GMBH, EX2009, page 3446
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
13 November 2008 (13.11.2008)

PCT

(10) International Publication Number
WO 2008/134910 A1

(51) International Patent Classification:
G07D 7/08 (2006.01) *G07D 7/06* (2006.01)

(21) International Application Number:
PCT/CH2008/000204

(22) International Filing Date: 2 May 2008 (02.05.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
00730/07 4 May 2007 (04.05.2007) CH

(71) Applicant *(for all designated States except US)*: **BOEGLI-GRAVURES S.A.** [CH/CH]; Rue de la Gare 24-26, CH-2074 Marin (CH).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **BOEGLI, Charles** [CH/CH]; Rue de la Gare 24, CH-2074 Marin (CH).

(74) Agent: **AMMANN PATENTANWÄLTE AG BERN**; Schwarztorstrasse 31, CH-3001 Bern (CH).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:
— *of inventorship (Rule 4.17(iv))*

Published:
— *with international search report*

WO 2008/134910 A1

(54) Title: METHOD AND DEVICE FOR THE RECOGNITION OF AN AUTHENTICATING MARK ON AN ENVELOPED SURFACE OF AN OBJECT

(57) Abstract: The method for the recognition of an authenticating mark on the surface of a packaging foil or an article by means of visual and/or electronic recognition means through an envelope is carried out by ultrasonic or X-ray techniques. In particular, the authenticating mark comprises at least one embossed authenticating mark having finest structures in the micrometer range, and the surface of the packaging foil or of the area of the article in which the authenticating mark is embossed is metallized or made of metal. In such a method, the package need not be opened or destroyed for inspection and the authenticating marks are not distinguishable from the outside in visible light.

K-FEE SYSTEM GMBH, EX2009, page 3447
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

METHOD AND DEVICE FOR THE RECOGNITION OF AN AUTHENTICATING MARK ON AN ENVELOPED SURFACE OF AN OBJECT

The present invention relates to a method and device for the recognition of an authenticating mark that is embossed on a surface of a packaging foil or of an article through an envelope, according to the preamble of claim 1, and mainly also to the authentication of cigarette packages, respective of cigarettes.

An object to be identified whose surface is recognized through an envelope that is impermeable to visible light is known in the art from US 2005/206500 A1. On one hand, the latter refers to relatively large objects and marks, and on the other hand, the employed radiations capable of passing through the envelope are only mentioned but not specified. More particularly, X-rays, different types of RF radiation, RMI technology or an acoustic imaging method are proposed.

DE 36 13 549 A1 discloses a method for reading bar-code information by means of sound waves that makes use of the fact that the bar-code is designed such that the spaces have different transmissive properties.

From EP-B-1 236 192 to the applicant of the present invention it is known to recognize an article by means of at least one authenticating mark that is applied in addition to other security elements, the authenticating marks being embossed by means of an embossing device that produces a special embossing pattern. In the introduction of this patent specification, different documents referring to the production of authenticating marks and elements are cited which consequently will not be enumerated here.

As explained in the specification and in claims 5 and 6 of EP-B-1 236 192, the authenticating mark should be recognized through the cigarette packet and more particularly through a corresponding window in the cigarette packet. However, an indication of a concrete method for recognizing the features through the package is not given in this reference.

According to EP-A-1 216 819, marks that are embossed on a first layer are read through windows in a second layer, the layers being cigarette packaging foils.

Similar authenticating marks may also be provided on packaging foils for foods such as chocolate or butter or for other articles - e.g. from the pharmaceutical industry, such as capsules or pills - or else for objects such as PC cards, that are to be recognized through a package of cardboard or the like.

Another problem area is the authentication of timepieces, more particularly wrist or pocket watches. In order to be able to recognize the authenticating marks, the latter have to be applied to the housing externally or the timepiece has to be opened, which generally requires specialized personnel. Therefore, a recognition through the dial or through the bottom would be very advantageous.

Recently, methods and devices for embossing ever smaller and thus increasingly fraud resistant authenticating marks have been developed by the applicant, e.g. according to US 7 229 681, and based thereon, it is the object of the present invention to provide a method and a device that allow recognizing even very small security elements such as authenticating marks and/or elements in the micrometer range on the surface of packaging foils around tobacco products, foods, pharmaceutical products or PC components through the

package, or on the surface of timepieces through the envelope, e.g. the dial or the bottom, with sufficient accuracy and dependability. This object is attained by the method according to claim 1 and by the device according to claim 15.

The invention will be explained in more detail hereinafter with reference to exemplary embodiments. Representatively for the above-mentioned articles, these examples refer to the authentication of cigarette packets or cigarettes, respectively. The term "authenticating mark" stands for security or authentication features that have been embossed on packaging foils by means of the embossing methods and devices mentioned in the introduction, or according to a conventional method on a part of a timepiece, on one hand, and on the other hand, for the entirety of characteristics that make up the nature of the object that is to be examined, such as e.g. embossing patterns on identical or different packaging foils.

The term "envelope" stands for packages of cardboard or paper that are impermeable to visible light and in the case of timepieces for dials or watch bottoms made of a material that is permeable to the applied sound waves or rays.

In EP-B-1 236 192, cited in the introduction, different commercial levels are defined, and these are incorporated, as far as they are applicable to the present invention, into the present description as part of an exemplary embodiment.

According to US 2007/0289701 A1, the method according to EP-B-1 236 192 can be further developed in that an array of authenticating marks is embossed as a pattern on-line, read by a suitable apparatus, and evaluated by means of an image processing method. With regard to the embossing pattern, all

known embossing types can be applied. In addition to the embossing apparatus, the device used for carrying out the method comprises a reading unit and an evaluating unit. In particular, this method reducing the requirements with respect to the embossing or reading quality without prejudicing the required safety.

According to the prior art, as mentioned in the introduction, either relatively large objects are recognized through an envelope or the mentioned articles are read and recognized directly, which implies that the package must be opened to access the foil or the article in order to be able to read the authenticating marks. The proposal to recognize the articles through a window in the package makes the manufacture more expensive as the window must be manufactured additionally, and the local application of the features is furthermore limited by the location of the window. This also applies analogously when the article is a timepiece.

In order to recognize ever smaller structures through a light-impermeable envelope, it is apparent to one skilled in the art in view of the prior art cited in the introduction that the radiation or the sound waves that are to be applied must be capable of resolving such structures. However, this knowledge alone is not sufficient for attaining the intended object. On the contrary, this requires the realization that there must be an interaction between a particular surface of the article and the adapted sound waves or radiation.

There are essentially two ways of using the sound waves for detection purposes, namely in transmission mode or in reflection mode. In view of the fact that the sound waves or rays have to pass through the envelope first to subsequently produce a useful signal, it has been recognized that the

detection signal obtained through reflection offers advantages when the reflecting surface is metallized or metallic, e.g. a metallized packaging foil or an aluminum foil.

Recently, ultrasonic apparatus having a high resolution of less than 0.1 mm have been developed, thereby also allowing to resolve and thus recognize the authenticating marks and elements that are being considered here and have been referred to above. Such an ultrasonic camera is disclosed in a publication that is accessible in the Internet and can be downloaded under the title "Optel Ultrasonic Technology / Fingerprint recognition".

Another publication from the year 2004, entitled "ultrasonic microscopy", of the Technical University of Dresden describes an apparatus with a transducer having a nominal frequency of up to 230 MHz, thereby achieving a lateral resolution of up to 10 µm. According to one of these methods, i.e. the so-called impulse echo technique, the surfaces or indentations to be examined are scanned by means of a suitable transducer and a three-dimensional image of the inspected area is reconstructed through an evaluation of the amplitude, the phase, and the delays of the backreflected signals.

Digital signal processing and image processing methods may also be applied to this end. The latter may be used to separate the image areas of interest and to extract the relevant information, respectively. In this regard, additional correlation methods may be applied for a better extraction of certain hidden patterns.

According to EP-A1-1 437 213 to the applicant of the present invention it is possible to modify the teeth of embossing

rolls in such a manner that macro- and microstructures are produced which are transmitted to the metallized surface of the packaging foil in the embossing procedure. Such a technique allows embossing the authenticating marks and elements with macro- or microstructures that have been mentioned in the introduction.

These authenticating marks or elements must then be readable by the ultrasonic apparatus in reflection mode through the package. To this end, a suitable sonic transducer will be used that is capable of reading the structures, i.e. the authenticating marks or elements, in the desired frequency range. More specifically, a sonic transducer having a nominal frequency comprised in a range of 5 to 500 MHz can be used, thereby allowing to achieve a large bandwidth of the resolving capacity, which is necessary depending on the structure and size of the authenticating marks. Furthermore, the ultrasonic beam should be focused and directed such that it may reach the features through the package without excessive losses and its backreflected rays can be detected.

Authenticating marks may furthermore be produced by differences in the arrangement of teeth, e.g. by individual teeth or groups of teeth of different shapes in the intended locations, e.g. teeth having a round or rounded horizontal projection in the midst of teeth having a rectangular horizontal projection, or different distances between the teeth.

Moreover, authenticating marks may also be produced by creating indentations, deformations or holes on the surface of the packaging foil by tools other than embossing rolls, e.g. by controlled pins or the like.

In the case of timepieces, the authenticating mark is applied to a watch component that is either covered by the dial or by the bottom and is therefore invisible to the eye. In this case, the recognition is achieved by an adapted ultrasonic or X-rays apparatus through the dial or through the bottom, whose material must be permeable to these sound waves or rays.

Problems might arise when operating at the limit of the resolution, but error corrections may be performed for a reliable recognition of the features, e.g. by means of an adapted mathematical algorithm. In this regard, the above-mentioned method according to CH-01086/06 facilitates the application of an error correction.

An evaluation by means of an adapted mathematical error correction allows an analysis of the embossing pattern, which differs from one embossing roll to another and thus constitutes an identification characteristic of the embossing system. In the embossing process, the surface profile of the embossing roll is transmitted to the paper.

Papers that have been embossed by different embossing rolls differ on a microscopic scale since the surface profiles of different embossing rolls differ from one another without a specific treatment of the teeth of these rolls. These small differences, which serve as the authenticating mark, are to be measured and quantified.

The profile of the embossed paper is not only a function of the embossing roll that has been used but also of the paper properties and of the process parameters adjusted in the embossing process. By means of measurements it has been experimentally shown that the surface profiles of the embossing roll and of the embossed paper differ from one

another. Therefore, generally, measurements of embossed papers cannot be related directly to the embossing roll that has been used for embossing but to an embossed reference paper. This reference measurement is periodically renewed in order to compensate for process-related variations. It is therefore an aim to determine, by means of the authenticating mark, i.e. by means of deviations or correlations between the pattern on the paper and that of the embossing roll, whether the paper was embossed by a particular embossing roll.

Theoretical considerations have lead to the assumption that with a refinement of ultrasonic technology, more particularly of the impulse echo method, these small differences could also be detected by means of ultrasonic technology through a package.

However, if these differences are very small, especially in the case of a recognition of differences after embossing with embossing rolls whose teeth have not been altered, they may no longer be detectable through the package by ultrasonic techniques so that another detection method must be applied.

If X-rays are employed, the X-ray apparatus used in the references of the prior art cited in the introduction cannot be applied as they cannot sufficiently resolve the fine structures.

In recent years, developments in X-ray tomography and micro-CT (Computer Tomography) have allowed the creation of X-ray apparatus of the size of a cigarette packet on the basis of carbon nanotubes (CNT). Such apparatus are capable of producing self-focusing measuring spots in the submicrometer range.

Tests have shown that such X-ray microdevices are capable of detecting authenticating marks through a cigarette packet in transmission mode. It is essential therefor that these authenticating marks are applied to a metallized foil or a foil made of aluminum. The effect may be reinforced if the authenticating marks are located in structures such as folds or the like.

In analogy thereto, on a timepiece component, the authenticating marks, i.e. the embossed marks, are identified through the dial or the bottom.

The detection of the rays is achieved by means of suitable semiconductor detectors that are connected to a processing unit of a similar design as that used in the ultrasonic detection of the inspected features.

- - - - -

Claims

1. Method for the recognition of an authenticating mark on the surface of a packaging foil or an article by means of visual and/or electronic recognition means through an envelope, the recognition method being carried out by ultrasonic or X-ray techniques, characterized in that the authenticating mark comprises at least one embossed authenticating mark having finest structures in the micrometer range and the surface of the packaging foil or of the area of the article in which the authenticating mark is embossed is metallized or made of metal.

2. Method according to claim 1, characterized in that the packaging foil contains tobacco products such as cigarettes, foods such as chocolate or butter, capsules or pills from the pharmaceutical industry, or PC cards, and is enclosed in a package of cardboard, paper, or plastics material.

3. Method according to claim 1, characterized in that the article is a timepiece and the authenticating mark embossed thereon is recognized through the dial or through the bottom thereof.

4. Method according to one of claims 1 to 3, characterized in that the ultrasonic source operates in a range of 5 - 500 MHz and in reflection mode.

5. Method according to claim 4, characterized in that the so-called impulse echo method is employed, the surfaces or indentations to be examined being scanned by means of a suitable sonic transducer and a three-dimensional image of the inspection area being reconstructed through an evaluation of the amplitude, the phase, and the delays of the reflected signals.

6. Method according to one of claims 1 to 4, characterized in that the identification method is carried out in transmission mode using an X-ray apparatus whose radiation can be focused onto a spot in the submillimeter range.

7. Method according to claim 6, characterized in that the X-ray apparatus operates on the basis of carbon nanotubes delivering radiation spots in the submicrometer range.

8. Method according to one of claims 1 to 7, characterized in that digital signal processing and image processing methods are applied in order to separate the image areas of interest and to extract the relevant information, respectively.

9. Method according to one of claims 1 to 8, characterized in that an array of authenticating marks is embossed on-line as a pattern and evaluated by an image processing method.

10. Method according to one of claims 1 to 9, characterized in that additional correlation methods are applied for a better extraction of certain hidden patterns.

11. Method according to one of claims 1 to 10, characterized in that teeth of the driven embossing roll are modified such that authenticating marks are embossed in the corresponding locations of the packaging foil.

12. Method according to one of claims 1 to 10, characterized in that no teeth of the driven embossing roll are modified and differences in the embossing pattern that are due to the manufacture of the rolls and/or to the paper quality are used as a authenticating mark, and identified.

13. Method according to one of claims 1 to 10, characterized in that the authenticating marks are created by differences in the arrangement of teeth, individual teeth or groups of teeth in the intended locations having a different shape, more particularly teeth that have a round or rounded horizontal projection in the midst of teeth that have a rectangular horizontal projection, or the teeth having different distances between them.

14. Method according to one of claims 1 to 10, characterized in that the authenticating marks are produced by tools other than embossing rolls, e.g. by controlled pins, in the form of indentations, deformations or holes on the surface of the packaging foil.

15. Device for carrying out the method according to any one of claims 1 to 5, 8-14, characterized in that it comprises an ultrasonic transducer.

16. Device according to claim 15, characterized in that the ultrasonic transducer operates in a range of 5 to 500 MHz.

17. Device according to any one of claims 6 to 14, characterized in that it comprises an X-ray apparatus whose radiation can be focused onto a spot in the submillimeter range.

18. Device according to claim 17, characterized in that the X-ray apparatus operates on the basis of carbon nanotubes delivering radiation spots in the submicrometer range.

- - - - -

INTERNATIONAL SEARCH REPORT

International application No
PCT/CH2008/000204

A. CLASSIFICATION OF SUBJECT MATTER
INV. G07D7/08 G07D7/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G07D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/073414 A1 (SPAHN MARTIN [DE]) 7 April 2005 (2005-04-07) abstract paragraph [0009] paragraph [0012] - paragraph [0013] paragraph [0016] - paragraph [0017] paragraph [0031] - paragraph [0036] paragraph [0039] - paragraph [0055] figures ----- -/--	1-4,15, 16

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 July 2008	18/07/2008

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Königer, Axel

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/CH2008/000204

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 33 08 278 A1 (ZEPPELLINI SERGE [FR]) 13 September 1984 (1984-09-13) abstract page 4 - page 5, paragraph FIRST page 6, paragraph FIRST - page 7, last paragraph page 8, last paragraph - page 9, last paragraph figures	1-3, 6-14,17, 18
X	US 2005/206500 A1 (FERREN BRAN [US] ET AL) 22 September 2005 (2005-09-22) paragraph [0012] - paragraph [0014] paragraph [0016] figure 1	1,4,5, 15,16
X	DE 36 13 549 A1 (STORCK WOLFGANG [DE]; BICZ WIESLAW [DE]) 29 October 1987 (1987-10-29) abstract column 1, line 45 - line 54 column 2, line 19 - column 3, line 24	1,4,15, 16

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/CH2008/000204

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005073414 A1	07-04-2005	DE 102004044978 A1	14-04-2005
DE 3308278 A1	13-09-1984	NONE	
US 2005206500 A1	22-09-2005	WO 2005089301 A2	29-09-2005
DE 3613549 A1	29-10-1987	NONE	

K-FEE SYSTEM GMBH, EX2009, page 3462
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 867 261 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
19.12.2007 Bulletin 2007/51

(51) Int Cl.:
A47J 31/52 *(2006.01)*

(21) Application number: **06425405.5**

(22) Date of filing: **15.06.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(71) Applicant: **RANCILIO MACCHINE PER CAFFE' S.p.A.**
I-20010 Villastanza di Parabiago (Milano) (IT)

(72) Inventor: **Carbonini, Carlo,**
c/o Rancilio Macchine per Caffé S.p.a
20010 Villastanza di Parabiago (Milano) (IT)

(74) Representative: **Robba, Pierpaolo**
INTERPATENT S.R.L.
Via Caboto No. 35
10129 Torino (IT)

(54) Apparatus for the regulation of operation parameters, in particular pressure, for a coffee machine, machine and operating method therefor

(57) The present invention relates to an apparatus for the regulation of operation parameters, in particular pressure, in a coffee machine. The apparatus (10) comprises a keyboard (15), arranged for activating the machine and setting operation parameters, and a plurality of light or sound emitting elements (16a, 16b, 16c, 16d, 16e) arranged to be selectively activated for highlight through a plurality of configurations the operation parameters of the machine set through the keyboard (15). Thanks to the invention it is possible to avoid on the machine the presence of a display that makes more complex and less reliable the machine. The invention relates also to a machine that comprises the apparatus and to the operating method of the apparatus.

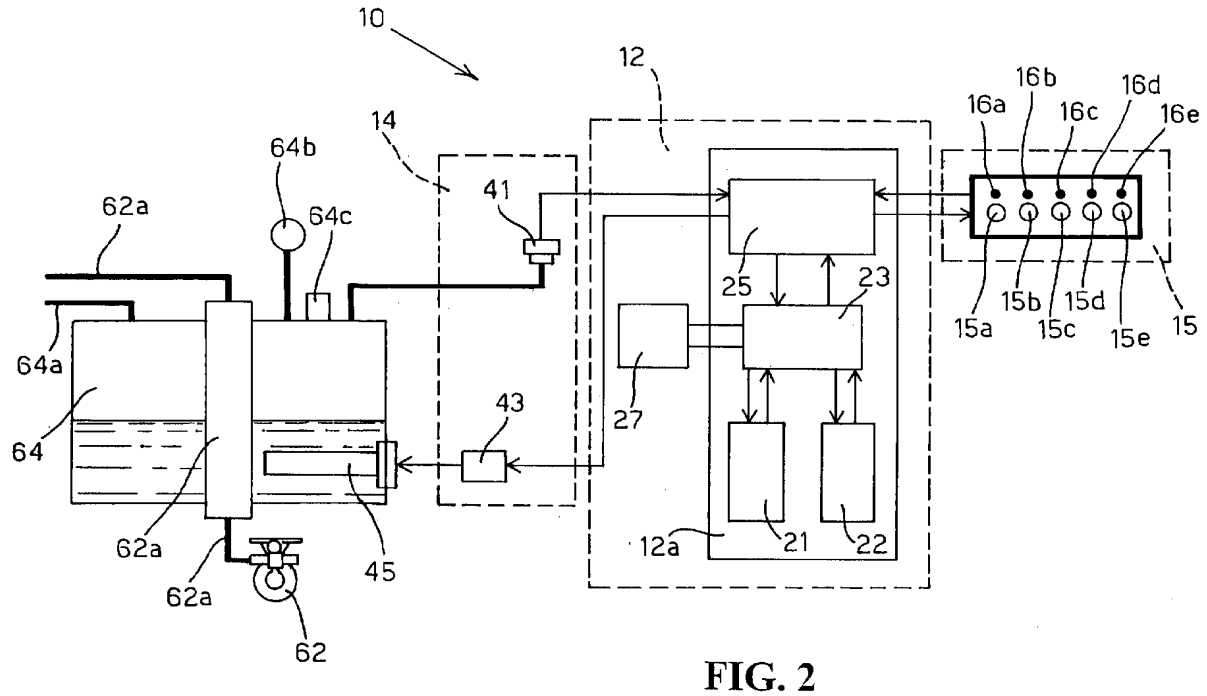


FIG. 2

EP 1 867 261 A1

Printed by Jouve, 75001 PARIS (FR)

K-FEE SYSTEM GMBH, EX2009, page 3463
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Description

Technical Field

[0001] The present invention relates, in general, to an apparatus for the regulation of operation parameters of a coffee machine, to the machine that comprises the apparatus and to the apparatus operating method.
In particular, the present invention relates to an apparatus for regulating the boiler pressure of an espresso coffee machine.

Background Art

[0002] Machines for preparing coffee, in particular espresso coffee, are known in the art.
Such machines are usually divided in traditional machines and super-automatic machines.
[0003] Traditional machines comprise, for instance, machines that in any case require the presence of an operator and in turn, they are conventionally divided in semiautomatic machines and automatic machines.
Semiautomatic machines comprise machines in which the dosage of ground coffee is measured by means of external measuring devices and the espresso coffee supply is controlled by the operator by means of a machine key.
Automatic machines comprise machines in which the dosage of ground coffee is measured by means of external measuring devices and the supply is activated by the operator by means of suitable keys in which each key corresponds, for instance, to a type of coffee to be supplied.
[0004] Super-automatic machines conventionally comprise machines in which it is provided that the dosage of ground coffee and the supply are controlled by the machines, whereby they may be activated by an operator or a user.
[0005] A super-automatic machine for the preparation of espresso coffee is known from the publication EP_0472272A2; this machine comprises a boiler, means for distributing beverages and microprocessor means for controlling both machine operations, such as beverages distribution, and operation parameters setting, such as the amount of water dispensed per each beverage, the water temperature in the boiler, etc.
Such a background art provides that, for controlling machine operations and, in particular, operation parameters setting, the machine comprises a plurality of push-buttons and a display unit arranged to display, for instance, the operation parameters that have been set.
[0006] Similarly, an automatic type traditional machine is known from patent US_5,072,660, said machine providing a plurality of push-buttons and a display unit for controlling and displaying, respectively, machine operations and operation parameters setting.
[0007] The Applicant has found that, typically, background art documents provide that, for controlling operation parameters of a coffee machine by means of a microprocessor, the presence is necessary both of a push-button device (keyboard) and of a numeric or alphanumeric visualisation device (display).
The presence of both such devices and in particular of the display involves, in Applicant opinion, a plurality of problems.
First of all, the display, unlike the keyboard, is an electronic device responsive to high temperatures and to humidity and, therefore, it must be placed so as not to be close to heat sources and to be protected from humidity; such a solution is not always easy to realise in a coffee machine, in particular if the machine is of the traditional type.
Secondly, the display position must be such to allow an operator or a user to see the displayed information.
Thirdly the displayed information, in order to be intelligible by the operator or user, must be in the operator's or user's language; such a requirement imposes the necessity to associate to the microprocessor enough additional memory to store the information to be displayed on the display in several languages, and this necessarily involves high manufacturing costs.
[0008] In summary the Applicant has found that the presence of additional devices, such as the display and the additional memory, besides involving greater malfunctioning risks, impose both higher design costs, as it is necessary to arrange the display with utmost precision, and higher manufacturing costs, because, as a matter of fact, it is necessary to provide for the presence of additional devices.

Disclosure of the Invention

[0009] Object of the present invention is an apparatus and a coffee machine that solve the prior art problems outlined above in a simple and effective way.
According to the present invention, such object is achieved by means of an apparatus for the regulation of operation parameters, in particular pressure, in an espresso coffee machine, as claimed. The present invention relates also to a coffee machine that comprises the apparatus according to the invention, to an operating method for the apparatus as well as to a computer program product loadable in the memory of at least one computer and including software code portions for performing said method when the product is stored in the memory of at least one computer.
[0010] Claims are an integral part of the teaching of the present invention.

K-FEE SYSTEM GMBH, EX2009, page 3464
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

[0011] According to a preferred embodiment the apparatus according to the present invention comprises a plurality of light emitting elements actuatable according to predetermined configurations corresponding each to an operation parameter chosen among a plurality of operation parameters.

[0012] According to a further feature of the present invention, the apparatus is configured for lightening at least one first light emitting element in fixed way and a second light emitting element in fixed or blinking way as a function of the value of the operation parameter chosen among a plurality of operation parameters. According to still another feature of the present invention, the apparatus comprises activation means configured for activating devices directed to the management of the operation parameters in the machine and is configured for making at least one light emitting element flash during activation of the activation means.

Brief Description of Drawings

[0013] These and further features and advantages of the present invention will appear more clearly from the following detailed description of preferred embodiments, provided by way of non-limiting examples with reference to the attached drawings, in which components designated by same or similar reference numerals indicate components having same or similar functionality and construction and wherein:

Fig. 1 shows a perspective view of a coffee machine;
Fig. 2 shows a logic block diagram of the apparatus according to the invention.

Best mode for Carrying Out the Invention

[0014] With reference to Fig. 1 and 2 an apparatus for the regulation of operation parameters (apparatus) 10 according to present inventions comprises a control device 12, an operation parameters management device (management device) 14 and at least one commands inputting device or keyboard 15. The apparatus 10, in the preferred embodiment, is associated to a coffee machine (machine) 60 comprising one or more supplying groups 62, of known type, arranged to supply, for instance, espresso coffee as a result of the activation of a key of the keyboard 15 and a boiler 64, of known type, arranged to maintain under pressure, at a particular temperature, water and steam. Preferably, the boiler 64 is connected to a duct 64a, known per se, for supplying in a controlled way steam under pressure and internally includes an hydraulic circuit 62a, of known type, connected to the supplying groups 62 and arranged to feed water to the supplying groups 62 for supplying coffee. Boiler 64, preferably, is connected to a gauge 64b, known per se, and to a safety valve 64c; the safety valve 64c is arranged to discharge steam in case of pressure in excess in the boiler 64.
The machine 60 in the example is a traditional automatic machine, but, as easily comprehensible to a technician in the field, the machine can be either a traditional semiautomatic machine or a super-automatic machine without departing from the scope of the invention as disclosed and claimed. The control device 12 of apparatus 10 comprises, for instance, a microprocessor 12a of known type, for instance a microprocessor model MC68HC908GR8 of the Freescale company, and a programmable memory (EEPROM or Electrically-Erasable Programmable Read Only Memory) 27, for instance an EEPROM model 93LC46 of the Microchip company, connected to the microprocessor 12a and configured for storing, for instance, operation parameters such as reference pressure values of the boiler 64 or pressure values set by the operator, as it will be disclosed later on in detail.
The microprocessor 12a comprises, in the preferred embodiment, an interface unit (I/O interface) 25, arranged to exchange analog or digital signals with other devices not shown, in particular with the management device 14 and keyboard 15, a central control unit (CPU) 23 connected to the I/O interface and arranged to manage through the I/O interface 25 the management device 14 and keyboard 15, a read only memory (ROM) arranged to store programs developed during the design phase of the apparatus 10, and a random access memory (RAM), all known per se.

[0015] The management device 14 is connected to the boiler 64 and to the control device 12 and comprises, in the preferred embodiment, a pressure sensor 41 and an activation circuit 43, all of known type.
The pressure sensor 41 is connected hydraulically to the boiler and electrically to the I/O interface 25, and is arranged both to detect the pressure inside the boiler 64 and to output, to the CPU 23 through the I/O interface 25, signals indicative of the detected pressure value so that they can be managed by the CPU 23.
For instance the pressure sensor can be a sensor K1 model of the Signal Lux Company, that is responsive to pressure changes of 0.1 BAR and is arranged to supply an output electric voltage indicative of the detected pressure.
The activation circuit 43 is connected to a heating unit 45 associated to the boiler 64 and to the CPU 23 through the I/O interface 25, and is arranged to activate and to deactivate the heating unit 45, on the basis of control signals transmitted from the CPU 23 to the activation circuit 43 itself.
In particular, the activation circuit 43, controlled by the CPU 23, is arranged to activate or to maintain deactivated the heating unit 45 for heating or not heating the water contained into the boiler 64 and, as easily comprehensible to a technician in the field, for consequently raising or lowering the pressure inside the boiler 64.

K-FEE SYSTEM GMBH, EX2009, page 3465
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

In the preferred embodiment the heating unit 45 comprises one or more resistors applied, in a known way, to the boiler 64. Preferably, the pressure inside the boiler 64 is changed, under the control of the CPU 23, between 0.6 BAR and 1.4 Bars by steps of 0.1 BAR around a reference pressure of 1 BAR by means, for instance, of commands arranged to activate the heating unit 45 (pressure increase) or commands arranged to maintain deactivated the heating unit 45 (pressure decrease). In summary, the management device 14 in the described configuration is arranged to manage the pressure inside the boiler 64, by detecting the values of pressure with sensor 41, by transmitting such values to CPU 23 so that it compares them with those stored in the EEPROM 27, and by receiving from the CPU 23 commands arranged to increase or decrease the pressure inside the boiler 64 so as to take it to or maintain it at the value stored in the EEPROM 27 by means of the heating unit (resistors) 45.

Obviously, in other embodiments, the management device can comprise sensors of operation parameters different from the pressure and activation circuits arranged to take or to maintain a particular operation parameter to a predetermined value.

The commands inputting device 15, of known type, for instance a keyboard 9.9.08.91.G model of the Gicar Company having five keys, respectively 15a, 15b, 15c, 15d, 15e, and five LEDs (Light-Emitting Diode), respectively 16a, 16b, 16c, 16d, 16e, is connected, in a known way, to the I/O interface and is arranged to exchange signals with the CPU 23 through the I/O interface 25.

In the exemplary embodiment, each key from 15a to 15e of the commands inputting device (keyboard) 15 is associated to a light emitting element, from 16a to 16e, for instance a LED, arranged to emit light as a result of key-press or activation of the corresponding key by an operator or as a result of commands transmitted by the CPU 23 to the keyboard 15.

Preferably the light emitting elements (LED), respectively 16a, 6b, 16c, 16d and 16e are inserted inside respective keys, 15a, 15b, 15c, 15d and 15e, and are integral part of the keyboard, but, in other embodiments they may also be separated from the single keys, located near the keys and be part or not of the keyboard.

Preferably the keys are activated by pressing, but as easily comprehensible to a technician in the field, the keys may be of different type, for instance of capacitive type, and actuatable in different ways, for instance by touch.

[0016] According to the preferred embodiment the keyboard 15 is configured for operating at least in two operation modes.

In the first mode of operation or operative mode, the keyboard 15, for instance, is arranged, on the basis of programs developed in the design phase of the machine 60 and stored, for instance, in the ROM 21, to activate the supply of several types of coffee on the basis of the key pressed by the operator; for instance, if the first key 15a is pressed, espresso coffee of "strong" type is supplied , if the second key 15b is pressed, espresso coffee of "regular" type is supplied, etc.

Preferably, concurrently with the pressing of a key, the corresponding LED lightens.

In the second mode of operation or operation parameters programming mode (programming mode) the keyboard 15, by means of suitable commands activated by means of keys from 15a to 15e, is arranged, on the basis of programs developed during the design phase of machine 60 and stored, for instance, in ROM 21, to allow both to display the operation parameters of machine 60 by means of the selective lightening of LEDs, and to modify and, for instance, store them in EEPROM 27 under the control of CPU 23.

In the programming mode, the modification and storing of parameters are supported, in the various operations, by the selective LED lightening, from 16a to 16e, controlled by CPU 23, so as to make the presence of a display unnecessary and, therefore, to eliminate all the problems already evidenced associated to the presence of the display.

Switching from the operative mode to the programming mode and vice-versa is carried out by pressing one or more predetermined keys, on the basis of programs developed in the design phase of machine 60 and stored, for instance, in ROM 21.

[0017] The operation of the apparatus 10 as described above is the following.

[0018] Taking as reference the operative mode, in such mode the machine 60 and apparatus 10 operates so as to supply, for instance, "strong", "regular" coffee, etc. depending on the key activated by the operator.

In the operative mode, the CPU 23 measures the pressure inside the boiler 64 on the basis of values detected by the pressure sensor 41 and commands the activation circuit 43 so as to maintain in the boiler a predetermined pressure value, for instance, the value stored in EEPROM 27.

In case of anomalies in the pressure level or in the connected devices, the CPU 23, on the basis of programs developed in the design phase, preferably, carries out predetermined procedures to remove the anomalies.

[0019] In case the operator wants to modify one or more operation parameters or values of machine 60, for instance the pressure, the operator proceeds to switch apparatus 10 from operative mode to programming mode, by keeping pressed, for instance, the key 15a for an extended time, for instance more than four seconds.

Such an operation is acknowledged by CPU 23 as a request to switch from operative mode to programming mode and immediately executed.

From this moment and until a subsequent restoration of the operative mode, the machine and the apparatus are in programming mode and the coffee supply is, for instance, blocked.

K-FEE SYSTEM GMBH, EX2009, page 3466
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

[0020] In the description that follows a plurality of programming steps for setting pressure in a coffee machine are described, by using as reference the table that follows (TAB. 1) in which predetermined meanings are assigned to several keys of the keyboard and to several LEDs.

[0021] Obviously, in other embodiments, other meanings may be assigned to the several keys and operation parameters, without departing from the scope of the invention as disclosed and claimed.

TAB. 1

KEY	LED	STATUS	FUNCTION
15a (+)		pressed	Sets the pressure value by + 0.1 steps at each key-press
	16a	lighted fixed	Indicates a reference pressure
	16a	lighted flashing with long intervals	Shows the number of steps above the reference pressure
15b (-)		pressed	Sets the pressure value by - 0.1 steps at each key-press
	16b	lighted fixed	Indicates a reference pressure
	16b	lighted flashing with long intervals	Shows the number of steps below the reference pressure
15c		pressed	Restores the reference pressure
	16c		
15d			Switches the apparatus to operative mode
	16d	lighted fixed	Shows status switched from programming mode to operative mode
15e			
	16e	lighted flashing	Shows that the set pressure value has not been reached
	16e	Switched off	Shows that the set pressure value has been reached

[0022] According to the present exemplary embodiment it is provided that in the programming mode the first and second LED, respectively 16a and 16b, signal the pressure level inside the boiler 64.

By taking as reference, for instance, the case in which machine 60 and apparatus 10 are set to operate at the reference pressure, that is 1 BAR (i.e. the value of 1 BAR is stored in EEPROM 27), in such a case the CPU 23, as a result of reading the value of 1 BAR from EEPROM 27, will command through I/O interface 25 to fixedly power on LEDs 16a and 16b. If the operator wants, in a first phase, to set a new operation value of the pressure, for instance to increase the pressure value, he will press or activate the first key 15a one or more times. Such an operation is immediately managed, through I/O interface 25, by CPU 23, that stores the new pressure value in RAM 22 and, in such a case, by maintaining the LED 16b fixedly powered on, intermittently flashes the LED 16a so that an equal number of flashes of the LED 16a corresponds to the number of pressures of the operator, alternated with a long period of pause, for instance 3 seconds, with the LED 16a being fixedly powered on.

Similarly, if the operator wants, in the first phase, to diminish the value of the pressure, he will press or activate the second key 15b one or more times. Such an operation is immediately managed through I/O interface 25 by CPU 23 that stores the new value of pressure in RAM 22 and, in such a case, by maintaining the LED 16a fixedly powered on, intermittently flashes LED 16b so that an equal number of flashes of LED 16b corresponds to the number of pressures of the operator, alternated with a long period of pause, for instance 3 seconds, with the LED 16a being fixedly powered on.

Obviously, if by switching from operative mode to programming mode, the set pressure is different from the reference pressure, CPU 23 will manage to fixedly power on one of the two LEDs and to flash the other with a number of flashes equal to the value diminished or increased with respect to the reference value, alternated with a long period of pause, for instance 3 seconds, with one of the two LEDs, 16a or 16b, being fixedly powered on.

[0023] Once the setting phase is completed, the operator can proceed, in a second phase, to save the setting by pressing, for instance, the fourth key 15d that transmits a corresponding signal to save parameters and switch to the operative mode.

In particular, as a result of such an operation, CPU 23, under the control of the programs developed during the design phase, stores in EEPROM 27 the new pressure value set, previously stored in RAM 22, and starts the control procedures arranged to bring the pressure of boiler 64 to the new value set.

[0024] Both in the operative and programming modes, during the period in which the value set by the operator does not correspond to the value measured by CPU 23 through the pressure sensor 41, CPU 23 sends to the management

K-FEE SYSTEM GMBH, EX2009, page 3467
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

device 14 commands arranged to raise or to lower the pressure inside the boiler 64 so as to reach the set value.
Preferably, during the programming mode, CPU 23 commands also, during the period in which the value set by the operator does not correspond to the measured value, flashing of LED 16e until the set pressure is reached inside the boiler 64. LED 16e powered off is indicative, in such a case, of the fact that the boiler 64 has reached the set pressure.

[0025] The apparatus, in the preferred embodiment has a keyboard that operates both in the operative and programming modes.
According to further embodiments, it is provided that all the keyboards present on the machine operate both in the operative and programming modes.
In still other embodiments it is provided that a keyboard and a boiler are associated to every supplying group and that each keyboard works in the operative and programming modes for the respective boiler.
In such a configuration the control device can be a single one and selectively usable for each associated keyboard and boiler or it can be replicated for each keyboard and boiler.

[0026] In the description reference has made to light emitting elements for highlighting, for instance, operation parameters of the machine.
In a further embodiment it is provided that the light emitting elements are replaced by elements emitting sound at different frequencies and that elements emitting sound at different frequencies are associated to the keys of the commands inputting device.
According to such a further embodiment the sound emitter elements may perform the same functions of LEDs by emitting uninterrupted or intermittent sounds instead of fixed or flashing light.

[0027] In summary, thanks to present invention, by means of the described apparatus the operator can set operation parameters of the coffee machine, such as pressure, by simply using one keyboard and, preferably, a plurality of LEDs, which are generally present in any case, without the necessity of providing a numeric or alphanumeric display on the machine.
The proposed solution does not require to store messages in a plurality of languages and therefore it requires control devices having smaller memory and therefore being simpler and less expensive.

[0028] Obvious changes and/or variations to the above disclosure are possible, as regards dimensions, shapes, materials, components, circuit elements, connections and contacts, as well as details of circuitry, of the described construction and operation method without departing from the scope of the invention as defined by the claims that follow.

Claims

1. Apparatus for the regulation of operation parameters, in particular pressure, in a coffee machine (60), comprising

- a commands inputting device (15) having a plurality of keys (15a, 15b, 15c, 15d, 15e), said commands inputting device (15) being configured for commanding the operation of said machine and inserting at least one operation parameter chosen among a plurality of operation parameters;
- a control device (12) having memory means (22, 27), said control device (12) being connected to said commands inputting device (15) and arranged to store said at least one operation parameter in said memory means (22, 27);

characterised by

- a plurality of light or sound emitting elements (16a, 16b, 16c, 16d, 16e) connected to said control device (12) and actuatable by said control device (12) according to predetermined configurations corresponding each to an operation parameter chosen among a plurality of operation parameters and inputted through said commands inputting device (15).

2. Apparatus according to claim 1, **characterised in that** it comprises

- a management device (14) having at least one sensor (41) arranged to detect a particular operation parameter in said machine (60) and activation means (43) configured for activating devices adapted to manage said operation parameter in said machine (60);
and **in that** said control device (12) is connected to said management device (14) and is configured for measuring said particular operation parameter, comparing said particular operation parameter with said operation parameter chosen among a plurality of operation parameters and commanding said activation means (43) to regulate said particular operation parameter in said machine (60) as a function of said operation parameter chosen among a plurality of operation parameters.

K-FEE SYSTEM GMBH, EX2009, page 3468
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

3. Apparatus according to claim 1 or 2, **characterised in that** said predetermined configurations comprise the fixed activation of at least one first emitter element (16a, 16b) and the fixed or intermittent activation of at least one second emitter element (16a, 16b).

4. Apparatus according to any one of claims 2 to 3,
characterised in that said control device (12) is configured for

- activating said management device to regulate said particular operation parameter in said machine (60) as a function of said operation parameter chosen among a plurality of operation parameters;
- activating at least one emitter element (16e) during activation of said activation means (43).

5. Apparatus according to any one of claims 1 to 4, **characterised in that** the inputting of said at least one operation parameter chosen among a plurality of operation parameters is realised by means of at least one first key configured for diminishing said operation parameter and at least one second key configured for increasing said operation parameter stored in said memory means.

6. Apparatus according to any one of claims 1 to 5, **characterised in that** at least one key of said commands inputting device is configured for switching said apparatus from an operative mode, in which said keys activate the machine to supply coffee, to a programming mode, in which said keys are arranged to input at least one operation parameter chosen among a plurality of operation parameters.

7. Apparatus according to any one of claims 1 to 6, **characterised in that** said operation parameters are operation pressure values in said machine (60).

8. Apparatus according to any one of claims 1 to 7, **characterised in that** said commands inputting device (15) comprises said plurality of emitter elements (16a, 16b, 16c, 16d, 16e) and **in that** each of said keys is associated to one of said emitter elements (16a, 16b, 16c, 16d, 16e).

9. Apparatus according to any one of claims 2 to 8, **characterised in that** said control device (12) comprises

- at least one microprocessor circuit comprising program means configured for controlling said commands inputting device (15) and said plurality of emitter elements (16a, 16b, 16c, 16d, 16e).

10. Coffee machine (60) comprising at least one supplying group (62) for supplying coffee and at least one boiler (64) connected to the supplying group (62), **characterised in that** it comprises an apparatus for the regulation of operation parameters as claimed in claims 1 to 9.

11. Operating method of an apparatus for the regulation of operation parameters, in particular pressure, in a coffee machine, comprising the steps of

- inputting, by means of a plurality of keys (15a, 15b, 15c, 15d, 15e), commands for commanding operation of said machine and at least one operation parameter chosen among a plurality of operation parameters;
- storing by means of at least one control device (12) having memory means (22, 27) said operation parameter chosen among a plurality of operation parameters;

characterised in that said step of ininputting at least one operation parameter chosen among a plurality of operation parameters comprises the step of

- activating, by means of said control device (12), a plurality of light or sound emitting elements (16a, 16b, 16c, 16d, 16e) according to predetermined configurations corresponding each to an operation parameter chosen among a plurality of operation parameters and inputted through said plurality of keys (15a, 15b, 15c, 15d, 15e).

12. Method according to claim 11, **characterised in that** it comprises the steps of

- comparing, by means of said control device (12), said stored operation parameter with a particular operation parameter detected by at least one sensor (41);
- regulating, by means of activation means (43) controlled by said control device (12), said particular operation parameter in said machine (60) as a function of said stored operation parameter.

K-FEE SYSTEM GMBH, EX2009, page 3469
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

13. Method according to claim 12, **characterised in that** said step of regulating, by means of activation means (43) controlled by said control device (12), said particular operation parameter in said machine (60) comprises the steps of

- activating regulation of said particular operation parameter in said machine (60) as a function of said stored operation parameter;
- activating in intermittent way at least one emitter element (16e) during said step of activating regulation.

14. Method according to any one of claims 11 to 13, **characterised in that** said step of inputting at least one operation parameter chosen among a plurality of operation parameters comprises the step of

- activating in fixed way at least one first emitter element (16a, 16b) and in fixed or intermittent way at least one second emitter element (16a, 16b).

15. Method according to any one of claims 11 to 14, **characterised in that** said step of inputting at least one operation parameter chosen among a plurality of operation parameters comprises the step of

- inputting an operation pressure value in said machine (60).

16. Computer program product or set of computer program products directly loadable in the internal memory of at least one electronic computer and comprising software code portions arranged to perform, when the product is run on at least one electronic computer, the method according to any one of claims 11 to 15.

K-FEE SYSTEM GMBH, EX2009, page 3470
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

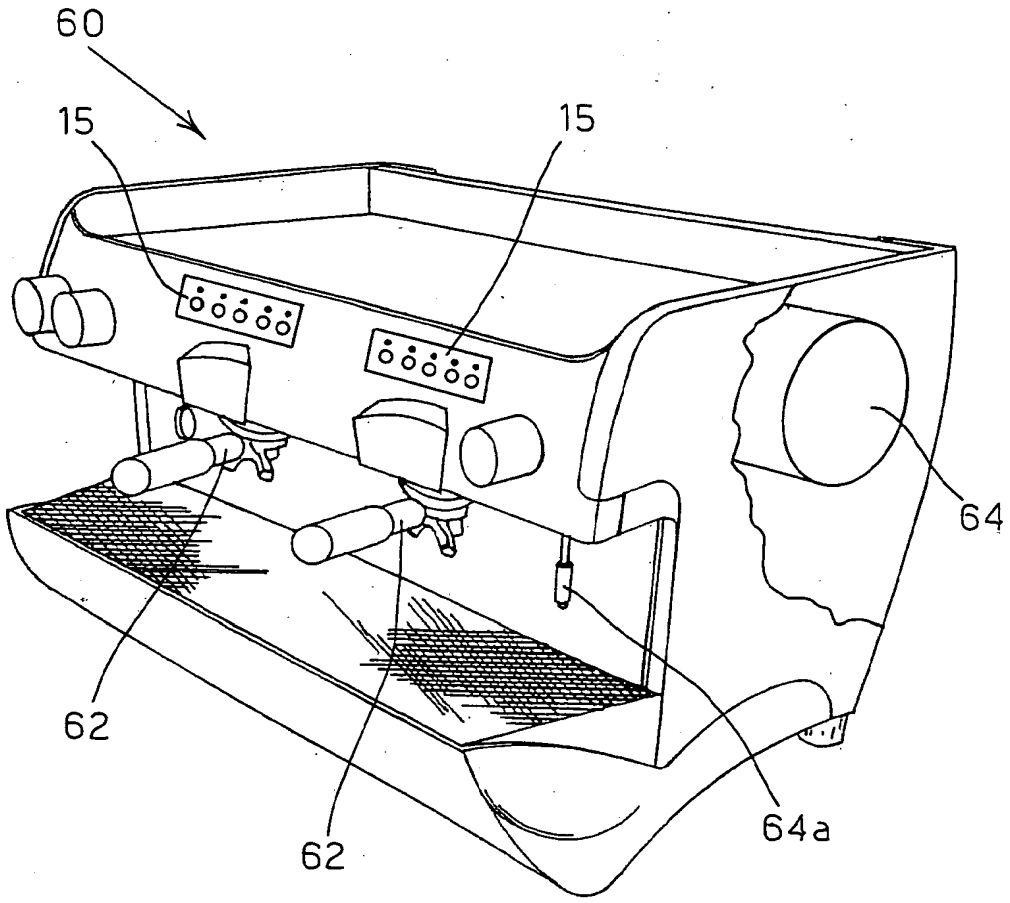


FIG. 1

K-FEE SYSTEM GMBH, EX2009, page 3471
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

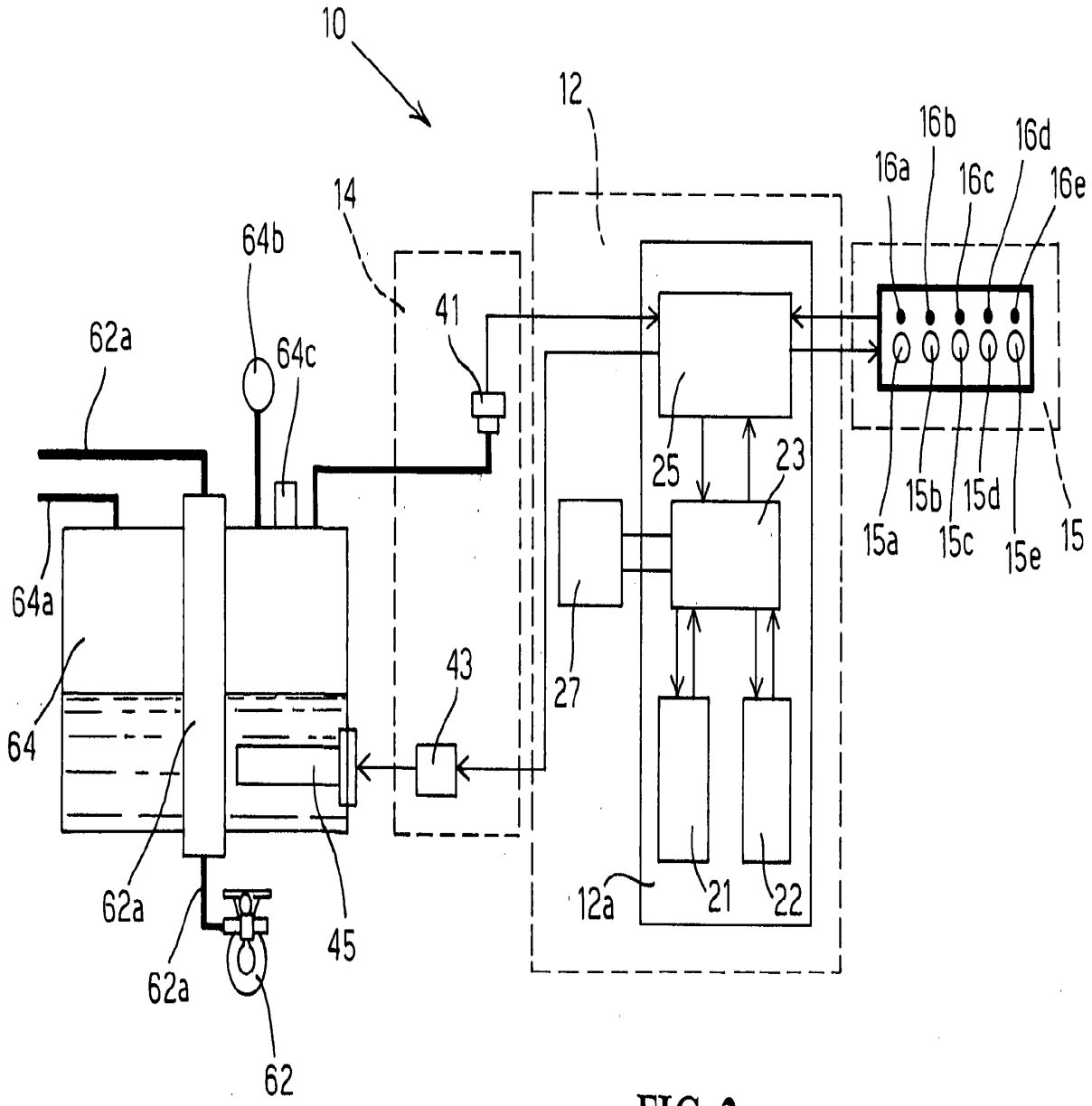


FIG. 2

K-FEE SYSTEM GMBH, EX2009, page 3472
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 42 5405

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2005/081081 A (BSH BOSCH SIEMENS HAUSGERAETE [DE]; MAASE JENS [DE]) 1 September 2005 (2005-09-01) * paragraphs [0030] - [0046]; figures 1-3 *	1-16	INV. A47J31/52
X	EP 0 328 705 A1 (SAN MARCO SPA [IT]) 23 August 1989 (1989-08-23) * column 2, line 22 - column 4, line 44; figures *	1,2, 5-12,15	
X	US 2006/021515 A1 (GRAVISS KENTON J [US] ET AL) 2 February 2006 (2006-02-02) * paragraphs [0020] - [0041] * * paragraphs [0032] - [0036]; figures *	1-4, 10-14	
X	WO 2004/036509 A2 (BUNN O MATIC CORP [US]; KNEPLER JOHN T [US]) 29 April 2004 (2004-04-29) * page 11, lines 10-22 * * page 13, lines 19-26 * * page 17, line 29 - page 37, line 1; figures *	1-16	TECHNICAL FIELDS SEARCHED (IPC) A47J
X	DE 100 35 181 C1 (HETTLER JOACHIM [DE]) 6 December 2001 (2001-12-06) * paragraphs [0033] - [0044]; claim 1; figures *	1,10,11	
A,D	EP 0 472 272 A2 (CAFFE ACORTO INC [US] ACORTO INC [US]) 26 February 1992 (1992-02-26) * page 5, line 3 - page 16, line 8; figures *	1-16	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 November 2006	De Terlizzi, Marino

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

K-FEE SYSTEM GMBH, EX2009, page 3473
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 42 5405

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-11-2006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2005081081 A	01-09-2005	DE 102004008737 A1	08-09-2005
EP 0328705 A1	23-08-1989	AT 75588 T	15-05-1992
		DE 3870851 D1	11-06-1992
US 2006021515 A1	02-02-2006	WO 2006014874 A2	09-02-2006
WO 2004036509 A2	29-04-2004	AU 2003277392 A1	04-05-2004
		CA 2501747 A1	29-04-2004
		EP 1551238 A2	13-07-2005
		MX PA05003931 A	01-07-2005
DE 10035181 C1	06-12-2001	NONE	
EP 0472272 A2	26-02-1992	AT 142447 T	15-09-1996
		CA 2045319 A1	26-12-1991
		DE 69122012 D1	17-10-1996
		DE 69122012 T2	10-04-1997
		ES 2091874 T3	16-11-1996
		JP 2908072 B2	21-06-1999
		JP 6022856 A	01-02-1994
		US 5509349 A	23-04-1996
		US 5207148 A	04-05-1993

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

K-FEE SYSTEM GMBH, EX2009, page 3474
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 0472272 A2 **[0005]**
- US 5072660 A **[0006]**

K-FEE SYSTEM GMBH, EX2009, page 3475
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Espacenet

Bibliographic data: JPH02108873 (U) — 1990-08-29

No title available

Inventor(s):

Applicant(s):

Classification:	**- international:** ***B65D51/24;*** (IPC1-7): B65D51/24
	- cooperative:
Application number:	JP19890015643U 19890213
Priority number(s):	JP19890015643U 19890213

Abstract not available for JPH02108873 (U)

K-FEE SYSTEM GMBH, EX2009, page 3476
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

⑲日本国特許庁（JP）　⑪実用新案出願公開

⑫公開実用新案公報（U）　平2−108873

⑤Int. Cl.⁵	識別記号	庁内整理番号	㊸公開　平成2年(1990)8月29日
B 65 D 51/24		D 6929−3E	

審査請求　有　請求項の数 3　（全3頁）

⑤④考案の名称　容器内の内容物を触覚的に識別する装置

㉑実　願　平1−15643
㉒出　願　平1(1989)2月13日

⑦②考 案 者　金子　昭伯　愛知県西尾市下町下山5番地
⑦①出 願 人　金子　昭伯　愛知県西尾市下町下山5番地
⑦④代 理 人　弁理士　竹中　一宣

⑤⑦実用新案登録請求の範囲

① 流体、粉体、顆粒等の粉流体形態をなす調味料、その他清流飲料水、コーヒー等の食料品が収納されている容器本体と、この容器本体に設けられる蓋体又はキャップとで構成される容器又は缶、瓶等の容器であつて、この蓋体並びにキャップに容器内の内容物を識別できる凹状及び／又は凸状又は凹凸状の組合せ等で形成される触覚的な記号が、瞬時に判断できる蓋体又はキャップのほぼ中央部の位置等に設けられている容器内の内容物を触覚的に識別する装置。

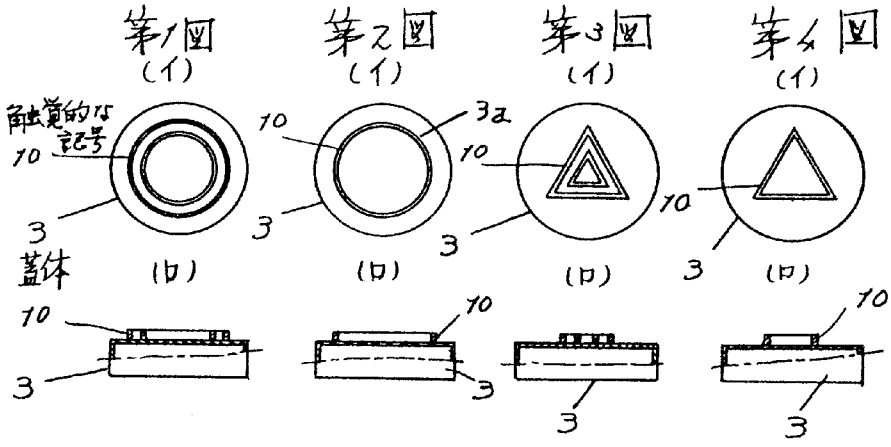
② 流体、粉体、顆粒等の粉流体形態をなす調味料、その他清流飲料水、コーヒー等の食料品が収納されている缶、瓶等の容器であつて、この容器の容器本体側に容器内の内容物を識別できる凹状及び／又は凸状又は凹凸状の組合せ等で形成される触覚的な記号が設けられ、かつこの触覚的な記号の上方が蓋側に向くように設けられている容器内の内容物を触覚的に識別する装置。

③ 触覚的な記号が、全国的に統一された触覚的な記号となつている実用新案登録請求の範囲第1項、第2項又は第3項記載の容器内の内容物を触覚的に識別する装置。

図面の簡単な説明

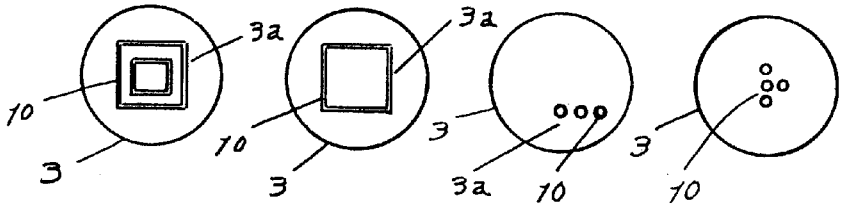
図面は本考案の一例を示すものであり、第1図イ～第4図イはそれぞれ一例を示す平面図、同ロはそれぞれ側面視した要部の一部を切り欠いた断面図、第5図～第10図はその他の一例の平面図、第11図、第12図は斜視図、第13図～第15図はアルミ缶の容器一例をそれぞれ示す斜視図、第16図～第18図は一升瓶等の容器一例をそれぞれ斜視図、第19図イ～オは凸状の触覚的な記号のその他の例を示す平面図である。

1：容器、2：容器本体、3：蓋体、3a：ほぼ中央部、4：容器本体側、5：蓋側、6：キャップ、6a：ほぼ中央部、8：飲み口、10，20，30：触覚的な記号。

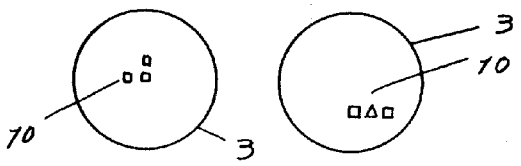


K-FEE SYSTEM GMBH, EX2009, page 3477
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

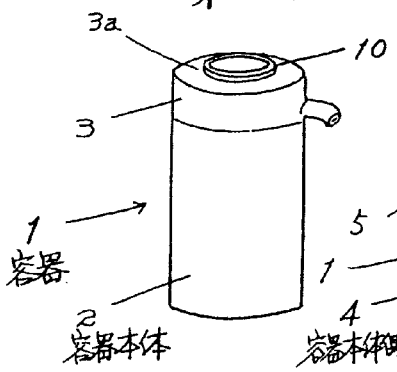
第5図　第6図　第7図　第8図



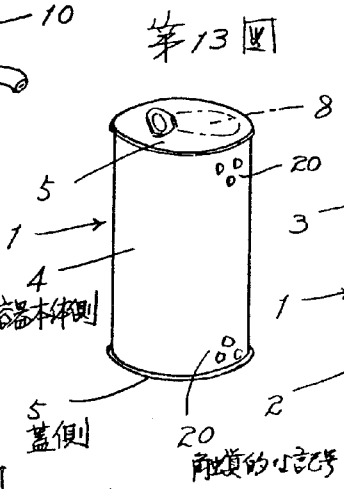
第9図　第10図



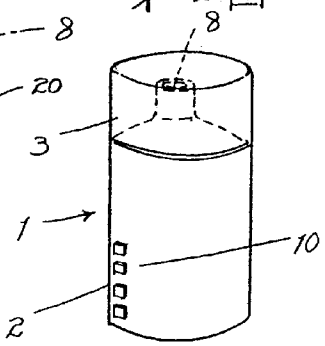
第11図



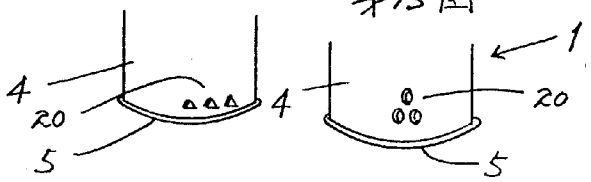
第13図



第12図

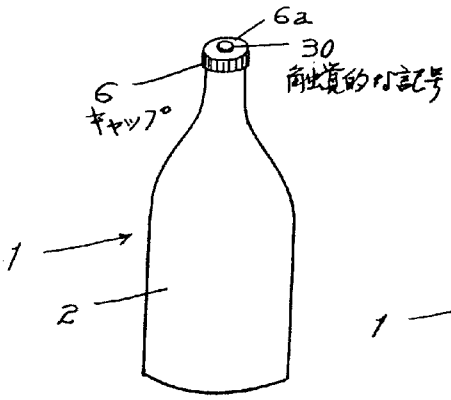


第14図　第15図

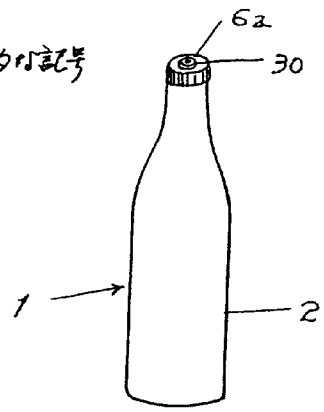


K-FEE SYSTEM GMBH, EX2009, page 3478
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

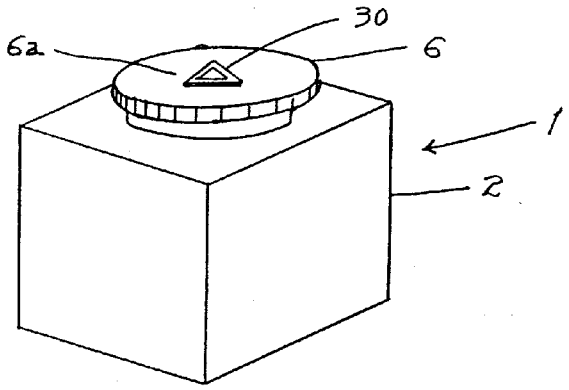
第16図



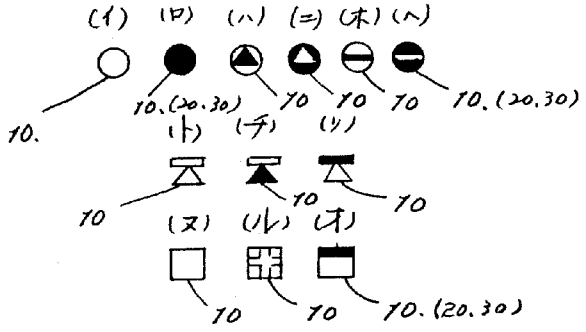
第17図



第18図



第19図



K-FEE SYSTEM GMBH, EX2009, page 3479
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Espacenet

Bibliographic data: JPS6248878 (B2) — 1987-10-15

CONTAINER CODE IDENTIFYING METHOD

Inventor(s): KURIBAYASHI YUKIYOSHI, ; KURIBAYASHI YUKYOSHI

Applicant(s): TOUYOU GLASS KK, ; TOYO GLASS CO LTD

Classification: - international: ***B07C3/18; B07C5/342; B65G47/48; B65G47/49; G06K19/00; G06K7/10***
- cooperative: **G06K7/10861**; B65G2201/0244

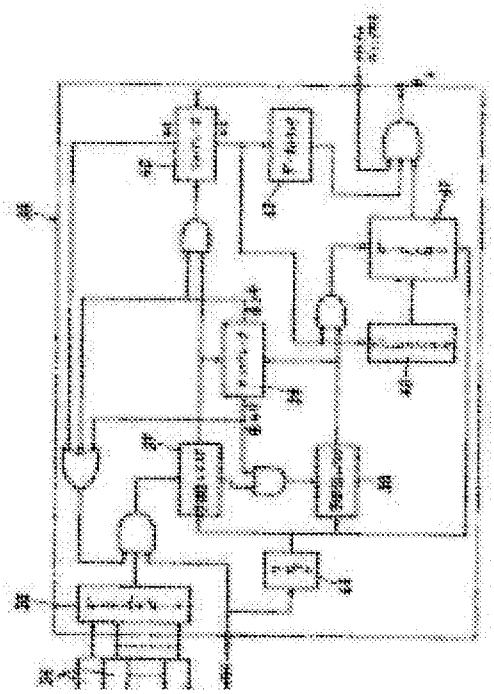
Application number: JP19830066320 19830416

Priority number (s): JP19830066320 19830416

Also published as: JPS59191676 (A)

Abstract of JPS59191676 (A)

PURPOSE:To detect and identify accurately a code despite of the revolving speed of a container by arraying the digitized marks on a circular track on the outer surface of the container with the patterns different from each other in the direction orthogonal to said circular track and then detecting those marks. CONSTITUTION:Two long and short code marks are put on a glass bottle at the lower edge part of the outer circumferential surface of the body part of the bottle orthogonally to the circular track of the outer circumferential surface of a container. When this bottle is positioned at the 1st check point, an input timing signal is fed to a microcomputer 35. Therefore the code read data is fed via a data input port 36 and stored first to a



K-FEE SYSTEM GMBH EX2009, page 3480
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923



present value register 37.; The contents of the register 37 are compared with those of a preceding value register 38 through a comparator 39 and then stored successively to a data memory 41. This procedure is repeated 10 times to obtain a 10-bit code with 10 marks. Owing to this 10-bit code data, the code can be detected and identified accurately despite the variation of revolving speed of the glass bottle.

K-FEE SYSTEM GMBH, EX2009, page 3481
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

⑲日本国特許庁（JP）　⑪特許出願公告

⑫特許公報（B2）　昭62－48878

⑤1Int.Cl.⁴	識別記号	庁内整理番号	㉔㊹公告 昭和62年(1987)10月15日
G 06 K 7/10		V－2116－5B	
B 65 G 47/48		7820－3F	
G 06 K 7/10		T－2116－5B	発明の数 1 （全12頁）

⑤4発明の名称　容器符号識別方法

㉑特　願　昭58－66320　　⑥5公　開　昭59－191676
㉒出　願　昭58(1983)4月16日　　㊸昭59(1984)10月30日

⑦2発明者　栗林　征喜　横浜市戸塚区名瀬町377番地　エミネンス東戸塚107号
⑦1出願人　東洋ガラス株式会社　東京都千代田区内幸町一丁目3番1号
⑦4代理人　弁理士　原田　信市
審査官　吉見　信明

1

⑤7特許請求の範囲

1　容器の外面の円軌道上に、その円軌道と直交する方向に長さを異ならせることによつて符号化したm個のマークを、ノーマーク区間を介在させて設け、容器を回転させつつその外面に光を照射し、その反射光を、上記直交する方向に並列するn個の光電変換素子でnビツトの並列2進電気信号として同時に検知することにより、各マークの長短に応じたデジタルデータ及びノーマーク区間に対応するデジタルデータをえ、その各デジタルデータの内容からマーク区間であるかノーマーク区間であるかの判定を行うとともに、前回のデジタルデータと今回のデジタルデータとの大小を比較することにより、マーク区間とノーマーク区間とが交互になつているか否かを判定し、交互になつていたときにマーク区間に対応するデジタルデータのみを取り出し、それをm回行うことによつて識別符号をうることを特徴とする容器符号識別方法。

2　マークを円軌道と直交する方向の長さの長短によつてデジタル化してなる特許請求の範囲第1項に記載の容器符号識別方法。

3　マークをドツトパターンにし、そのドツトパターンの数の違いによつてデジタル化してなる特許請求の範囲第1項に記載の容器符号識別方法。

4　マークをセグメントパターンにし、そのセグメントパターンの数の違いによつてデジタル化してなる特許請求の範囲第1項に記載の容器符号識別方法。

2

発明の詳細な説明

本発明は、ガラスびん等の容器の外面にその型番、製造年月日などを表すコードマークを付しておき、このコードマークを光電検知して符号（コード）の識別を行う容器符号識別方法に関する。

このような容器符号識別方法として、本出願人は特開昭56－57171号公報に記載のものを既に提供している。

これを第1，2図によつて概説すると、符号識別しようとするガラスびん1の底面2には、コードマークとして細長い凸部3……が成形時に形成されている。

これら凸部3……はガラスびん1の軸線を中心とする円軌道Rに沿つて配列し、全体として2値論理コード体系になつている。

すなわち、そのコードは、底面2上にその中心より一定の位相差をもつて放射する放射等分線P……を仮想し、これら放射等分線P……上に凸部3を形成するかしないかによつて体系づけられている。

ガラスびん1はゲージングプレート4の検出口5上に1個ずつ送られ、ここで静止したままロータリスキヤナ6によつて底面2を円軌道Rに沿い光学走査（第2図矢印方向）される。

ロータリスキヤナ6は、底面2を照射する投光器7とその反射光を受光する受光器8とを備え、モータ9によつて常時回転せられている。

ロータリスキヤナ6への電源供給はロータリトランス10によつて行われる。

K-FEE SYSTEM GMBH, EX2009, page 3482
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

受光器8は1個の光電変換素子を有し、その出力はフオトアイソレータ11を構成する投光器12と受光器13によつて改めて光電変換され、外部の符号変換回路へ入力される。

ロータリスキヤナ6と同時にロータリエンコーダ14が回転してクロツクパルスが出力され、同じく符号変換回路へ入力される。

符号変換回路は、受光器13の出力を上記放射等分線P……の等分角度に対応する間隔でサンプリングする。

これによつて凸部3……のあるなしに応じた2進電気信号がえられ、それがマイクロコンピユータによつて解析され、最終的に符号が識別される。

本出願人が先きに提供した方法はこのような構成になつているものであるが、これによると次のような欠点がある。

(1) マーク（凸部）のあるなしをロータリスキヤナの回転によつて旋回走査するので、回転するロータリスキヤナへの電源供給に、可動部と固定部とを有する複雑な電源供給手段（ロータリトランス）を必要とする。

(2) このような電源供給手段は概して電圧ノイズを発生し易く、これがもとで誤検知を招くことがしばしばある。

(3) 投光器とともに受光器も回転するので、その受光器の出力を外部へ取り出すにも特別の手段（フオトアイソレータ）を必要とする。

(4) 各種ガラスびんのなかには底面に凸部を形成することが好ましくないものがあり、そのようなものの場合にはその胴部の外周面に凸部を形成することになる。このようなガラスびんに対し、それを静止しておいてその胴部外周面を走査するという方法を採るとなると、投光器と受光器とがガラスびんの周りを旋回する構成にしなければならず、その旋回作動に複雑な機構を必要とする。

ガラスびんを静止しておいて旋回走査するという方法はこのような欠点があることから、これを解消するものとして本出願人は、実開昭56－83858号公報に記載のものを別途提供している。

これを第3，4図によつて概設すると、ガラスびん1′の胴部の外周面の下端部（いわゆる裾部）に、第1，2図に示したものと同じ原理で細長い凸部3′……が形成されている。

ガラスびん1′は、モータ15によつて回転されるターンテーブル16上に倒れないように載置され、矢印方向に回転せられる。

このように回転するガラスびん1′の裾部の凸部のあるなしは、一定の位置に固定したセンサ17によつて検知される。

センサ17は、第4図に示すようにガラスびん1′の裾部を照射する投光器18とその反射光を受光する受光器19とを内蔵している。

受光器19は1個の光電変換素子を有し、その光電変換素子の出力は、ターンテーブル16と同時回転するロータリエンコーダ20よりのクロツクパルスにもとづいてサンプリングされ、以下第1，2図に示したものと同様にして符号が識別される。

しかし、この第3，4図に示す方法の場合には、

(a) ガラスびんとそれを回転させる手段（ターンテーブル）とがスリツプすると、放射等分線P……の等分角度とロータリエンコーダ20のクロツクパルスにもとづくサンプリング間隔とにずれが生じ、誤検知する、

という欠点がある。

さらに、特開昭53－1047号公報に開示されているように、ガラスびんの外周面に、コードマークとそれを読み取るためのタイミングマークとを上下に設け、しかもその両端のタイミングマークを、コードマーク読み取り開始用の始動信号と終了用の終了信号として機能させ、これらコードマークとタイミングマーク、さらに始動信号及び終了信号となるマークを、それぞれに対応するフオトダイオードで別々に検知し、タイミングマークを検知してタイミングパルスをえながらコードマークの検知にかかる信号をサンプリングするものもある。

しかし、この方法によると次のような欠点がある。

(A) コードマーク及びタイミングマークを読み取るための上下に配置されたフオトダイオードの他に、その横にさらに始動信号または終了信号を検知するためのフオトダイオードが別に必要で、検知構造が複雑となる。

(B) コードマークの他に、タイミングマーク、さ

K-FEE SYSTEM GMBH, EX2009, page 3483
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

らに始動用信号及び終了信号となるマークが必要である。

(C)　コードマークとタイミングマークとを別々に検知する動作が必要なため、装置が複雑になりやすい。

本発明の目的は、上記(1)～(4)に示したような欠点がないのはもちろん、(a)さらに(A)～(C)に示したような欠点もなく、しかも上述した従来の３つの方法では必要であつたロータリエンコーダやサンプリング回路等を省略することができる容器符号識別方法を提供することである。

このような目的を達成するため、本発明は、容器の外面の円軌道上に、その円軌道と直交する方向に長さを異ならせることによつて符号化したm個のマークを、ノーマーク区間を介在させて設け、容器を回転させつつその外面に光を照射し、その反射光を、上記直交する方向に並列するn個の光電変換素子でnビットの並列２進電気信号として同時に検知することにより、各マークの長短に応じたデジタルデータ及びノーマーク区間に対応するデジタルデータをえ、その各デジタルデータの内容からマーク区間であるかノーマーク区間であるかの判定を行うとともに、前回のデジタルデータと今回のデジタルデータとの大小を比較することにより、マーク区間とノーマーク区間とが交互になつているか否かを判定し、交互になつていたときにマーク区間に対応するデジタルデータのみを取り出し、それをm回行うことによつて識別符号をうることを特徴とする。

以下には本発明の実施例を第５～１４図を参照に詳細に説明する。

第５図に示すように、コンベヤ２１によつて１列にではあるがランダムに送られてきたガラスびんB……は搬入バイパス２２へ導かれ、ここにおいてフイードウオーム２３によつて一定の間隔に整列されたのち検査ステーションCSへ送り込まれる。

ここへ送り込まれたガラスびんは、間欠回転するスターホイール２４に嵌合捕捉され、これによつて間欠的に回送されて先ず第１検査ポジションCP_1において本発明方法により型番を検査され、次いで第２検査ポジションCP_2、次に第３検査ポジションCP_3においてそれぞれ所定の欠陥検査を受ける。

このような検査を受けた結果、良品とされたガラスびんは搬出バイパス２５に導入され、これを通じて再びコンベヤ２１上に乗載して他所へ搬送される。

一方、不良品とされたガラスびんは排除ポジションDPまで回送されて排除される。

本発明方法を実施する第１検査ポジションCP_1の詳細は第６図に示されている。

ガラスびんBは、スターホイール２４の上下の円板２４ａ，２４ｂのびん受口２６ａ，２６ｂに嵌合することによつてこれに捕捉され、このスターホイール２４が間欠回転することによりゲージングプレート２７上に乗載したまま一定時間だけ同図に示す位置に保留せられる。

この位置には、びんドライブホイール２８が軸架されているとともに、投光器２９及び受光器３０が架設されている。

びんドライブホイール２８は常時回転しており、上記のように一定時間だけ保留されるガラスびんBはこのびんドライブホイール２８によつて少なくとも１回転せられる。

ガラスびんBの胴部の外周面下端部（裾部）には、長短２様の凸部によるコードマークが次のようなコード体系にして付されている。

なお、以下には長い方の凸部を長マーク、短に方の凸部を短マークと称し、長マークを符号M_1で、短マークを符号M_0で表す。また、これら長短両マークを総称する場合には単にマークという。

長マークM_1と短マークM_0は、第７図に詳しく示すように幅員が同じでいずれもガラスびんBの軸線方向に細長くなつているが、長マークM_1は短マークM_0よりも上側に２倍長くなつていて、この長短の違いによつてデジタル化されている。

因みに、長マークM_1を２進数の「１」とすると短マークM_0は「０」となる。

ガラスびん１本あたりのマーク総数mは決められており、本例の場合は10個になつている。

10個のマークは、ガラスびんの外周面上を円周方向（円軌道）に一定のピツチで一列に（従つて互いに平行に）配列し、全体として10ビットの２進コード体系になつている。

従つて、第６図に示したガラスびんの場合には、そのマーク配列を反時計方向に見ると、「短

K-FEE SYSTEM GMBH, EX2009, page 3484
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

短短長長短短長短短」になつているので、「0001100100」の体系になつていることになる。

投光器29は、ゲージングプレート27の下方よりその窓孔31を透してガラスびんの裾部を照射する。この光線の照射エリアLA（第7図）は、1個の長マークM_1の全体を照射するに充分な大きさになつている。

受光器30は、ガラスびんを反射した反射光線を前面において受光すべくゲージングプレート27の上方に設置されている。

この受光器30の前面には、第7図に簡略化して示す複素子形フオトセンサ32が取り付けられている。

フオトセンサ32は、マークの長手方向に一定のピツチで配列するn個、本例の場合8個の光電変換素子33……と、これらよりの電気信号を増幅及び波形整形する回路（後述する）を実装したワンチツプ構造になつている。

これら8個の光電変換素子33……とマークとは、8個の光電変換素子全部で長マークM_1を検知し、下側半分の4個の光電変換素子で短マークM_0を検知する対応関係になつている。

すなわち、マークのない部分（凸部のない平坦部）を反射した光線はいずれの光電変換素子にも入光しないようになつているのに対し、長マークM_1を反射した光線は、下側から数えて1番目より8番目までの全光電変換素子に入光し、また短マークM_0を反射した光線は、1番目より4番目までの4個の光電変換素子に入光するようになつている。

従つて、各光電変換素子33の出力は第9図に示すようにマークがあるとHレベル、マークがないとLレベルになり、長マークM_1の場合には1番目より8番目までの全光電変換素子の出力がHレベル、短マークM_0の場合には1番目より4番目までの4個の光電変換素子の出力がHレベルになるもので、以下にはマークのない区間をスペースという。

なお、長マークM_1であつても、1番目から8番目までの8個の光電変換素子の出力が全てHレベルにならないときもあり、また短マークM_0であつても、1番目から4番目までの4個の光電変換素子の出力が全てHレベルにならないときもあり、さらに長マークM_1及び短マークM_0の長さも成形の関係上規定長さよりも短かくなつている場合もあり得るもので、8個の光電変換素子の出力による長マークM_1と短マークM_0の後述するような伴定は、所要の許容度をもつて行われるようになつている。

8個の光電変換素子33……の出力は、第8図に示す8個の増幅及び比較回路34……によつてそれぞれ増幅されたのち基準電圧と比較され、第9図に示すようにマークのあるなしに応じた2進電気信号となつてフオトセンサ32の各出力端子より出力される。

従つて、このようにして出力される電気信号は、光電変換素子個々にはマークのあるなしに応じた直列2進電気信号となり、8個の光電変換素子全体としては8ビツトの並列2進電気信号となる。

この8ビツトの並列2進電気信号はマイクロコンピユータ35にインプツトされ、これによつてリアルタイムでデジタル処理されるもので、次にはそのデジタル処理について第10図のフローチヤートを適宜参照しつつ説明する。

なお、マイクロコンピユータ35にインプツトされた8ビツトの並列2進電気信号を16進数で表すと、第9図に示すように長マークM_1が「FF」、短マークM_0が「0F」、スペースが「00」となるが、マイクロコンピユータ35内においては後述するようにマークとスペースが交互になつているかどうかの判定が行われたあと、長短両マークM_1，M_0に対応するもので符号の識別が行われるもので、以下においては便宜上、インプツトされた8ビツトの並列2進電気信号のうちマーク区間（長マークM_1及び短マークM_0）に対応するものをデータX、スペース区間に対応するものをデータYという。また、これらX，Yを総称する場合には単にデータという。

上述のようにガラスびんBが第1検査ポジションCP_1に位置決めされると、マイクロコンピユータ35にインプツトタイミング信号が入る。

このインプツトタイミング信号が入つていることが判定（第10図ステツプ100）されると、データ入力ポート36を通じてデータがインプツト（ステツプ101）される。

このインプツトされたデータ（XあるいはY）は先ず今回値レジスタ37にストアされ、前回値

K-FEE SYSTEM GMBH, EX2009, page 3485
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

レジスタ３８の内容とコンパレータ３９によつて比較（ステツプ102）される。

コンパレータ３９は両レジスタ３７，３８の内容の大小を比較、つまり前回値＞今回値であるか前回値≦今回値であるかを判定する。

最初は前回値レジスタ３８の内容が10進数にして０（16進数で00）になつているので、今回値レジスタ３７にストアされたデータがX，Yいずれであつてもそれは前回値レジスタ３８にロードされる。

このようにしてロードされると、新たなデータがインプツトされて今回値レジスタ３７にストアされ、コンパレータ３９によつて同様に比較される。

ここに前回値＜今回値であると、つまり前回値レジスタ３８の内容がデータY、今回値レジスタ３７の内容がデータXであると、再び同様のことが行われる。すなわち、前回値レジスタ３８の内容がデータXになるまでステツプ101及び102が繰り返される。

前回値＞今回値になると、新たにインプツト（ステツプ103）されて今回値レジスタ３７にストアされたデータは０であるか否か、つまりデータYであるか否かがコンパレータ４０によつて判定（ステツプ104）される。

データYであると、前回値レジスタ３８の内容、つまりデータXがデータメモリ４１にロード（ステツプ105）され、その決められた記憶番地、すなわちアドレスコントローラ４２が指定する記憶番地に記憶される。

また、これと同時にアドレスコントローラ４２の指定番地がインクリメント（ステツプ106）されるとともに、データカウンタ４３もインクリメント（ステツプ107）される。

このデータカウンタ４３のカウントアツプ数はガラスびん１本あたりのマーク総数mに対応させてある。本例の場合その数を「10」に設定してあり、上記一連のステツプ101～107はこのデータカウンタ４３が「10」になるまで（ステツプ108）繰り返される。

この一連のステツプ101～107の要約すると、先ずステツプ101と102によつてデータXが検出され、次いでステツプ103と104によつてデータYが検出されるとステツプ105によつてデータXがデータメモリ４１に記憶され、そしてこのようなことが10回繰り返されて10個のマークに係るデータXがデータメモリ４１に順次記憶される。

換言すると、マイクロコンピユータ３５は、データがインプツトされるつどそれがマークであるかスペースであるかの判定及びそれが交互になつているかどうかの判定を行い、交互になつていたときマークに係るデータのみを取り出してデータメモリ４１の定められた記憶番地に順次記憶し、このようなことを10回だけ行うことによつて結果的に10個のマークによる10ビツトの符号データをえているものである。

従つて、長マークM_1を２進数の「１」、短マークM_0を「０」とすると、第６図に示したガラスびんBの場合には、第９図の最下段に示すように「0001100100」（10進数で表すと200）の符号データが最終的にえられる。この符号データは、ガラスびんBとびんドライブホイール２８とがスリツプしてガラスびんBの回転速度が変動しても、その変動に関係なく的確にえられること明らかである。

なお、第１検査ポジションCP_1に位置決めされたときのガラスびんBの円周方向の向きはランダムで、マイクロコンピユータ３５に最初にインプツトされるデータは、ガラスびんの円周方向のどの位置のものであるか定まつていなく、データXのインプツト順位はランダムであるが、最終的にえられる符号データは、マークの配列順序に合うようにそのビツト配列（MSBからLSBまでの順序）を整列されるようになつている。

このようにしてえられた符号データ（すなわち型番）は、マイクロコンピユータ３５に外部よりアウトプツトタイミング信号が入力（ステツプ109）されたときにアウトプツト（ステツプ110）される。

このアウトプツトされたデータは例えばプリンタに入力されてプリントアウトされ、あるいはホストコンピユータに送られてこれによつて総合的なデータ処理をされる。

以上のような一連の動作を行つている間入力されていた前記のインプツトタイミング信号がなくなると、リセツト回路４４によつてレジスタ３７，３８及びデータメモリ４１がリセツトされ、初期状態に戻つて次のガラスびんについて上記と

K-FEE SYSTEM GMBH, EX2009, page 3486
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

同様のことが行われる。

上述した実施例では、マークを一本の連続した長マークM_1と短マークM_0とによつてデジタル化（符号化）したが、マークは必ずしも連続していなくとも、光電変換素子３３……によつて検知される部分のみ実質的にマークになつていれば、上記と同様に長短によるデジタル化が行える。例えば、第１１図に示すように上記短マークM_0のようなパターンのものを１個のマークセグメントM′とし、その数の違い、すなわち２進数の「１」に対応するものをマークセグメント２個、「０」に対応するものをマークセグメント１個としてデジタル化してもよい。

また、第１２図及び第１３図に示すようにマークをドットパターンM″で構成し、その数の違いによつてデジタル化してもよい。

マーク１個を構成するドットパターンの個数が少ない場合には、第１３図に示すようにドットパターン１個に対して複数の光電変換素子３３……を対応させ、そのうちの１つでもHレベルになればこれはドットパターンであるとする判定方法を採れば、誤検知を少なくできる。

さらに、このようなマークとしては必ずしも凸状である必要はなく、光の反射によつて光学検知できるものであればどのような態様でもよい。

さらにまた、上述した実施例においては、マークとスペースの検知を、前者の反射光だけが光電変換素子に入光し後者の反射光は入光しないようにすることによつて行つたが、これとは逆の関係にして検知してもよく、また両者の反射率を異ならせておいていずれも光電変換素子に入光するようにし、その反射率の相違にもとづく電圧レベルの違いによつて検知するようにしてもよい。

また、第１４図に示すようにガラスびんBの底面B′の円周方向（円軌道上）に、マーク、例えば半径方向に細長い長マークM_1及び短マークM_0を付し、これら両マークを半径方向に配列した光電変換素子３３……で検知するようにしてもよい。

さらに、本発明方法はガラスびん以外の他の容器、また型番以外の他の符号の識別にも適用できること上記より明らかである。

以上述べた通り本発明によれば次のような効果がある。

① 容器の円軌道と直交する方向に並列するｎ個の光電変換素子で、ｍ個のマークの長さを順次デジタルデータとして検知しながら、前回のデジタルデータと今回のデジタルデータとの大小を比較することにより、マーク区間とノーマーク区間とが交互になつているか否かを判定し、交互になつていたときにマーク区間に対応するデジタルデータのみを取り出し、それをｍ回行うことによつて識別符号をうるため、容器の回転に応じたタイミングパルスやサンプリングパルスが不要であるばかりでなく、マークを計数するカウンタ等も不要で、検知回路構成を簡素にできる。

② マークを等間隔に配置する必要はなく、その配設に特別の配慮がいらない。

③ マークをいわばパターンで検知することになるので、マークを計数しなくともよい。

④ １個の光電変換素子よりの電気信号を容器の回転速度に応じてサンプリングして２進電気信号とする従来の方法のように、容器の回転速度の変動によつて誤検知を招くというようなことはなく、容器の回転速度が変動してもｍ個のマークによる符号を的確に検知及び識別できる。

⑤ 従来では必要であつたロータリエンコーダやサンプリング回路等を省略でき、経済的であるとともに、回路設計が容易である。

⑥ 符号化されたマーク以外の他のマーク、すなわちその読み取りタイミングのためのタイミングマークや読み取り開始及び終了のための特別の形態のマークは不要である。

図面の簡単な説明

図面第１，２図はガラスびんを静止しておいて旋回走査する従来例を示し、第１図はその簡略断面図、第２図はガラスびんの底面図、第３，４図はガラスびんを回転させながら検知する別の従来例を示し、第３図はその一部切欠き正面図、第４図はガラスびんとセンサの関係を示す拡大断面図、第５～１０図は本発明の一実施例を示し、第５図はガラスびんの流れを説明するための簡略平面図、第６図は要部の斜視図、第７図はマークと光電変換素子の関係を示す説明図、第８図は本発明方法に使用するマーク検知及び識別装置の一例を示すブロックダイヤグラム、第９図はそれによる信号処理過程を説明するためのタイムチャート、第１０図はその動作を説明するためのフロー

K-FEE SYSTEM GMBH, EX2009, page 3487
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

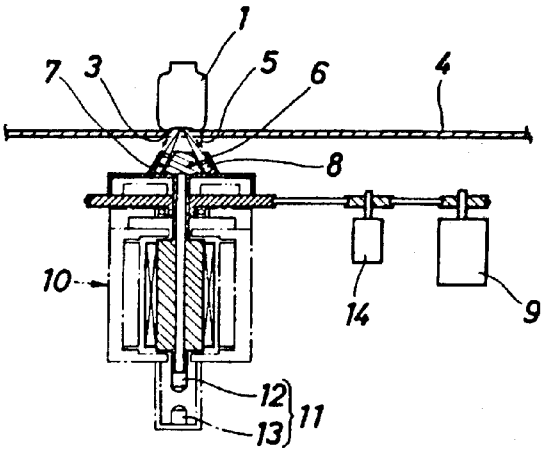
13

チャート、第１１，１２，１３図はそれぞれマークの他の例を示す説明図、第１４図はガラスびんの底面にマークを付した他の例を示すその底面図である。

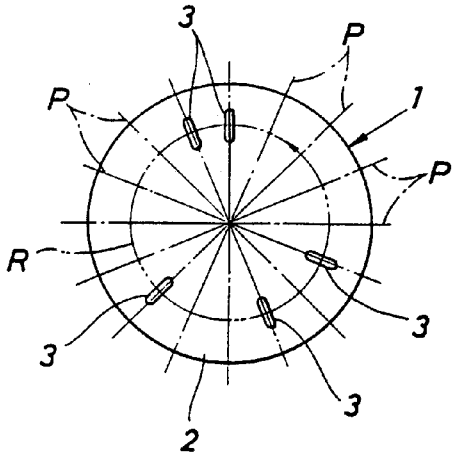
14

B……ガラスびん（容器）、M_1，M_0，M′，M″……マーク、３３……光電変換素子、３５……光電変換素子よりの電気信号をデジタル処理するマイクロコンピュータ。

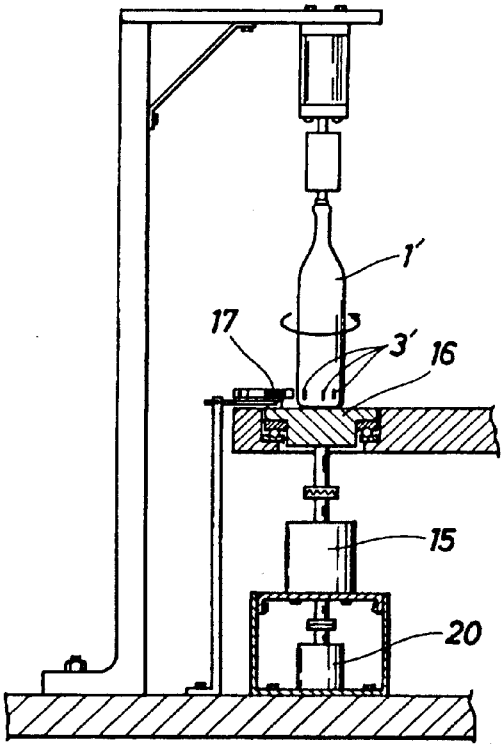
第１図



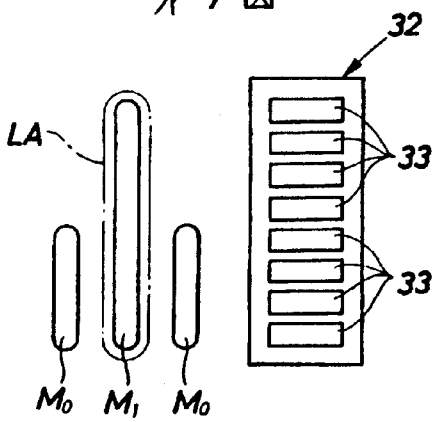
第２図



第３図

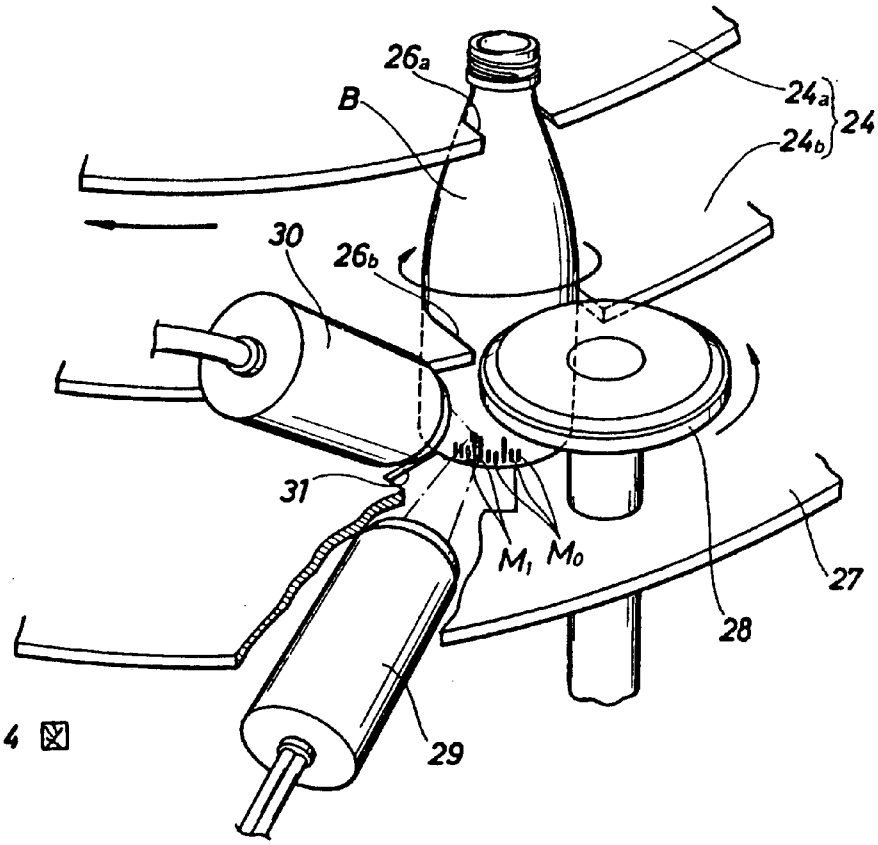


第７図

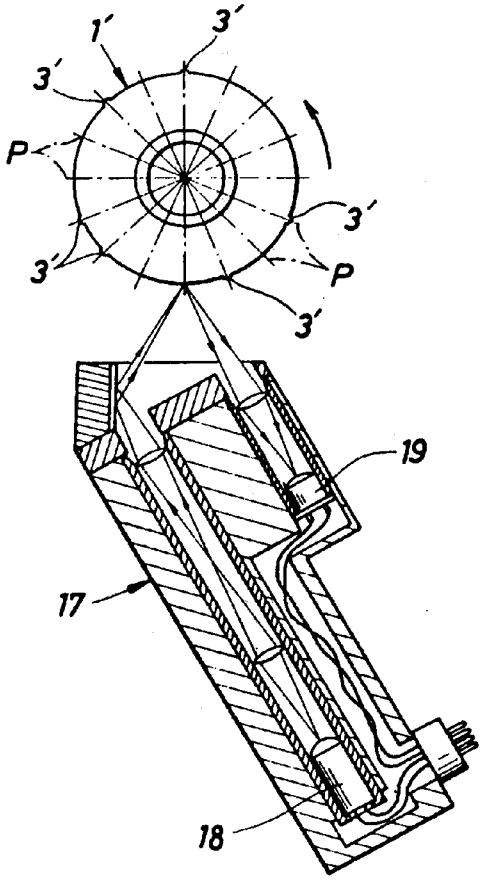


K-FEE SYSTEM GMBH, EX2009, page 3488
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

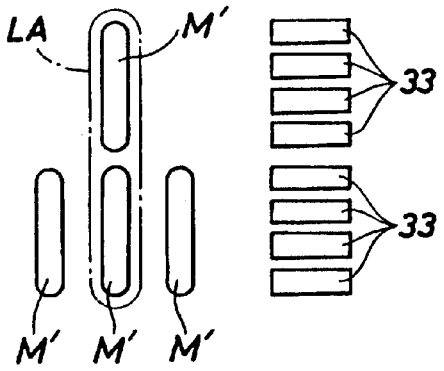
第 6 図



第 4 図

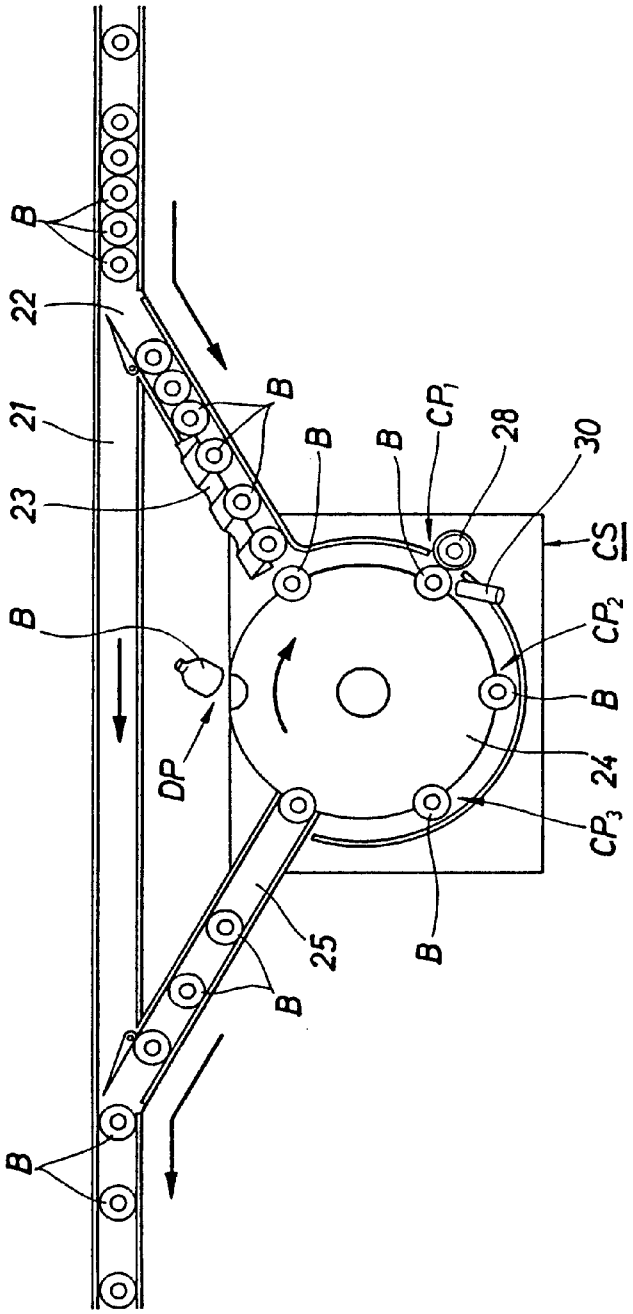


第 11 図



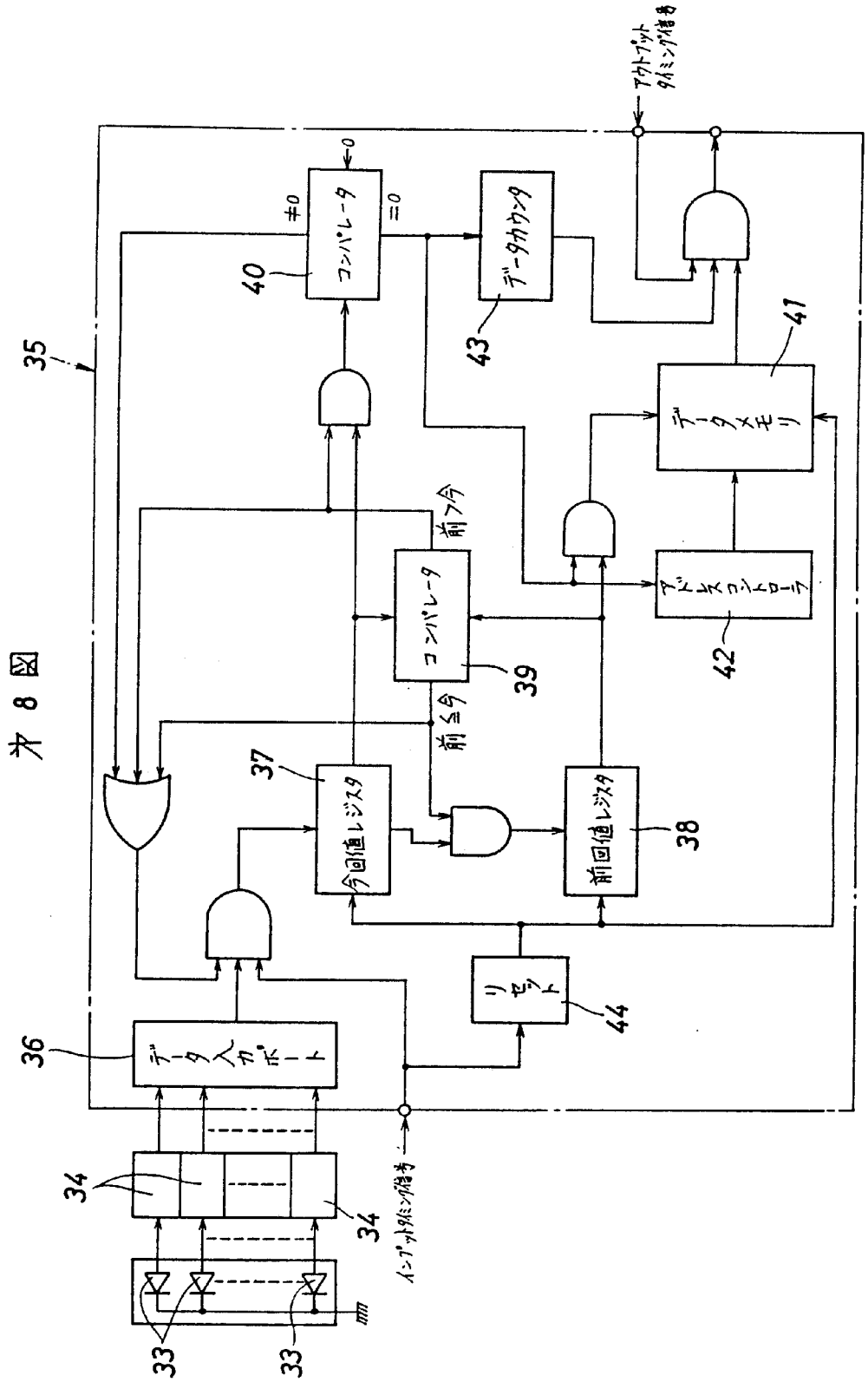
K-FEE SYSTEM GMBH, EX2009, page 3489
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

第５図



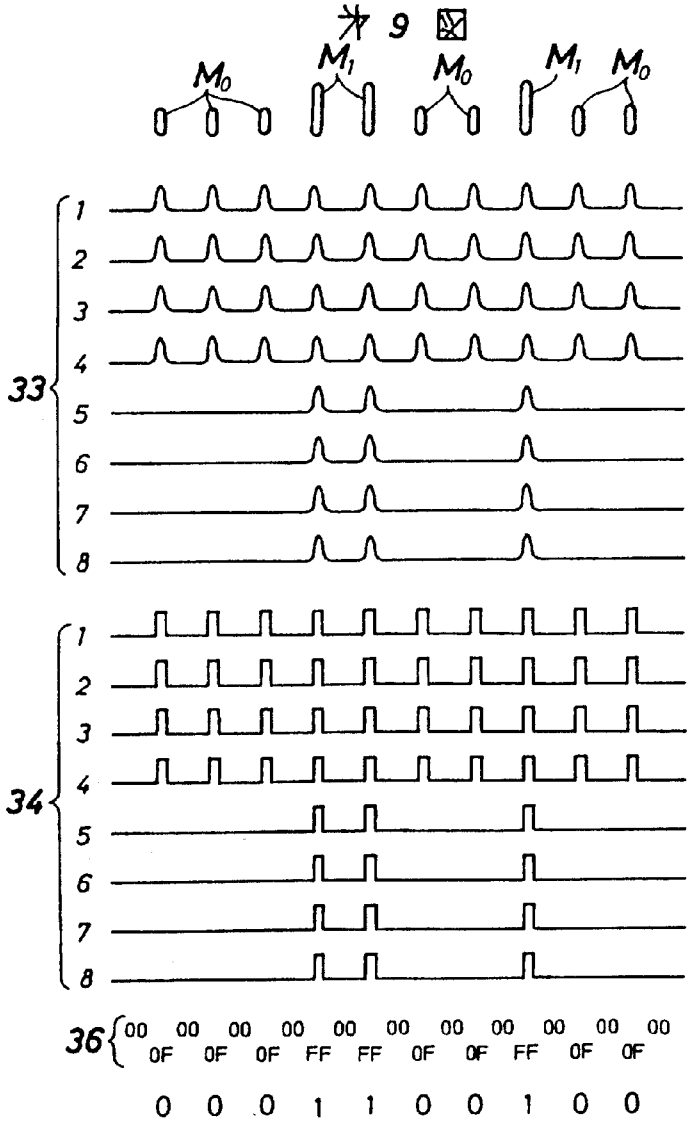
K-FEE SYSTEM GMBH, EX2009, page 3490
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

第 8 図

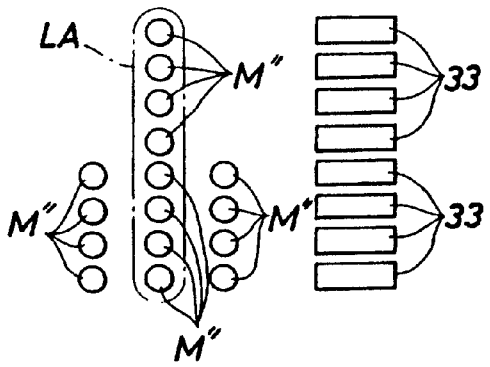


K-FEE SYSTEM GMBH, EX2009, page 3491
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

第 9 図

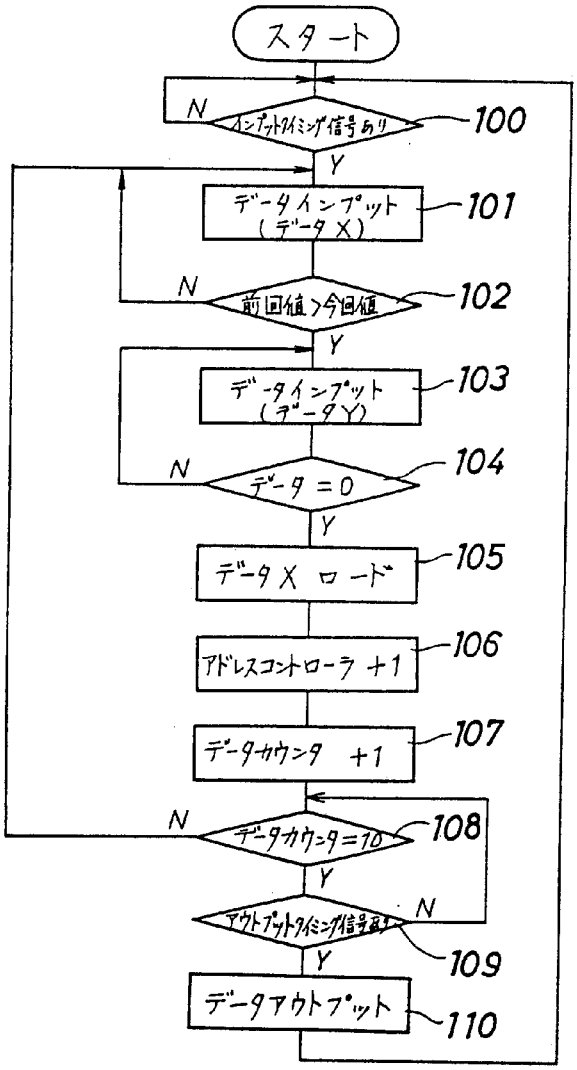


第 12 図

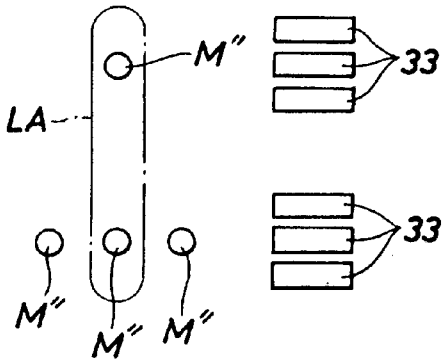


K-FEE SYSTEM GMBH, EX2009, page 3492
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

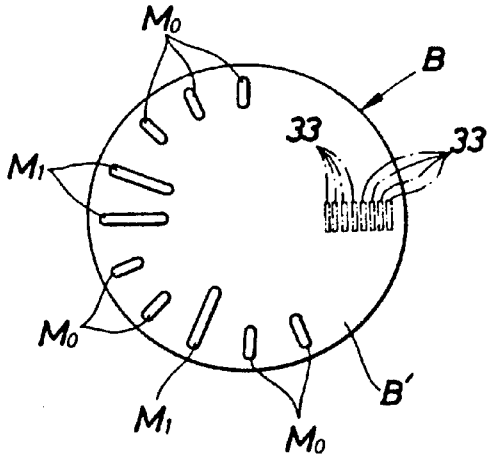
第 10 図



第 13 図



第 14 図



K-FEE SYSTEM GMBH, EX2009, page 3493
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 December 2008 (11.12.2008)

PCT

(10) International Publication Number
WO 2008/148601 A1

(51) International Patent Classification:
A47J 31/06 (2006.01) *A47J 31/22* (2006.01)

(21) International Application Number:
PCT/EP2008/054401

(22) International Filing Date: 11 April 2008 (11.04.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

07109579.8	5 June 2007 (05.06.2007)	EP
07109580.6	5 June 2007 (05.06.2007)	EP
08102148.7	29 February 2008 (29.02.2008)	EP
08102149.5	29 February 2008 (29.02.2008)	EP
08102147.9	29 February 2008 (29.02.2008)	EP

(71) Applicant *(for all designated States except US)*: **NESTEC S.A.** [CH/CH]; Avenue Nestlé 55, CH-1800 Vevey (CH).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **YOAKIM, Alfred** [CH/CH]; Ch. de la Routiaz 2, CH-1806 St-Legier-la Chiesaz (CH). **DENISART, Jean-Paul** [FR/CH]; Ch. de la Jaque 15, CH-1093 La Conversion (CH). **RYSER, Antoine** [CH/CH]; Rue du Simplon 19, CH-1006 Lausanne (CH).

(74) Agent: **BORNE, Patrice**; Ave Nestlé 55, CH-1800 Vevey (CH).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

[Continued on next page]

(54) Title: METHOD FOR PREPARING A BEVERAGE OR LIQUID FOOD AND SYSTEM USING BREWING CENTRIFUGAL FORCE

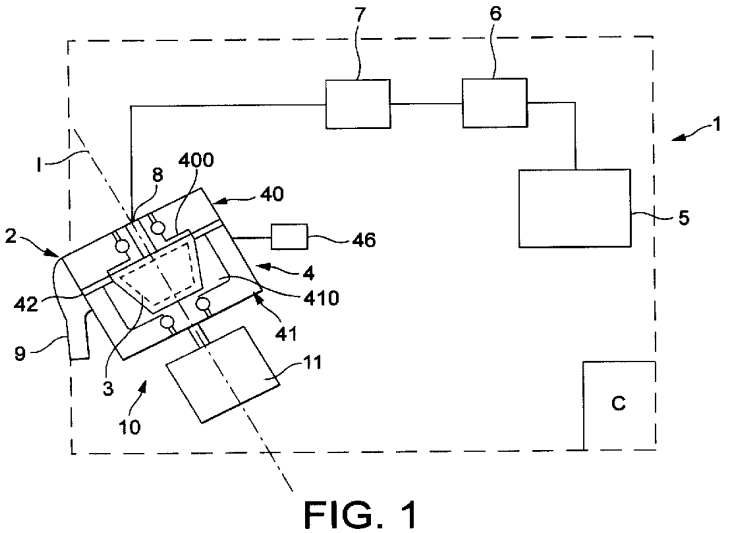


FIG. 1

(57) Abstract: A method for preparing a beverage or liquid from a food substance contained in a filtering receptacle (3) by passing water through the substance using brewing centrifugal forces comprising: feeding water in the receptacle (3), driving the receptacle in centrifugal rotation to force water to flow through the substance in a centrifugal flow path to outlet means of the receptacle, wherein the receptacle is formed by a sealed capsule (3) before its use which is opened for water to be introduced in the capsule; said capsule containing a predetermined dose of food substance and being discarded after use.

WO 2008/148601 A1

K-FEE SYSTEM GMBH, EX2009, page 3494
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
— *of inventorship (Rule 4.17(iv))*

Published:
— *with international search report*

Method for preparing a beverage or liquid food and system using brewing centrifugal force

The present invention relates to a method for preparing a beverage or liquid food from a food substance which is brewed or extracted by using centrifuge forces exerted on a receptacle which contains the substance. The invention also relates to a system for carrying out the method.

It is known to prepare beverages wherein a mixture consisting of brewed coffee and coffee powder is separated with centrifugal forces. Such a mixture is obtained by bringing hot water and coffee powder together for a defined time. The water is then forced through a screen, on which screen powder material is present.

Existing systems consist of placing the coffee powder in a receptacle which is usually a non-removable part of a machine such as in EP 0367 600B1. Such devices have many disadvantages. Firstly, the coffee powder must be properly dosed manually in the receptacle. Secondly, the spinned coffee waste becomes dry and it must be removed by scraping the surface of the receptacle. As a result, the coffee preparation requires a lot of manual handling and is so very time consuming. Usually coffee freshness can also vary a lot and this can impact on the cup quality because coffee comes generally from bulk package or coffee is ground from beans in the receptacle itself.

Also, depending on the manual dosage of coffee and the brewing conditions (e.g., centrifugal speed, receptacle size) the cup quality can vary a lot.

Therefore, these systems have never reached an important commercial success.

In DE 102005007852, the machine comprises a removable holder into which an open cup-shaped part of the receptacle is placed; the other part or lid being attached to a driving axis of the machine. The advantage is to be able to conveniently remove and clean the receptacle. However, a disadvantage is the intensive manual handling. Another disadvantage is the difficulty to control quality of the coffee due to a lack of control for the dosing of the powder and a lack of control of the freshness of the coffee powder.

Other devices for brewing coffee by centrifuge forces are described in WO 2006/112691; FR2624364; EP0367600; GB2253336; FR2686007; EP0749713;

K-FEE SYSTEM GMBH, EX2009, page 3496
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

DE4240429; EP0651963; FR2726988; DE4439252; EP0367600; FR2132310; FR2513106; FR2487661; DE3529053.

The effect of centrifugal forces to brew coffee or other food substances presents many advantages compared to normal "espresso" type brewing methods using high pressure pumps. In "espresso" types brewing methods, it is very difficult to master all the parameters which influence the quality of extraction of coffee. These parameters are typically the pressure, the flow rate which decreases with the pressure, the compaction of the coffee powder which also influences the flow characteristics and which depends on the coffee ground particle size, the temperature, the water flow distribution and so on.

Therefore, there is a need for proposing a new extraction process and a capsule adapted therefore for which the extraction parameters can be better and more independently controlled and therefore can be better mastered for controlling quality of the final brewed liquid.

There is also a need for providing a system capable of brewing different kinds of beverages, in particular, coffee beverages, for example, espresso, filter coffee or café latte, while adjusting the brewing characteristics of each beverage so that the optimum beverage can be obtained. In particular, there is a need for a versatile system which provides an easy, simple way of controlling the brewing parameters, in particular, the brewing pressure range on the bed of substance.

At the same time, there is a need for a method which is more convenient compared to the prior art centrifugal devices and which provides a better in-cup quality with a higher control of important quality parameters such as freshness and dosage in the receptacle.

The invention relates, in the more general sense, to a method for preparing a beverage or liquid from a food substance contained in a filtering receptacle by passing water through the substance using brewing centrifugal forces comprising:

feeding water in the receptacle,

driving the receptacle in centrifugal rotation to force water to flow through the substance in a centrifugal flow path to outlet means of the receptacle, wherein the receptacle is formed by a sealed capsule before its use which is opened for water to be

K-FEE SYSTEM GMBH, EX2009, page 3497
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

introduced in the capsule; said capsule containing a predetermined dose of food substance and being discarded after use.

The capsule can be sealed in a gastight manner to preserve freshness of the substance contained in its enclosure. The capsule can be opened in the device itself, e.g., by piercing of the capsule, or alternatively before the capsule is inserted in the device, e.g., by piercing of the capsule or removing a sealing foil of the capsule.

The capsule can be opened for water to be introduced in the capsule, after insertion of the capsule in the beverage preparation device, by piercing of the capsule.

The capsule can also be opened for water to be introduced in the capsule, before insertion of the capsule in the beverage preparation device by providing at least one passage, by piercing or removing a sealing foil of the capsule.

The method more particularly relates to the preparation of a liquid food or beverage, in a beverage preparation device, from a food substance contained in a filtering receptacle by passing water through the substance using brewing centrifugal forces comprising:

feeding water in the receptacle,

driving the receptacle in centrifugal rotation to force water to flow through the substance in a centrifugal flow path to outlet means of the receptacle,

wherein the receptacle is formed by a capsule which is sealed before use;

wherein the capsule contains a dose of food substance;

wherein the capsule is placed in the beverage preparation device,

wherein the capsule is opened for water to be introduced in the capsule;

wherein the capsule is removed from the beverage preparation device for being discarded after the liquid has been brewed from the capsule by centrifugation of the capsule in the beverage preparation device.

The term "sealed" capsule means that the capsule is made of materials having gas barrier properties and is sealed in a fluid tight manner so that ingress of air in the capsule is prevented. Furthermore, the capsule preferably contains an inert gas that improves the freshness of substance in the capsule. The capsule can also be wrapped with an outer protective membrane which is removed before the capsule is placed in the device.

Preferably, the capsule contains a dose of substance for preparing one or two servings (e.g., cups) of beverage. Cups of beverage are usually sized between about 25 to 220 mL.

K-FEE SYSTEM GMBH, EX2009, page 3498
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

The dose of substance for a single cup of coffee may be, for instance, between 4 to 8 grams of roast and ground coffee.

It must be noted that surprising improved brewing results are obtained by this method which can lead to amounts of coffee solids in the cup which are higher than pressure using methods (e.g. "espresso" type methods using brewing water pressurized by a pump). Without being bound by theory, it is supposed that water flow is more uniformly distributed by centrifuge effect and it creates less or no preferential flow paths in the coffee bed as compared to traditional methods using a positive pressure obtained by a pressure pump.

The food substance in the capsule can be ground coffee powder, soluble coffee, tea, chocolate, whitener, flavours and combinations thereof

The capsule is preferably driven in rotation at a centrifugal speed of at least 5000 rpm, more preferably between 5000 and 16000 rpm. Surprisingly, at such high rotational speeds, improved coffee crema is obtained with a capsule containing ground coffee. Crema has a more creamy consistency like a real emulsion of oil and water compared to usual crema obtained by traditional methods which is more watery with larger bubble size.

Of course, the speed also depends on the nature of the food ingredient. For leaf tea, the centrifugal speed is preferably low to provide infusion rather than a pressure extraction. In particular, for leaf tea, the centrifugal speed is comprised between 10 and 1000 rpm, more preferably between 50 and 500 rpm.

The capsule can comprise a sealing lid. The sealing lid can comprise a flexible membrane. The membrane can comprise gas barrier and support layers made of polymers, aluminium and/or aluminium alloys.

The capsule can also comprise a cup-shaped body onto which the sealing lid is sealed. The cup-shaped body also comprises gas barrier materials. It can be in metal such as thin aluminium and/or plastic.

In another embodiment, the capsule is made of two sealed flexible foils. The foils can be symmetrically arranged forming two identical sides and welded at a peripheral seam.

In another mode, the capsule comprises a plastic lid attached to a cup-shaped body. The plastic lid and body can be attached through a clipping member comprising a deflectable sealing lip. The deflectable lip is designed so that it opens under the effect of the centrifugal forces transferred to the brewed liquid exiting the capsule. In

K-FEE SYSTEM GMBH, EX2009, page 3499
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

a variant of this mode, the capsule comprises a plastic lid welded on a cup-shaped body whereas a series of premade peripheral outlets are provided in the lid and/or body for the brewed liquid to leave the capsule under the effect of the centrifugal forces. The premade peripheral outlets may be a series of small slits of small size to also filter the brewed liquid and maintain solid particles of the substance in the capsule. The lid and body can thus be welded by ultrasounds or any suitable connection method.

The method of the invention comprises an operation wherein hot water is introduced into the capsule at substantially no pressure. Water can be brought by a hot water feed mechanism using a principle of aspiration or vaporisation.

Alternatively, for a higher flow consistency, hot water can be introduced using a low pressure pump such as a peristaltic pump or a diaphragm pump and the like.

The method also encompasses an operation during which at least one peripheral liquid outlet is made before or when water is introduced in the sealed capsule.

The outlets can be pierced on a lid of the capsule. Outlets can also be pierced on a sidewall of the capsule.

In one mode, a plurality of outlets is formed by piercing at a peripheral area of the capsule. This method has the advantage to require a simpler capsule. The number of outlets can be chosen to control the flow rate of the brewed liquid. Since the outlets are radially oriented in series, a high pressure layer or jets of the brewed liquid is formed that is expelled out of the capsule.

Preferably, in the method of the invention, the brewed liquid is also collected to form a homogeneous flow of the liquid food or beverage which can be directed to the cup.

In a mode, at least one peripheral outlet is formed in the capsule by an opening occurring under the effect of the pressure of liquid carried out by the centrifugal forces.

The invention also concerns a system for preparing a beverage or liquid food from a food substance contained in a filtering receptacle by passing water through the substance using centrifugal forces comprising:

a device comprising:

- water feed means for introducing water in the receptacle,
- driving means for driving the receptacle in centrifugal rotation,

K-FEE SYSTEM GMBH, EX2009, page 3500
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

wherein the receptacle is formed by a capsule which contains the food substance and is insertable in the device for brewing of the liquid food and then removable from the device after brewing of the liquid food,
wherein the system further comprises referencing means for positioning and referencing the capsule in a removable manner in the device and in operational relationship with the water feed means and along an axis of rotation along the driving means.

Preferably, the capsule is a gastight sealed receptacle before being inserted in the device.

In one aspect of the system of the invention, the capsule comprises trunconical sidewalls which promote the drainage of the brewed liquid across the substance to the outlet(s) of the capsule.

In another possible aspect, the capsule has a rigid lid resiliably attached to a cup-shaped body. The lid can be plastic. The lid and body can be attached via a radial deflectable sealing means which opens by effect of the centrifugal effect to let the brewed liquid pass. For example, the deflectable sealing means can comprise at least one peripheral plastic lip of the lid engaging in a seat of the cup-shaped body or vice versa.
The invention also relates to a device for preparing a beverage or liquid food from a food substance contained in a capsule by passing water through the substance in the capsule comprising:
- water feed means for introducing water in the capsule,
wherein it further comprises referencing means for positioning and referencing the capsule along an axis of rotation in the device and driving means for driving the capsule in centrifugal rotation.

The referencing means are designed for receiving the capsule in a removable manner. They are designed for receiving the capsule in the device in operational relationship with the water feed means and the driving means. The referencing means comprise a capsule holder comprising a cavity which is drivable in rotation. The capsule holder can be driven in rotation at a speed of more than 7500 rpm. The capsule holder is, for instance, connected to a motor via a drive shaft arranged for driving the capsule holder about a central rotational axis. The referencing means comprise a water injection lid closing on the injection surface of the capsule. The lid

K-FEE SYSTEM GMBH, EX2009, page 3501
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

and capsule can co-act in closure about the capsule while leaving a collecting chamber. The driving means comprise a motor and a shaft associated in rotational arrangement with the capsule holder and/or lid. The capsule holder and lid can swivel along bearings. The collecting chamber preferably comprises surfaces that surround the capsule radially. The collecting chamber can be associated to a duct for directing the flow of brewed liquid to a recipient (e.g., a cup).

The device may optionally comprise a by-pass conduit arranged to add a part of water in the collector without this part of water passing in the capsule. The additional part of water enables to prepare beverages of larger volumes with a part of brewed liquid and a part of water. For large coffee, for instance Americano-type, since the total volume of the coffee beverage is not passed through the capsule, an over-extraction of the ground coffee can be avoided and bitterness can be reduced. This results in a large coffee beverage having an improved taste.

According to another aspect of the invention, the device comprises a control unit adapted to vary the speed of the driving means for driving the capsule in centrifugal rotation therefore providing different centrifugal pressures in the capsule. As a result, the brewing pressure conditions in the capsule can be easily tailored to the type of beverages to be brewed. More preferably, the control unit is programmed to provide at least two different centrifugal speeds. In an example, a first rotational speed is comprised within a value range of 500 to 15000 rpm and a second rotational speed is comprised within a value range of 5000 and 20000 rpm. For example, low speed values can be set by the control unit to brew coffee with less or no foam such as American coffee. The higher speed values can be set by the control unit to brew coffee with a higher amount of foam such as espresso or lungo coffee. The foam (e.g., coffee crema) is obtained by shearing the liquid through the passages in the capsule and also by the brewed liquid which impacts on the surfaces of the collector at a higher energy therefore creating an emulsion with entrapment of gas. Therefore, the kinetic energy of the liquid impacting on a surface is decisive for the improvement of the foam. In the usual espresso-type methods generating a "water piston", this phenomenon does not take place since there is no sufficient speed of the liquid leaving the capsule.

Additional features of the invention will appear in the detailed description of the figures which follows.

Figure 1 is a schematic representation of system of the invention;

K-FEE SYSTEM GMBH, EX2009, page 3502
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Figure 2 is a schematic representation of a brewing module in open position of the system of the invention into which is inserted a capsule;

Figure 3 is a schematic representation of a brewing module in closed position of the system of the invention which encloses a capsule;

Figure 4 is a detailed cross sectional view of the system of the invention in a first embodiment;

Figure 5 is an exploded view of another embodiment of the device of the invention;

Figure 6 shows a sealed capsule which can be used in the device of the invention according to figures 4 or 5;

Figure 7 shows a capsule after its use in the system of the invention;

Figure 8 is a detailed cross sectional view of the system of the invention in a second embodiment;

Figure 9 shows a detail of the system of figure 8;

Figure 10 shows a cross sectional view of the cup-shaped body of the capsule in the system of figures 8 and 9;

Figure 11 shows a detail view of the clipping edge of the cup-shaped body;

Figure 12 shows a cross sectional view of a detail, i.e., of the engaging connection, of the cup-shaped body of figure 10;

Figure 13 shows a plane view of the detail of figure 12;

Figure 14 shows a cross sectional view of the lid of the capsule in the system of figures 8 and 9;

Figure 15 shows a detailed view of the deflectable sealing means of the lid of figure 14;

Figure 16 shows a cross sectional view of the cup-shaped body of the capsule according to another embodiment;

Figure 17 shows a cross sectional view of a detail of the body of figure 16;

Figure 18 shows a cross sectional view of the lid of the capsule that connects to the capsule's body of the embodiment of figures 16 and 17;

Figure 19 shows a detail of the lid of figure 18;

Figure 20 shows a sealed capsule and an operational mode for removing the seal of the capsule;

Figure 21 shows a schematic view of the system of the invention according to another possible embodiment;

K-FEE SYSTEM GMBH, EX2009, page 3503
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Figure 22 shows a schematic view of the system according to still another embodiment;

Figure 23 shows a schematic view of the system according to still another embodiment;

Figure 24 shows a view of a capsule according to another mode of the invention;

Figure 25 shows a schematic representation of a brewing module in closed position of the system of the invention according to yet another embodiment of the invention.

The system 1 of the invention is illustrated in figure 1 in the more general sense. The system comprises a device 2 and a capsule 3. The device has a brewing module 4 into which the capsule can be inserted for being brewed and is removed after use for being discarded (e.g., for waste or recycling). The module is in fluid communication with a water reservoir 5 containing fresh or, alternatively heated water. A fluid transport means such as a low pressure pump 6 can be provided in the water circuit to transport water from the reservoir to the module. A water heater 7 is further provided to heat water to the desired temperature. It can be noted that water could be heated in the reservoir itself and water could be transported from the reservoir by effect of vaporisation. Water can be fed into the module 4 at low or substantially no pressure. For example, a pressure between 0 and 2 bars above atmospheric pressure can be envisaged at the inlet 8 of the module.

The brewing module 4 can comprise referencing means 40, 41 for retaining the capsule in a predetermined position in the module. The capsule can be maintained in a slightly inclined position to promote the exit flow of the brewed liquid to a brewed liquid outlet 9. For instance, an angle of inclination relative to vertical can be between 2 and 65 degrees. The referencing means can comprise a capsule holder 410 and an injection lid 400. Both holder 410 and lid 400 are mounted to rotate along an axis of rotation I. The capsule holder comprises a cavity having the shape of the capsule to be received. The lid is designed to assemble against the capsule holder in a removable manner. A liquid passage 42 can be created in the module to enable liquid to be drained and collected from the capsule to the fixed outlet 9.

Driving means 10 are provided for driving the lid 400 and capsule holder 410 together in rotation and, by way of consequence, the capsule too. For this, the driving means includes an electrical motor 11 having a shaft connected to the capsule holder

K-FEE SYSTEM GMBH, EX2009, page 3504
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

to force the capsule holder 41 in rotation. Since the lid 40 is attached to the capsule holder 41, the lid is also driven in rotation at the same speed as the capsule holder.

The surfaces of the collecting means of the device can be regulated in temperature so that the brewed liquid exiting the capsule is maintained at a proper temperature and does not cool down before reaching the cup. For this the lid assembly 40 and /or capsule holder assembly 41 can be associated to heating elements 46 for maintaining the capsule holder at a heated regulated temperature, such as with heating wires or thick films and the like.

Figures 2 and 3 show a detailed view of the principle of centrifugation of the capsule. The device comprises a capsule holder assembly 41 with a holder 410 having a trunconical housing 44 in which the capsule 3 is inserted. The holder is mounted along an axis of rotation I by a bearing 43. The injection lid assembly 40 is provided with an internal lid 400 which can be mounted on a fixed support part 401 of the lid assembly 40 in a pivotable manner along the axis I when the device is closed (Figure 3).

The lid assembly and capsule holder assembly are associated along a transversal axis A between an open position as illustrated in figure 2 and a closed position of figure 3.

At the inside surface of the injection lid 40 is placed a piercing structure 450 which has the function of piercing the injection side 30 of the capsule. A water injector or lance 50 is provided which traverses the injection side 30 and which comprises an injection conduit for carrying water from the water circuit into the capsule. The water injector 50 is preferably located in the centre of the capsule. Water can thus be injected in the capsule at a location placed between the capsule lid 30 and the capsule bottom 31. The outlet of the water injector is placed closer to the bottom 31 than to the lid so that water can first wet the substance in the bottom area of the capsule. The lid further comprises outlet piercing elements 51 which are placed on the inside of the lid at a peripheral position. Preferably, a series of piercing elements 51 are placed uniformly along the periphery of the lid. Further the capsule comprises an inclined sidewall 32 which widens from the bottom 31 to the top 30 in direction of the peripheral openings or outlets pierced by the piercing elements 51. The lid is further provided with a collecting assembly 52 comprising an inside chamber 53 surrounding the capsule's peripheral openings and a nozzle 530 forming a tube for directing the beverage of liquid food to the recipient or cup. It can be noted that there is no need for

K-FEE SYSTEM GMBH, EX2009, page 3505
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

a hermetical arrangement between the upper and lower parts 40, 41 of the device. Since water is pushed by the effect of gravity, water flows radially and uniformly to the sidewall 32 of the capsule to traverse the substance toward the periphery of the capsule and upwards to the peripheral opening along the sidewall 32. The brewed liquid so impacts the outward surface of the collecting assembly 52 and is so collected and pushed still by effect of gravity to the collecting nozzle 530. The advantage of the system is that there is a low axial pressure therefore there is less need for high mechanical closure forces. The technology is relatively simple since a motor working at low current is sufficient to provide the necessary momentum to carry out the brewing process. Furthermore, several types of heaters can be used such as thermos or gas.

Figure 4 shows a more sophisticated system of the invention. The system comprises a capsule holder 41 which is associated to a central rotating rod 45 mounted along a lower bearing 43, which is supported on a support 46. On the lower end of the rod 45 is associated an electric rotary motor 11. At the opposite side, a lid 40 is associated to an upper bearing 47, along a hollow rotating rod 48 for the entry of water in the capsule through a conduit 49 traversing the rotating rod 48. The rotating rod 45 is mounted on an upper frame 60 of the system. A series of needles 51 is also positioned on the side of the lid 40 to form small perforations at the periphery of the upper side of the capsule. The number of needles can be set between 5 and 50, preferably between 10 and 30. The higher the number of needles, the more uniform the distribution of liquid can be. When the needles 51 are engaged in the capsule, the lid is driven in rotation by the capsule itself which is also driven by the rotor 45.

The rotational speed can be set between about 5000 and 20000 rpm. For this a control unit C (figure 1) is provided in the device for adjusting the rotational speed as a function of the beverage to be brewed. The higher the rotational speed, the more centrifugal pressure is exerted in the capsule by the liquid and the more the substance is compacted on the sidewall of the capsule. Also, the higher the speed, the lower the residence time of the liquid in the capsule.

For example, for tea, the rotational speed can be minimal to enable a slow transfer of water through the mass of tea leaves and to provide an infusion of the tea.

For ground coffee, the speed should be high, i.e., higher than 5000 rpm, preferably within a range of about 8000-16000 rpm, in order to perform optimal extraction conditions in term of coffee solid contents in the cup and quality of the

K-FEE SYSTEM GMBH, EX2009, page 3506
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

crema. It has been surprisingly found that crema obtained is much creamier than by using the standard espresso brewing methods.

Therefore, depending on the types of beverage to be brewed, the control unit can be programmed to adjust the optimal centrifugal conditions. For instance, the control unit may be associated to a capsule recognition system enabling to recognize the types of capsules, i.e., espresso, lungo, cappuccino, latte, tea, etc, and to adjust the speed and/or other brewing parameters (e.g., water temperature) according the capsule which is inserted in the device.

The brewed liquid is collected in a collecting chamber 52 of the support 46 and drained through a collecting tube 9.

Figure 5 illustrates another embodiment in which the injection lid 40 is connected to the capsule holder 41 by a bayonet type connection 55 or any equivalent connection means. In this embodiment, only one lower bearing (not shown) is necessary. The capsule holder 41 and the lid 40 are thus connected together and both turn along a lower rotational axle 45. The capsule holder comprises a cavity 550 for receiving the capsule. The injection lid is then connected to the capsule holder along an helicoidal tightening momentum by the bayonet means 55. For example, the bayonet means can comprise a series of radially extending protrusions on the lid which fits into a series of hooks carried on the edge of the capsule holder. Tightening may be performed by a gripping portion 61 placed on the upper side of the lid. However, the assembly must let liquid pass between the lid and the holder. A sealing joint between the lid and holder is therefore not desirable. A predefined clearance may also be ensured for controlling the exit flow of the brewed liquid by foreseeing slots or grooves of predetermined dimensions at the interface between the lid and holder.

A collecting assembly 46 having the shape of a cup larger than the capsule holder is also placed about the brewing enclosure 40, 41 for collecting the brewed liquid. The collecting assembly takes support on a base 62 of the device onto which is connected the motor 11. A liquid duct 9 is provided on a side of the cup which is slightly inclined downwards for the liquid to flow in the direction of a receptacle (e.g., a beverage cup).

Figures 6 and 7 illustrate a capsule that can suit the device according to the different embodiments of figures 2 to 5. In figure 6, the capsule 7 comprises a cup-shaped body 70 with upwardly oriented sidewall 76 and a bottom wall 77. The sidewall forms a portion of cone which promotes the collection of the brewed liquid

K-FEE SYSTEM GMBH, EX2009, page 3507
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

internally. The body terminates by an upper edge 72 raising outwards onto which is sealed a lid 71. The lid may be a flexible pierceable membrane of several microns in aluminium and/or plastic. The lid can be welded on the upper edges 72 of the body. It can be pointed out that the membrane and body preferably comprise gas barrier layers such as aluminium and/or EVOH.

The capsule contains a substance chosen among the list consisting of ground coffee, soluble coffee, tea, a whitener such as dairy or non-dairy ingredient(s), herbal tea, nutritional substance, culinary ingredients and a mixture thereof.

Figure 7 illustrates the capsule after brewing of the substance in the device. A central water inlet 73 is pierced through the lid for passage of the water injector 50. On the side of the lid are pierced outlets 74 communicating with the inside cavity for the brewed liquid to exit the capsule.

Another embodiment of the present invention is illustrated in relation to figures 8 and 9. In this embodiment, a capsule 8 comprising its own inflow and outflow means. More specifically, the capsule comprises a cup-shaped body 80 made of plastic onto which is secured a plastic lid 81. The lid can be tightly clipped onto the body along its edge by sealing means 82 illustrated in more details in figures 9, 14 and 15. The sealing means act as a valve. More particularly, the edge of the body comprises a peripheral groove 83 formed of two small parallel and circular portions of wall rising upwardly. For this, the lid has a peripheral portion of wall forming a lip 84 that inserts itself in the groove 83. The lip 84 can end by a thicker rounded shape 85 to create a closing pressure on the surface of the groove 83 in the housing, which pressure must be overcome to let the liquid pass through the cavity or annular groove 83. The sealing lip 84 is designed in such a way that it can open a radial passage in the groove for the brewed liquid under the effect of liquid opening them when the liquid is centrifuged.

At the periphery of the lid is provided a secondary closure lip 86 that fits on the outer edge 87 of the body. This second lip 86 is designed to provide locking of the lid on the body of the capsule. For this, the lip 86 comprises an enlarged section 860 which presses on the outer surface 87 of the edge of the body.

The secondary lip 86 creates a clipping function for connection of the lid onto the body and eventually it also forms a second hurdle to be overcome for the brewed liquid to pass. This tortuous path as formed by the series of lips 84, 86 and the groove 83 generates high shear forces on the brewed liquid. The secondary lip can also be

K-FEE SYSTEM GMBH, EX2009, page 3508
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

traversed by radial slits for promoting the flow of the brewed liquid (not shown). For coffee, this may result in generating a thicker and more stable crema. It can be noted that this lip could be omitted in the context of a simpler structure of the capsule.

In the centre of the capsule's lid is provided a water flow distribution member formed of a tubular portion 88 extending from the lid. This tubular portion 88 has a water inlet 89 which can be fitted to the water injection conduit 49 of the injection lid 40 of the system. The tubular portion 88 ends by flow distributing means 880 formed of several slots directed outwards in the cavity of the capsule. Several slots are distributed at the free end of the tubular portion 88. The tubular support may abut against the bottom surface of the body for demarcating the slots and for directing water in many radial directions. For instance, the number of slots may be comprised between 2 and 10. Therefore, water coming from the top will traverse the tube 88 and will exit the tube at the slots in the radial direction of the arrow B identified on figure 9. It can be noticed that water is so injected preferably close to the bottom of the capsule; therefore ensuring a proper wetting of the substance, e.g., coffee powder, and in the direction from the bottom to the top (i.e., between the lid and body) where the brewed liquid leaves the capsule.

The capsule 8 of figures 8 to 15 according to this embodiment can further include means 840 for gripping the bottom of the capsule and so enabling the capsule to be properly driven in rotational motion by the device. For this, the means 840 comprises a small tubular portion protruding in the bottom of the capsule and into which can be inserted a complementary tubular portion 450 of the rotational driving means of the device.

The driving means of the device further comprise a drive shaft 45 associated to a support 451 for holding the bottom of the capsule. Of course, the shape of the gripping means can take many other variations without departing from the scope of the present invention. Figures 12 and 13 show a gripping structure 840 having a central recess 841 and four arched recesses 842, 843, 844, 845 extending from the central recess 841. This gripping structure forms a lock into which is fitted a complementary engaging structure 450, i.e., a key, of the capsule holder 451. The complementary shapes of the capsule and capsule holder enable to fulfil both the gearing function for driving the capsule at high speeds in rotation and a safety function for ensuring that only capsules adapted to the system can be used and brewed successfully.

K-FEE SYSTEM GMBH, EX2009, page 3509
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

In this embodiment for figures 8 and 9, the device itself comprises, as in the preceding modes, upper and lower bearings 43, 47 for enabling the injection lid and support of capsule 451 to rotate in conjunction with the capsule 3. Surrounding the capsule is a collecting assembly 52 with a cup 520 formed of a side and bottom walls 521 and an upper closing cover 522. The cover also serves for receiving the upper bearing 43 while the lower cup 520 has a central recess for receiving the lower bearing 47. The cup 520 and the cover 522 can be assembled in fluid tight manner to avoid uncontrolled projection of brewed liquid. Therefore connection means 523 can be provided and a fluid tight sealing element, such as an O-ring 524, can also serve to ensure tightness between the two parts. Also a beverage outlet tube (not shown) can be provided to drain the beverage outside of the collecting assembly.

As also apparent in figure 8, the driving means of the device comprise a lower electrical motor 11 which is coupled to a driving shaft or drive connector 45 which is itself connected to the capsule holder 451. Note that the capsule holder may be a simple plate support or disc 451 or a support shaped as a cup, for example, if the capsule has no sufficiently rigid sidewalls.

The brewing operation of the system of figures 8 and 9 can be shortly explained as follows:

A capsule 3 as described contains a dose of substance is provided. The capsule can be filled with roast and ground coffee. The capsule is inserted in the cup 520 when the cover is removed and placed on the capsule holder 451 with the engaging structure of the engaging structure 450 fitting the recess portion 840 of bottom of the capsule. By the approach and connection of the cover 522 to the cup 520, The injection lid 40 is then connected or associated to the capsule's lid 81 with the water conduit 89 coming in communication with the water injection tube 88 of the capsule. When the device is in the closed position of figure 8, water can be injected at low pressure or just poured into the conduit through the tubular portion 88. Preferably, some water is poured to start wetting the substance in the capsule before the capsule is driven in rotation by the rotational driving means of the device. Then, the control unit starts the motor and the capsule is so driven in rotation at high speed to perform the centrifugal brewing operation. Under the effect of centrifugal forces, the powder substance tends to compact itself radially whereas water is forced to flow through the substance. This results in the substance being both compacted and intimately wetted by water. Due to high speed rotational movement, the centrifugal forces exert

K-FEE SYSTEM GMBH, EX2009, page 3510
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

themselves uniformly on the mass of substance. Consequently, the water distribution is also more uniform compared to usual methods using a pressure pump to exert pressure on and through the bed of substance. As a result, there is less risk of preferential flow path through the substance which could lead to areas which are not properly wetted and so not properly extracted. With ground coffee powder, the liquid that reaches the internal sidewall of the capsule is so a liquid coffee extract. This liquid extract is then forced to flow upwards along the side of the capsule up to the sealing means 82. The sealing means 82 are thus submitted to an opening force by the liquid under the centrifuge effect. This results in the lip that tends to bend outwardly to create a passage between the surface 85 and the inner surface of the groove. Similarly, the second lip is also forced to bend or alternatively may allow a certain leakage, for example, with premade slits for letting the liquid escape the capsule. The liquid can thus flow through the small peripheral groove 83 and can exit out of the capsule. The brewed liquid can be so collected by the collector 52 and be guided outside of the device into the recipient.

Figures 16 to 19 illustrate another embodiment of the capsule according to the invention. This capsule has a cup-shaped body 80 comprising the same gripping means 840 at its outer surface for enabling the capsule to be driven in rotation in the device. The capsule also comprises a lid 81 shown in figures 18 and 19. Contrary to the capsule of the preceding mode, the lid 80 and body 81 are attached by permanent connecting means such as ultrasonic welding. The brewed liquid that is centrifuged is allowed to pass through a series of slits 810 provided on the upwardly protruding edge 880 of the body. The slits are sized so to act as a filter for retaining the solid particles such as the ground coffee particles but let the liquid leave the capsule. The lid is connected with the edge 880 fitting into a radial groove 840 of the lid 81 (Figure 19). Figure 17 also shows small indents 830 serving as energy directors that can melt during the ultrasonic welding. In the present mode, the capsule does not comprise a deflecting sealing lip but it simply has slits 810 for enabling the brewed liquid to traverse the capsule. The capsule of this mode can be used in a device as illustrated in figures 8 and 9.

In figure 20, a sealed capsule of the invention is shown. The capsule is formed, as described in the preceding modes, of a cup-shaped body 80 onto which is assembled a lid 81. The water inlet 89 of the lid is covered by a sealing membrane 890. The radial outlet area placed between the lid and body is also covered by a

K-FEE SYSTEM GMBH, EX2009, page 3511
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

sealing membrane 891. Note that the same sealing membrane could cover both the water inlet 89 and the outlet area for the brewed liquid. The sealing membrane 891 can be a tamper evidence element such as a ribbon of an adhesive membrane sealed along the line between the lid and body. The ribbon can be cut by a cutting tool 910 in the machine, such as a blade or an equivalent means. As the capsule is driven in rotation (as shown by arrow C), the cutting tool is approached in contact with the ribbon which is thus automatically cut. The capsule is so no longer impervious and liquid can escape the capsule through the radial edge of the capsule as previously explained. One can note that the sealing membrane(s) can also be made of a peelable adhesive material so that the user himself can remove it (them).

According to figure 21, the system may also foresee an injection of water by aspiration under the effect of the rotational momentum. For this, a capsule is housed in the referencing means 40, 41. An injection tube 8 connects a water reservoir to the inside of the capsule. The device is so oriented that the reservoir is below the capsule and water is transported by the vacuum that is produced in the centre of the capsule. The injection tube also engages into the capsule up to a region preferably closer to the more narrow side or bottom so that water can wet the whole mass of substance, e.g., ground coffee powder.

One can note that the capsule can be positioned with its sidewall widening downwardly. In figure 22, the system is similar but the orientation of the capsule is simply inverted and it widens upwardly.

In the two embodiments of figures 21 and 22, water is preferably injected near the more narrow side of the capsule, i.e., opposite the widening side, in order for the liquid to flow through the substance in the direction of the wider side of the capsule and to then exit the capsule.

Figure 23 illustrates another capsule of the invention. The capsule comprises means for connecting it to the external rotational driving means of the device. For this, capsule has a toothed structure 75 on at least one of its outer surface. The capsule has a body 70 comprising an upper edge 72 which can be closed by an upper membrane 71. The toothed structure comprises a series of teeth which is positioned below the edge or rim 72 of the body of the capsule. The teeth are placed along the whole periphery of the body of the capsule. The body of the capsule can be made of plastic and/or aluminium or aluminium alloy. For example, it can be moulded by injection of plastic or deep drawn in aluminium. For example, the shape of the teeth could be

K-FEE SYSTEM GMBH, EX2009, page 3512
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

slightly triangular, oval, rectangular or pyramidal. It should be noticed that the teeth could be replaced by other equivalent structures such as series of elements in relief and/or hollow. For example, slits, pins or small needles can be envisaged.

The device itself that receives the capsule of figure 23 comprises a toothed surface of complementary shape. Figure 24 shows a capsule holder 44 adapted to receive the capsule of figure 23. The capsule holder has a cavity into which are provided hollow teeth 440. The hollow teeth are arranged to fit the teeth 750 on the outer surface of the capsule.

It should be noted that the connecting or engaging structure of figure 23 can replace the structure of the capsule of figure 8 and 9 or reciprocally.

In figure 25, is illustrated another embodiment of the brewing system of the invention. The difference is here that a water by-pass conduit 500 is provided in addition to the main water conduit 50 for adding a volume of water in the collecting assembly 52. A volume of water may be added before, during or after the centrifugal brewing operation in the capsule. The by-pass conduit ends on the upper surface of the rotating lid 400. The upper surface of the lid 400 may comprise a water distribution structure such as radial grooves or recesses to promote the flow of water toward the surface of the collecting assembly. The control unit may control the delivery of the added volume of water so that the volume is added at the same time as the coffee extract is delivered by centrifugation so that the foam that is created on the top of the beverage is not destroyed.

The system and method of the invention provide remarkable brewing results with solid contents which are higher than usual methods and devices. The results are very reproducible from capsule to capsule. Surprisingly, crema is also remarkably improved with a creamier, more stable and thicker texture.

Of course, the invention may encompass many variants which are included in the scope of the patent claims that follow.

K-FEE SYSTEM GMBH, EX2009, page 3513
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

CLAIMS:

1. Method for preparing, in a beverage preparation device, a beverage or liquid from a food substance contained in a filtering receptacle by passing water through the substance using brewing centrifugal forces comprising:

feeding water in the receptacle,

driving the receptacle in centrifugal rotation in the beverage preparation device to force water to flow through the substance in a centrifugal flow path to outlet means of the receptacle,

wherein the receptacle is formed by a sealed capsule before its use which is opened for water to be introduced in the capsule; said capsule containing a predetermined dose of food substance and being discarded after use.

2. Method according to claim 1, wherein the capsule is opened for water to be introduced in the capsule, after insertion of the capsule in the beverage preparation device, by piercing of the capsule.

3. Method according to claim 1, wherein the capsule is opened for water to be introduced in the capsule, before insertion of the capsule in the beverage preparation device by providing at least one passage, by piercing or removing a sealing foil of the capsule.

4. Method according to any of claims 1 to 3, wherein the capsule contains a dose of substance for preparing one or two servings of beverage.

5. Method according to any of claims 1 to 4, wherein the capsule contains ground coffee powder, soluble coffee, tea, chocolate, whitener, flavours and combinations thereof.

6. Method according to any of claims 1 to 5, wherein the capsule is sealed in a gas tight manner.

K-FEE SYSTEM GMBH, EX2009, page 3514
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

7. Method according to any of the preceding claims, wherein the capsule is driven in rotation at a centrifugal speed of at least 500 rpm.

8. Method according to any of the preceding claims, wherein water is introduced in the capsule at substantially no pressure.

9. Method according to any one of claims 1 to 8, wherein at least one peripheral beverage outlet is made before or when water is introduced in the capsule.

10. Method according to claim 9, wherein the peripheral outlets are pierced on a lid of the capsule.

11. Method according to claims 9, wherein peripheral outlets are pierced on a sidewall of the capsule.

12. Method according to any of claims 1 to 9, wherein at least one peripheral outlet is formed by an opening occurring under the effect of the pressure of liquid carried out by the centrifugal forces.

13. Method according to claim 12, wherein the at least one peripheral outlet is obtained by the centrifugal forces which exert a flexure on at least one deflectable portion of the capsule.

14. Method according to any one of the preceding claims, wherein the capsule is referenced with its axis of rotation being vertical or inclined relative to vertical of an angle lower than 90 degrees.

15. System for preparing a beverage or liquid food from a food substance contained in a filtering receptacle by passing water through the substance using centrifugal forces comprising:

a device comprising:

- water feed means for introducing water in the receptacle,
- driving means for driving the receptacle in centrifugal rotation,

K-FEE SYSTEM GMBH, EX2009, page 3515
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

wherein the receptacle is formed by a capsule which contains the food substance and is insertable in the device for brewing of the liquid food and then removable from the device after brewing of the liquid food,

wherein the system further comprises referencing means for positioning and referencing the capsule in a removable manner in the device and in operational relationship with the water feed means and along an axis of rotation along the driving means.

16. System according to claim 15, wherein the referencing means comprises a capsule holder associated to the driving means for allowing the capsule to be rotated around its central axis.

17. System according to claims 15 or 16, wherein the capsule is impermeable to gas and, preferably, comprises a sealing lid.

18. System according to claim 17, wherein the lid comprises a flexible membrane.

19. System according to any one of claims 15 to 18, wherein the capsule comprises a cup-shaped body.

20. System according to claim 19, wherein the capsule comprises trunconical sidewalls.

21. System according to claims 19 or 20, wherein the capsule has a rigid plastic lid resiliably attached to the cup-shaped body.

22. System according to claim 21, wherein the lid and body are attached via a peripheral deflectable sealing means which opens by effect of the centrifugal effect to let the food liquid pass.

23. System according to claim 22, wherein the deflectable sealing means comprises at least one peripheral plastic lip engaged in a seat.

K-FEE SYSTEM GMBH, EX2009, page 3516
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

24. System according to any of the preceding claims 15 to 21, wherein the capsule comprises a pierceable membrane and the device comprises inlet piercing means for piercing the membrane and for enabling the water feed means to introduce water in the capsule.

25. System according to claim 24, wherein the inlet piercing means is arranged to pierce at least one water inlet near or at the axis of rotation of the capsule device.

26. System according to claim 25, wherein the inlet piercing means is a single needle.

27. System according to any one of claims 15 to 26, wherein the device comprises outlet piercing means for enabling liquid to exit the capsule wherein the outlet piercing means are radially positioned with respect to the axis of rotation of the capsule in the device.

28. System according to claim 27, wherein the outlet piercing means comprises a series of needles positioned in a circular pattern and arranged in relation to the capsule to pierce radial holes in the capsule.

29. Device for preparing a beverage or liquid food from a food substance contained in a capsule by passing water through the substance in the capsule comprising:
- water feed means for introducing water in the capsule, wherein it further comprises referencing means for positioning and referencing the capsule along an axis of rotation in the device and driving means for driving the capsule in centrifugal rotation.

30. Device according to claim 29, wherein the driving means comprises a drive shaft and an electrical motor connected to the referencing means for driving the capsule in rotation.

31. Device according to any one of claims 29 or 30, wherein the referencing means are designed for receiving the capsule in a removable manner and for receiving the capsule in the device in operational relationship with the water feed means and the driving means.

K-FEE SYSTEM GMBH, EX2009, page 3517
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

32. Device according to claim 31, wherein the referencing means comprise a capsule holder comprising a cavity which is drivable in rotation.

33. Device according to claim 32, wherein the capsule holder is connected to a motor via a drive shaft arranged for driving the capsule holder about a central rotational axis.

34. Device according to any one of claim 31 or 32, wherein the referencing means comprise a water injection lid closing on the capsule.

35. Device according to claim 34, wherein the water injection lid is traversed by a water conduit.

36. Device according to claim 35, wherein the water injection lid comprises means for puncturing at least one water inlet in the capsule.

37. Device according to any one of claims 29 to 36, wherein it comprises means for piercing peripheral outlets enabling the brewed liquid to leave the capsule.

38. Device according to claim 37, wherein the piercing means are formed by a series of needles on the injection lid.

39. Device according to any one of claims 29 to 38, wherein it comprises a collector for collecting the brewed liquid.

40. Device according to claims 29 to 39, wherein it comprises a by-pass conduit arranged to add a volume of water in the collector without water passing in the capsule.

41. Device according to any one of claims 29 to 40, wherein it comprises a control unit adapted to vary the speed of the driving means for driving the capsule in centrifugal rotation therefore providing different centrifugal pressure in the capsule.

42. Device according to claim 41, wherein the control unit is programmed to provide at least two different centrifugal speeds.

K-FEE SYSTEM GMBH, EX2009, page 3518
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

43. Device according to any of claims 29 to 42, wherein the water feed means comprises a pump.

44. Device according to any of claims 29 to 43, wherein the water feed means comprises an injection tube connected to a water reservoir for injection of water in the capsule under the effect of the rotational momentum.

K-FEE SYSTEM GMBH, EX2009, page 3519
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

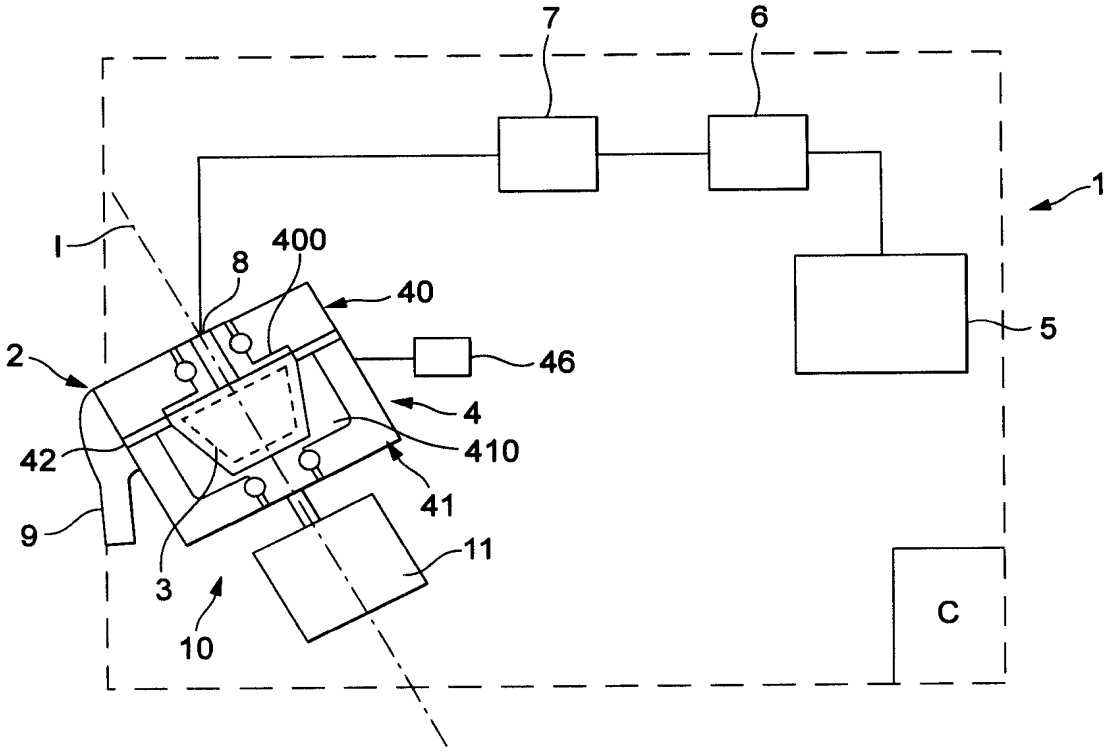


FIG. 1

K-FEE SYSTEM GMBH, EX2009, page 3520
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

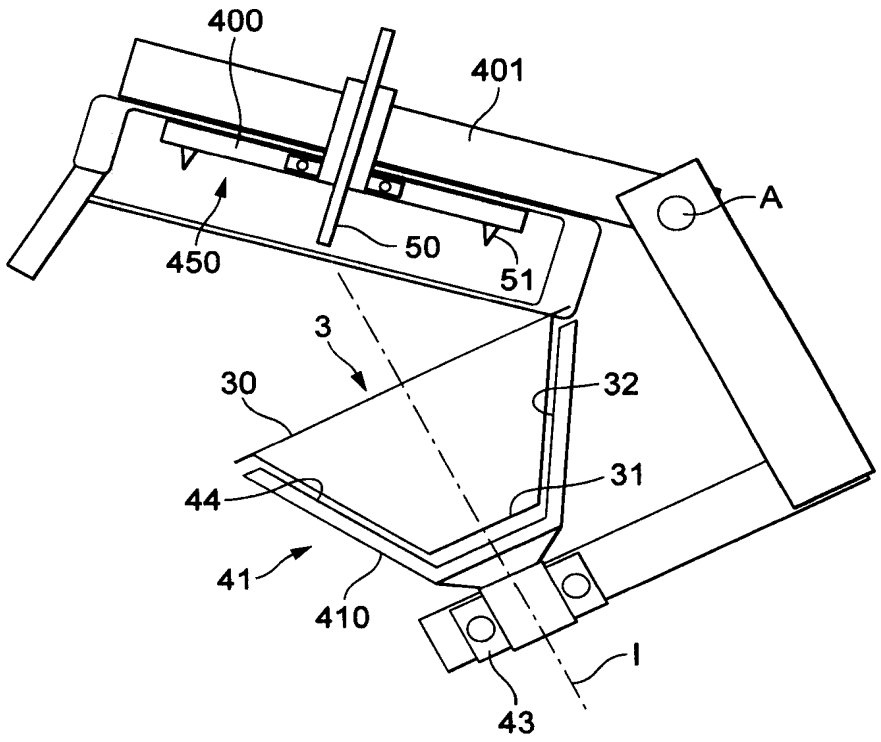

400
401
A
450
50
51
3
30
32
31
44
41
410
I
43

FIG. 2

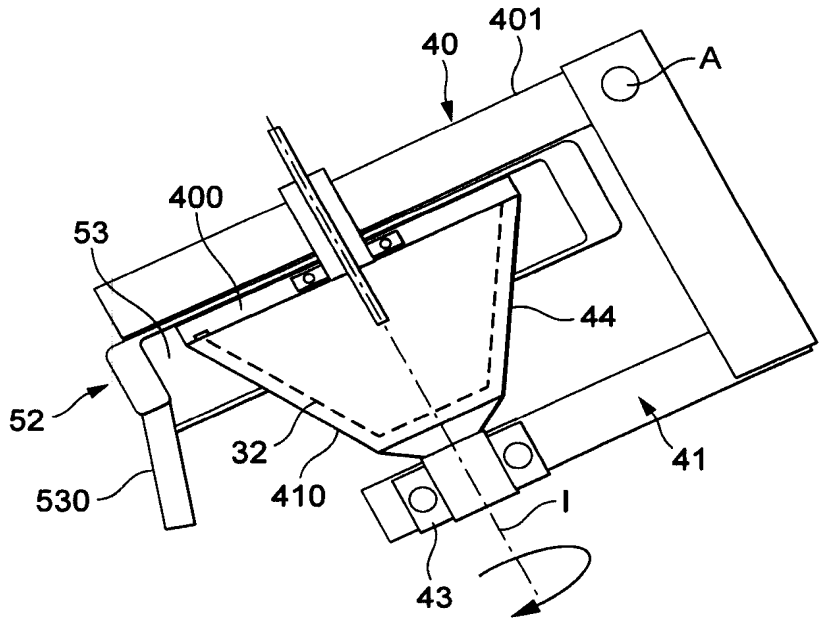

401
40
A
400
53
44
52
32
41
530
410
I
43

FIG. 3

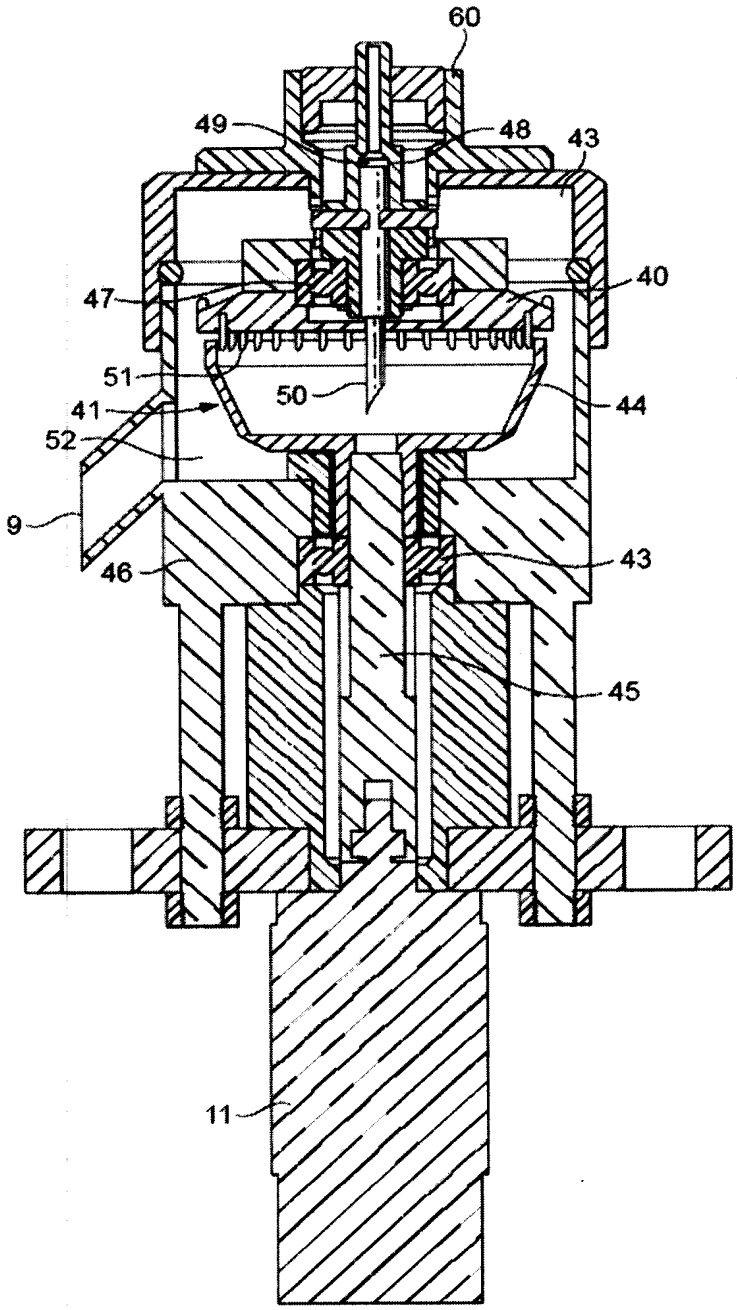


FIG. 4

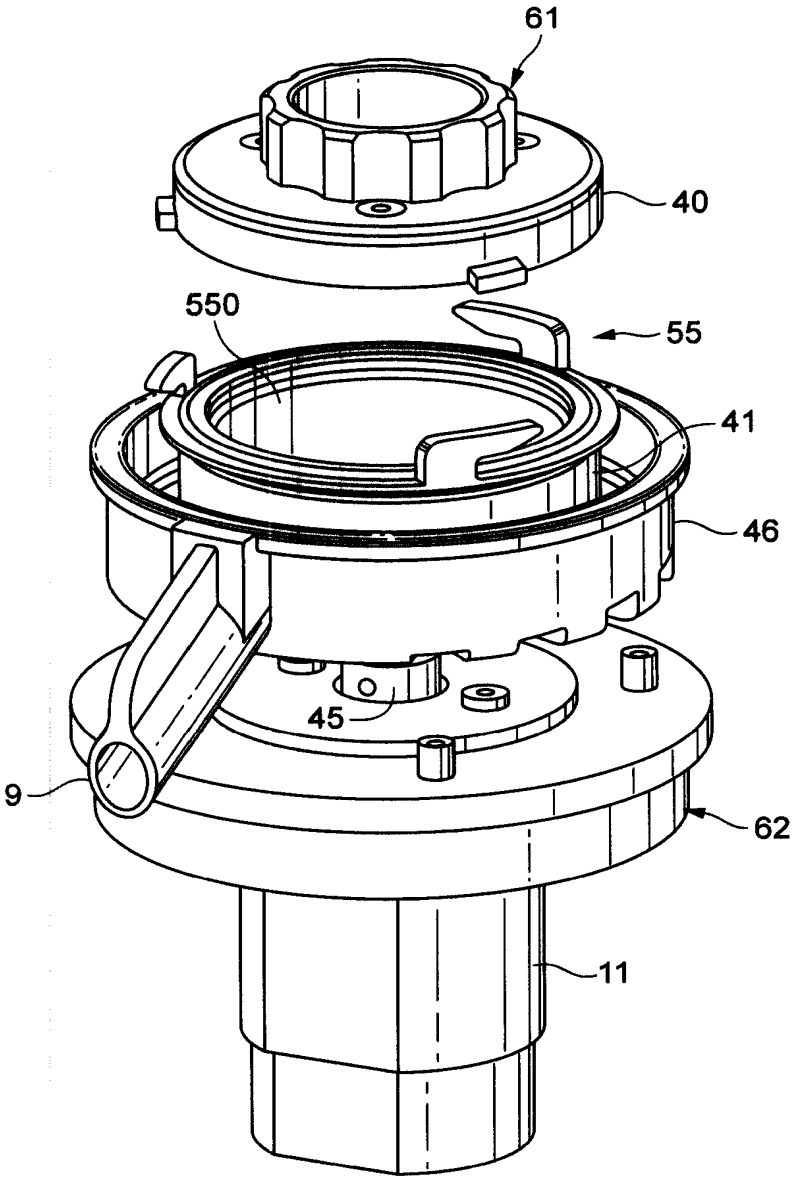


FIG. 5

K-FEE SYSTEM GMBH, EX2009, page 3523
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

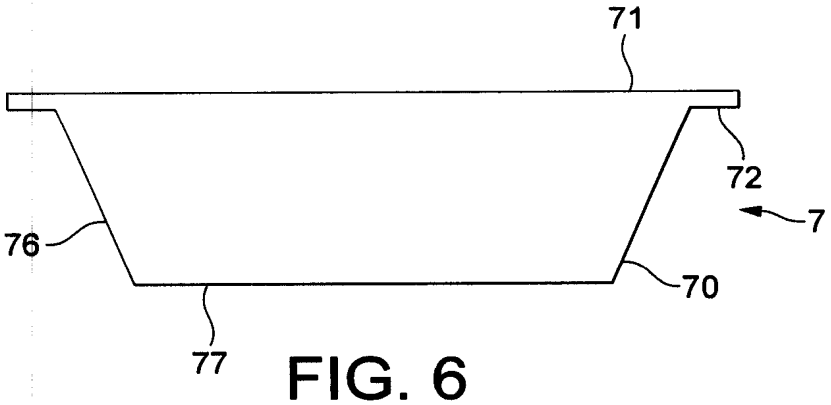


FIG. 6

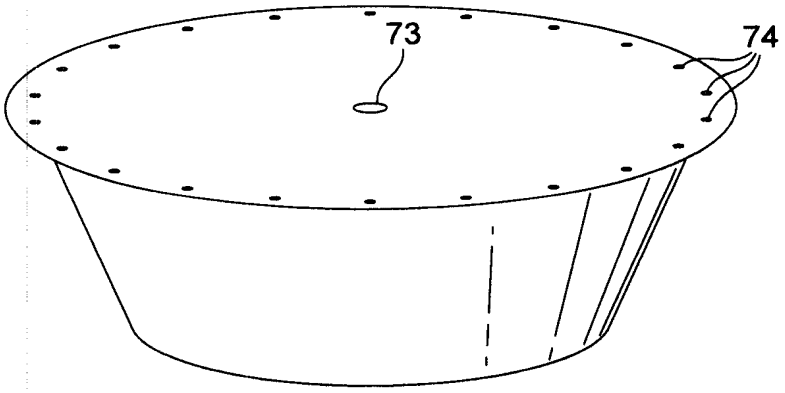


FIG. 7

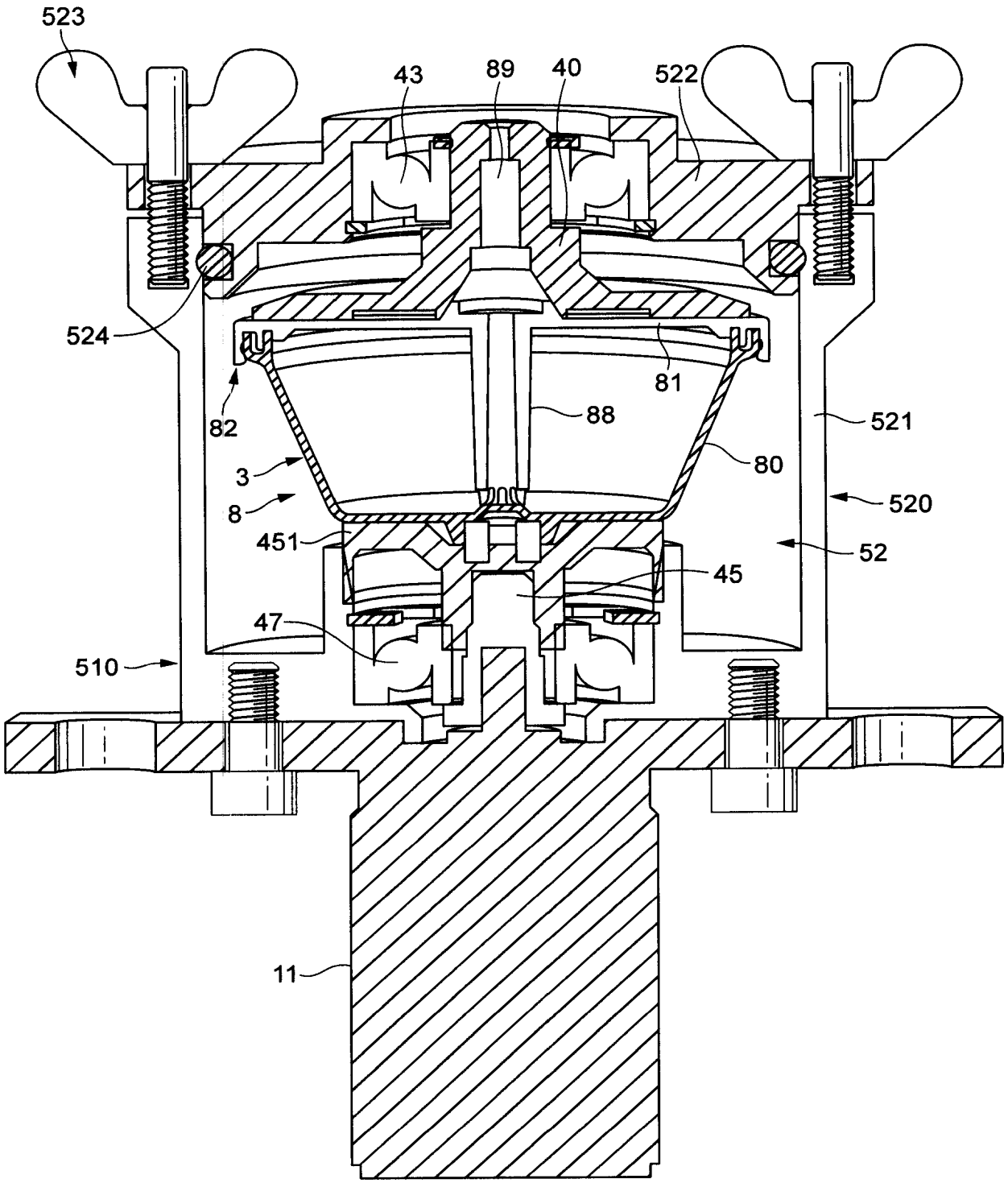


FIG. 8

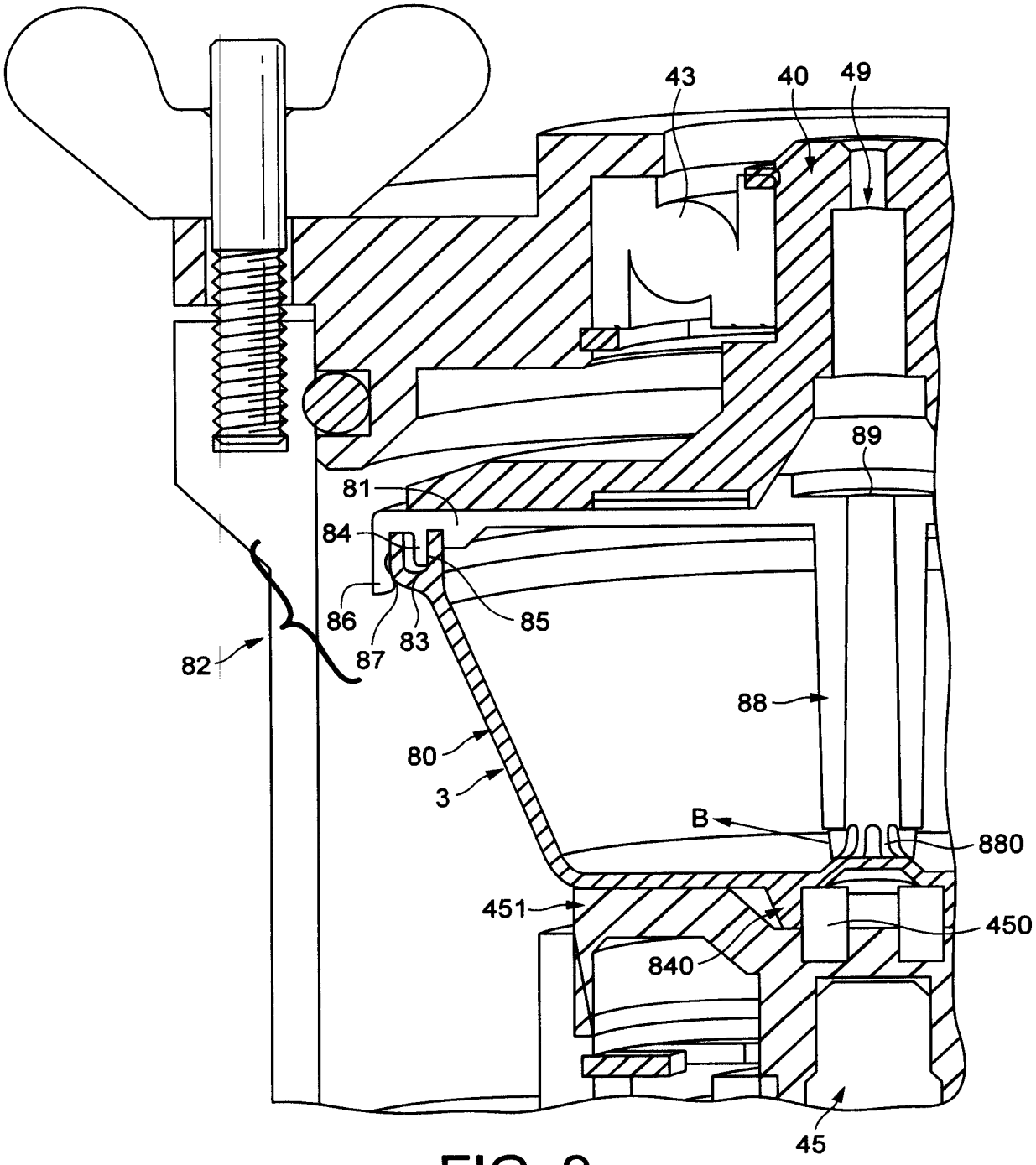


FIG. 9

K-FEE SYSTEM GMBH, EX2009, page 3526
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

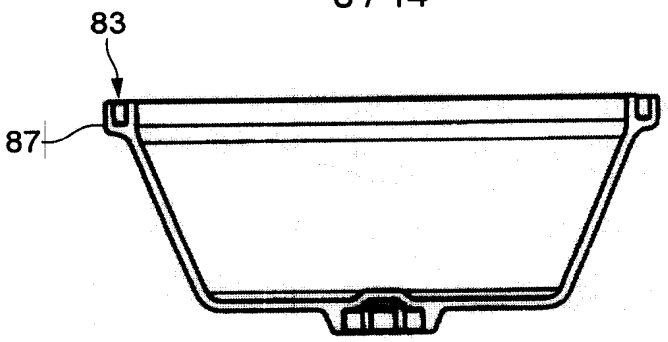


FIG. 10

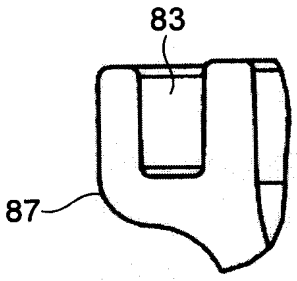


FIG. 11

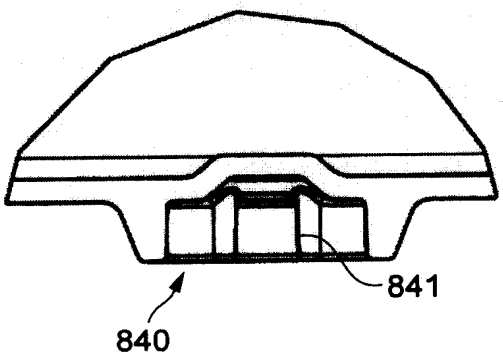


FIG. 12

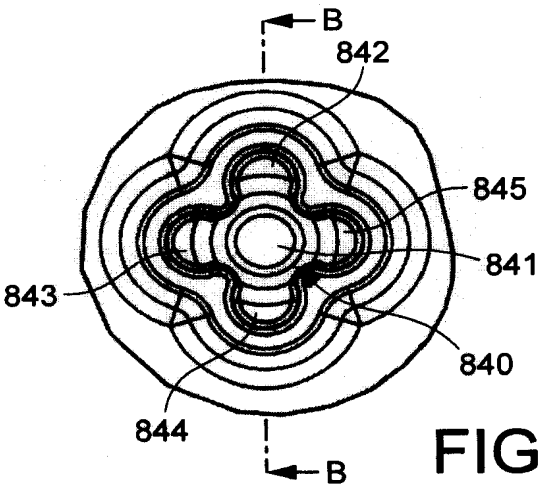


FIG. 13

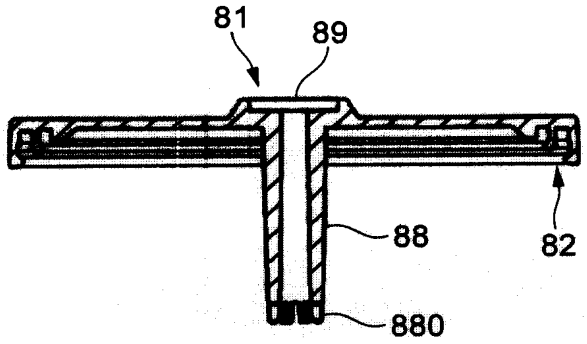


FIG. 14

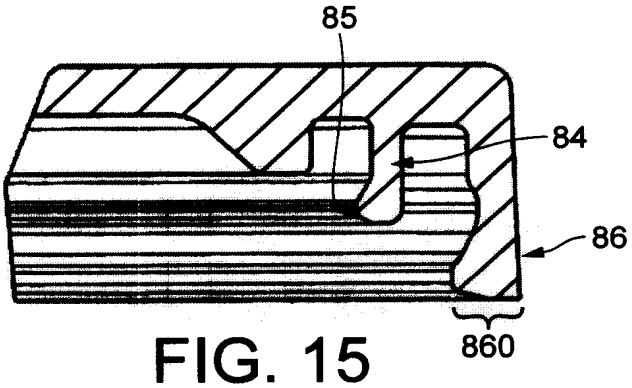


FIG. 15

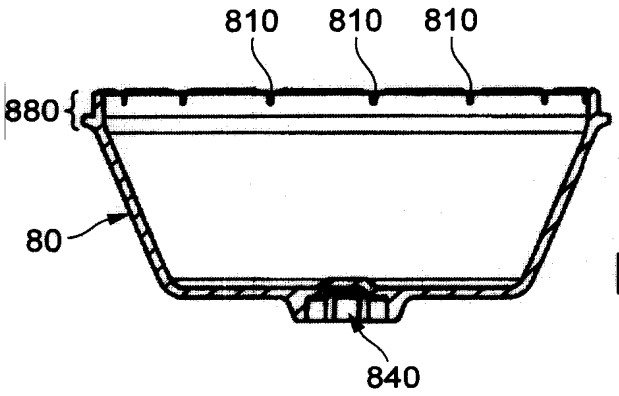


FIG. 16

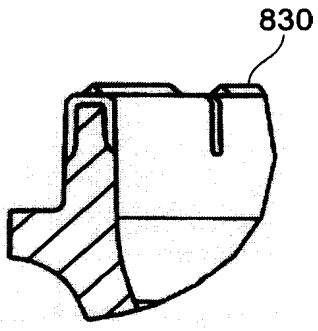


FIG. 17

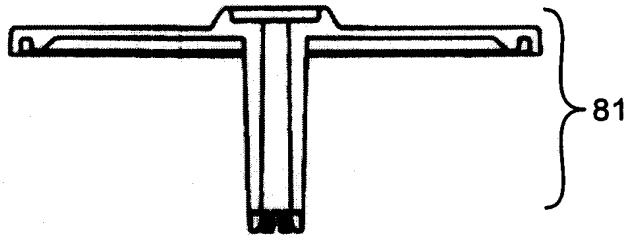


FIG. 18

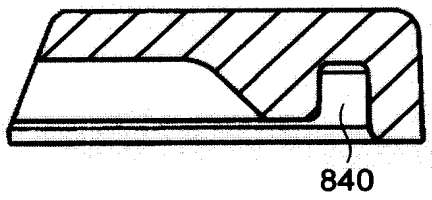


FIG. 19

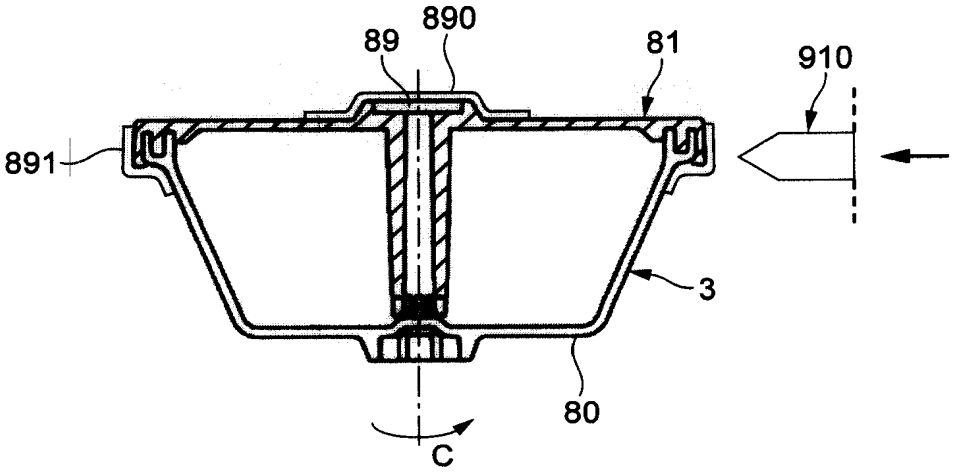


FIG. 20

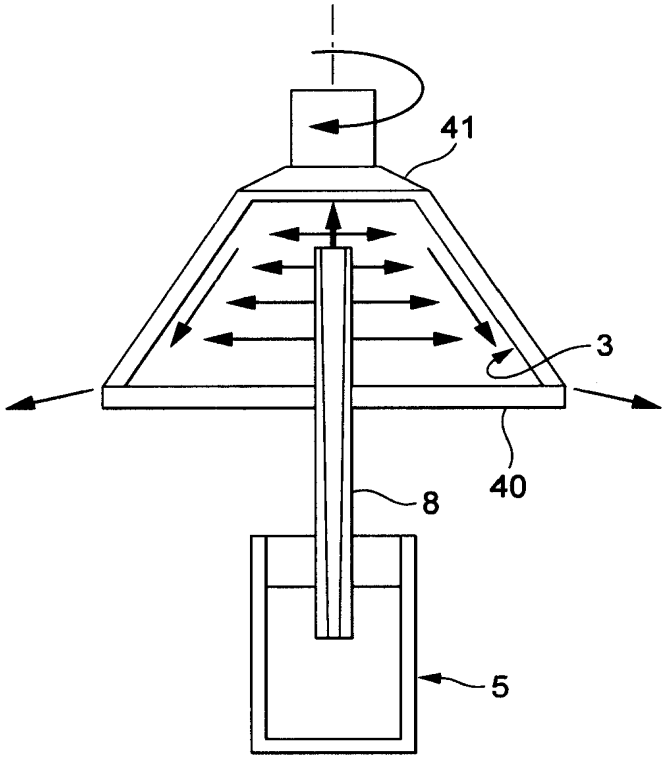


FIG. 21

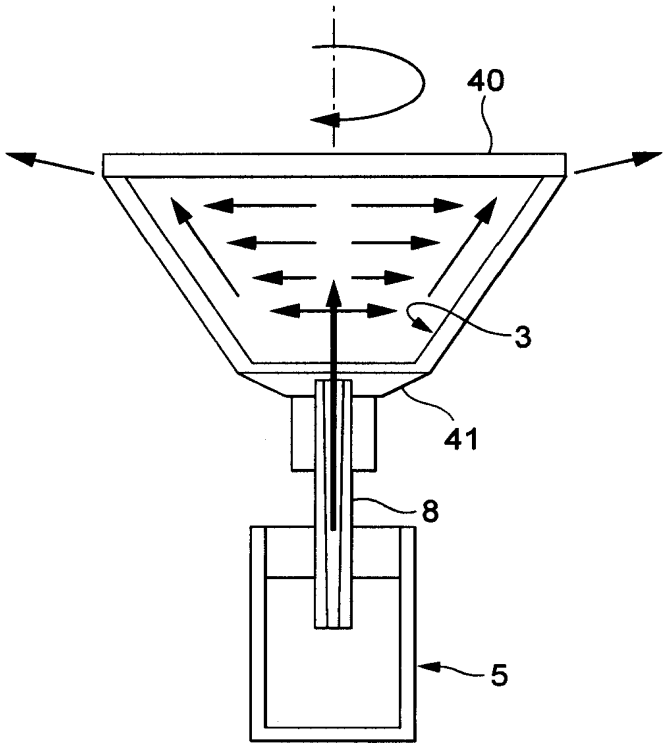


FIG. 22

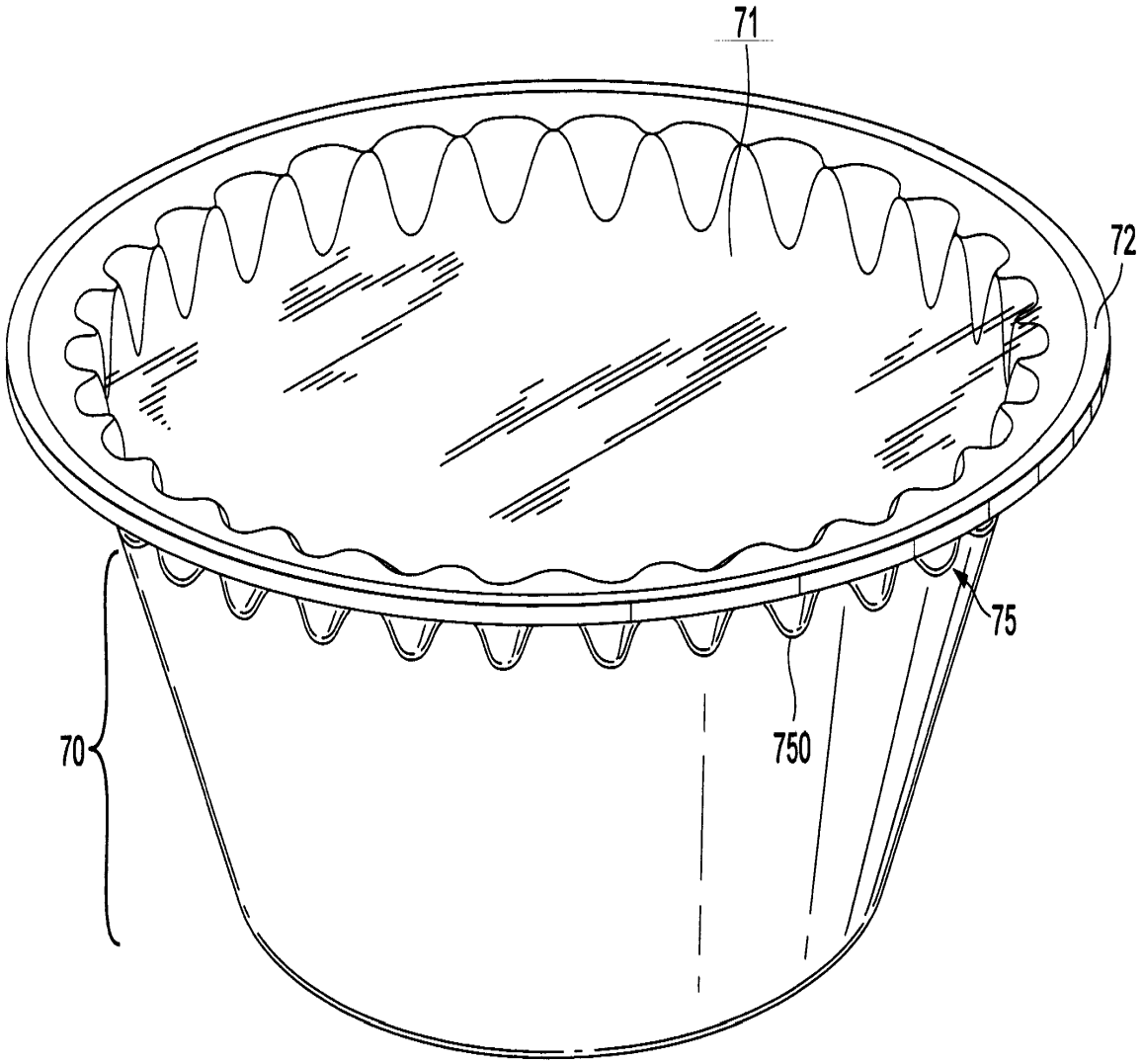


FIG. 23

K-FEE SYSTEM GMBH, EX2009, page 3531
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

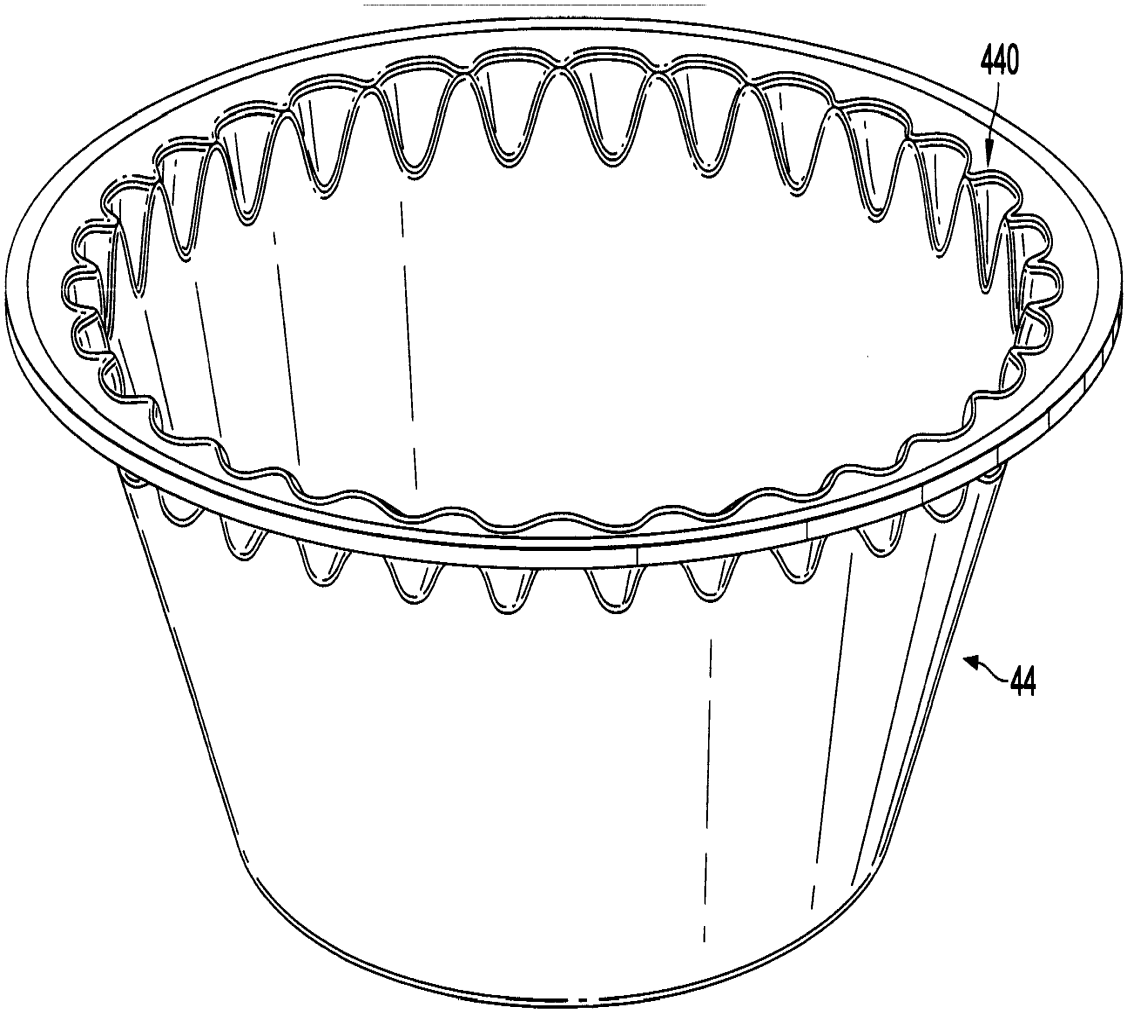


FIG. 24

K-FEE SYSTEM GMBH, EX2009, page 3532
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

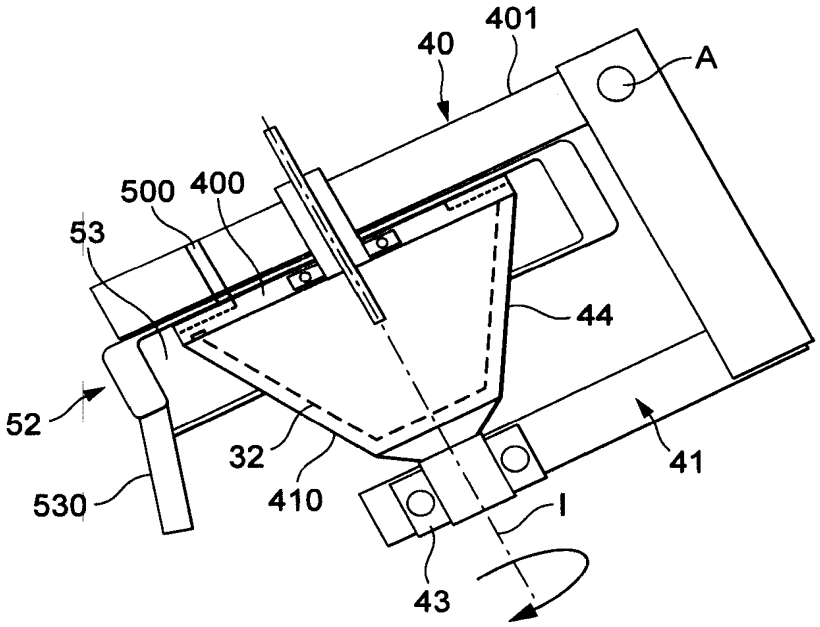


FIG. 25

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/054401

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47J31/06 A47J31/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 42 40 429 A1 (BRAUN AG [DE]) 9 June 1994 (1994-06-09) cited in the application	15,16, 19, 29-35, 39,40,44
A	column 5, line 17 - column 6, line 6 column 6, line 39 - column 7, line 44 figure 1	1,5,8, 20,41
X	DE 10 2005 007852 A1 (WIESAUPLAST KUNSTSTOFF UND FOR [DE]) 31 August 2006 (2006-08-31) cited in the application	15,17, 19-21, 29-31, 34,35,39
A	paragraphs [0029] - [0033], [0035], [0038] - [0046]; figures 1,2,6	1,5,8, 23,41

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 August 2008	11/09/2008

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Novelli, Bruno

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/054401

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 545 296 A (BEN-SHMUEL SONJA [US]) 8 October 1985 (1985-10-08)	15,29-33
A	column 5, lines 12-65 column 6, lines 38-46 column 6, line 58 - column 7, line 18 figures 1,4	1,6

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2008/054401

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 4240429 A1	09-06-1994	NONE	
DE 102005007852 A1	31-08-2006	NONE	
US 4545296 A	08-10-1985	NONE	

Form PCT/ISA/210 (patent family annex) (April 2005)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 October 2013 (31.10.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/160278 A1

(51) International Patent Classification:
A47J 31/52 (2006.01) *A47J 31/44* (2006.01)

(21) International Application Number:
PCT/EP2013/058351

(22) International Filing Date:
23 April 2013 (23.04.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12165274.7 24 April 2012 (24.04.2012) EP

(71) Applicant: **NESTEC S.A.** [CH/CH]; Av. Nestlé 55, CH-1800 Vevey (CH).

(72) Inventors: **BESSON, François**; Chemin des Ruaux 26, CH-2013 Colombier (CH). **PERENTES, Alexandre**; Avenue Virgile Rossel 10, CH-1012 Lausanne (CH).

(74) Agent: **SIVIER, Damien**; Ave Nestlé 55, -, CH-1800 Vevey (CH).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: USER-INTERFACE FOR BEVERAGE PREPARATON MACHINES

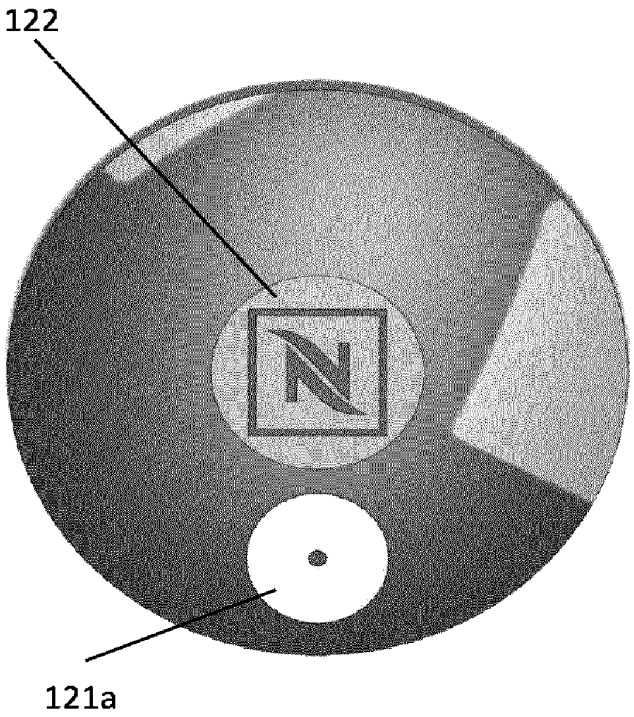


Fig. 5d

(57) Abstract: The invention relates to a Beverage preparation machine (1) comprising: - a user-interface (13) having a selection element (121) for selecting a first value related to at least one property of beverage; - an ingredient processing module for a preparation of a beverage according to the first value, with at least one ingredient supplied in a capsule. The user-interface (13) comprises a feedback element configured to present a default value for the first value, the default value being computed according to values previously used for said at least one property by the machine to prepare beverages.

WO 2013/160278 A1

K-FEE SYSTEM GMBH, EX2009, page 3537
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

USER-INTERFACE FOR BEVERAGE PREPARATON MACHINES

Field of the Invention

The field of the invention pertains to beverage preparation machines, in particular using capsules of an ingredient of the beverage to be prepared, such as beverage preparation machines having a passage for inserting a beverage ingredient into the machine, in particular an ingredient supplied in the form of a preportioned ingredient capsule, and a member for covering and uncovering the passage, as desirable during normal use of the machine.

For the purpose of the present description, a "beverage" is meant to include any human-consumable liquid substance, such as tea, coffee, hot or cold chocolate, milk, soup, baby food, etc… A "capsule" is meant to include any pre-portioned beverage ingredient, such as a flavouring ingredient, within an enclosing packaging of any material, in particular an airtight packaging, e.g. plastic, aluminium, recyclable and/or biodegradable packagings, and of any shape and structure, including soft pods or rigid cartridges containing the ingredient. The capsule may contain an amount of ingredient for preparing a single beverage serving or a plurality of beverage servings.

Background Art

Certain beverage preparation machines use capsules containing ingredients to be extracted or to be dissolved and/or ingredients that are stored and dosed automatically in the machine or else are added at the time of preparation of the drink. Some beverage machines possess filling means that include a pump for liquid, usually water, which pumps the liquid from a source of water that is cold or indeed heated through heating means, e.g. a thermoblock or the like.

Especially in the field of coffee preparation, machines have been widely developed in which a capsule containing beverage ingredients is inserted in a brewing

device. The brewing device is tightly closed about the capsule, water is injected at the first face of the capsule, the beverage is produced in the closed volume of the capsule and a brewed beverage can be drained from a second face of the capsule and collected into a receptacle such as a cup or glass.

Brewing devices have been developed to facilitate insertion of a "fresh" capsule and removal of the capsule upon use. Typically, the brewing devices comprise two parts relatively movable from a configuration for inserting/removing a capsule to a configuration for brewing the ingredient in the capsule.

While it is desirable to increase the number of different functionalities and to allow the user to prepare beverages according to its own preferences, this is generally achieved at the cost of the simplicity and efficiency.

EP2309902 discloses a machine for dispensing beverages having a user interface – customized menu – that is capable of being adapted to the preference of a given user, said user being recognized by a biometric arrangement. This solution requires additional steps and equipments to identify the user for adapting its interface.

Summary of the Invention

An object of the invention is to provide more convenience, and to reduce user's interventions required before starting the preparation of a beverage. Another object is to provide added value functionalities such as semi-automatic or automatic preparation modes. Another object is to allow the configuration of the preparation process, according to the preferences of a user, in a convenient, quick and user-friendly way.

One or more of these objects are met by a machine according to the independent claim(s). The dependent claims further provide solutions to these objects and/or additional benefits.

More particularly, according to a first aspect, the invention relates to a beverage preparation machine comprising a user-interface having a selection element for selecting a first value related to at least one property of a beverage. The machine comprises an ingredient processing module for a preparation of a beverage according to the first value, with at least one ingredient supplied in a capsule. The user-interface comprises a feedback element configured to present a default value for the first value, the default value being computed according to values previously used for said at least one property by the machine to prepare beverages.

The beverage preparation machine can be an in-home or out of home machine. The machine may be for the preparation of coffee, tea, chocolate, cacao, milk, soup, baby food, etc…. The machine may be arranged for preparing within the beverage preparation module a beverage by passing hot or cold water or another liquid through a capsule containing an ingredient, such as a flavouring ingredient, of the beverage to be prepared, such as ground coffee or tea or chocolate or cacao or milk powder.

The beverage preparation typically includes the mixing of a plurality of beverage ingredients, e.g. water and milk powder, and/or the infusion of a beverage ingredient, such as an infusion of ground coffee or tea with water. One or more of such ingredients may be supplied in loose and/or agglomerate powder form and/or in liquid form, in particular in a concentrate form. A carrier or diluents liquid, e.g. water, may be mixed with such ingredient to form the beverage. The ingredient is optionally inserted into the processing module and/or evacuated therefrom within an ingredient capsule, e.g. an aluminium or plastic or paper enclosure containing the ingredient.

The machine typically includes a control unit, in particular a unit for controlling the ingredient processing module. The control unit may comprise a power management module arranged to power the control unit and optionally further electric components, such as the user-

interface and/or a thermal conditioner in particular a heater, when the control unit is unpowered or in standby state. The machine can comprise a motor for driving the processing module: from a configuration for processing the ingredient; to an ingredient transfer configuration for inserting said ingredient into the processing module and/or removing said ingredient therefrom; and/or vice versa. The motor may be arranged to drive the processing module into: the processing configuration when the cover is moved into the covering position; and/or the transfer configuration when the cover is moved into the uncovering position. A motorization for the processing module is for instance disclosed in PCT/EP11/057233, PCT/EP11/057235 and PCT/EP12/050033. A further motorization of the beverage preparation module is for example disclosed in EP 1 767 129.

The machine may have a control unit for controlling the ingredient processing module, the control unit being arranged to initiate automatically beverage preparation when the ingredient is inserted into the processing module and the cover is moved into the covering position. Insertion of the ingredient into the module may be detected by any system, e.g. as known in the art such as an optical detection.

The control unit may be arranged to initiate automatically a shut-down or standby process and/or a service process, when no ingredient is inserted in the processing module. Likewise, the absence of insertion of the ingredient into the module may be detected by any suitable system, e.g. as mentioned above.

Typically, the user-interface is arranged to allow the user choosing the first value with the selection element, for example amongst a plurality of individual value, or within a range. The selection element may comprise buttons, wheels, levers, touch-sensitive elements, pad, keyboard, or any combination of these elements. The feedback element may comprise displays, lights, sound emitters, vibrant elements, mechanical elements, or any combination of these elements. In particular, the selection element and the feedback element may be grouped in one component, for example a

mechanical push button provided with lights or a touch-sensitive display.

For example, the default value may be computed according to the last eleven values previously used for said at least one property by the machine to prepare beverages. More particularly, the default value may be computed by identifying the most frequently selected value for preparing a beverage amongst the last eleven values previously used.

In an embodiment, the selection element comprises a first button for selecting a first volume of beverage to prepare and a second button for selecting a second volume of beverage to prepare. The ingredient processing module is configured to prepare the first volume of beverage if the user has pressed the first button, or the second volume of beverage if the user has pressed the second button. The default value is set to the first volume if the first value is the most frequently selected value amongst the last eleven values previously used, or to the second volume if the second value is the most frequently selected value amongst the last eleven values previously used. If the default value is set to the first volume, then the first button is lightened and the second button is not lightened. If the default value is set to the second volume, then the second button is lightened and the first button is not lightened. Then the user has a visual feedback of which default value is proposed. In an embodiment, the ingredient processing module is configured to prepare the volume of beverage according to the default value when the preparation process is triggered and if the user has not selected another value for the volume of beverage to prepare.

In an embodiment, the machine further comprises an interaction logger configured to record in a log the first value used by the ingredient processing module for preparing the beverage. The machine also comprises a controller adapted to compute the default value according to the content of the log. Preferably, the content of the log is preserved when the machine is switched off. For instance, the log may be stored on a permanent storage, in particular that keeps the data or its contents

regardless if the power of the beverage is turned off. The log may contain entries, each entry comprising the first value.

The controller may be adapted to compute the default value by determining the most frequently chosen value according to the content of the log, or by determining a mean value based upon the content of the log. The controller may also be adapted to compute the default value by determining a most-likely value based upon the content of the log and information related to one or a combination of the following information: current time, current date, identification data related to the capsule, recipes for preparing the beverages. For instance, if the type of the capsule inserted in the preparation module is known or recognized, for example the type of ingredients enclosed within the capsule inserted in the ingredient processing module, the default value may be computed by determining the most frequently selected value for the at least one property, amongst the last eleven values previously used to prepare a beverage with this recognized type of capsules. For example, for a first types of capsule, the most frequently selected value amongst the last eleven values previously used for preparing the first type of capsule may be a third value, whereas for a second type of capsule, the most frequently selected value amongst the last eleven values previously used for preparing the second type of capsules may be a fourth value. Then the default value is set to the third value if a capsule of the first type is inserted in the ingredient processing module. The default value is set to the fourth value if a capsule of the second type is inserted in the ingredient processing module.

The user-interface may be configured to set the first value to the default value after each preparation of a beverage and/or at each power-up of the machine.

The at least one property may relate to a volume of beverage to be prepared. Typically, the volume of beverage corresponds to a serving. The volume of such a serving may be in the range of 25 to 200 ml and even up to 300 or 400 ml, e.g. the volume for filling a cup, depending on the type of beverage. Formed and dispensed

beverages may be selected from ristrettos, espressos, lungos, cappuccinos, latte macchiato, café latte, americano coffees, teas, etc... In particular, a coffee machine may be configured for dispensing espressos, e.g. an adjustable volume of 20 to 60 ml per serving, and/or for dispensing lungos, e.g. a volume in the range of 70 to 150 ml per serving.

The at least one property may relate to a recipe for preparing a beverage and/or any parameters having influence on the preparation of the beverage, like the temperature of the dispensed beverage.

The selection element may be adapted to allow modifications of the first value during the preparation of the beverage, the ingredient processing module being configured to take into consideration said modifications for preparing said beverage if it is still possible. For example, the controller may have computed a default value corresponding to the first volume according to the content of the log, and the ingredient processing module may have begin the preparation of the first volume of beverage according to the default value. However if the selection element is used by the user to select the second volume during the preparation process, the processing module may be configured to take into consideration this event. For instance, if the second volume is greater than the first volume, the processing module may be configured to continue the preparation of the beverage until the second volume is reached. If the second volume is smaller than the first volume, if the volume of beverage already produced is inferior to the second volume, the processing module may be configured to continue the preparation of the beverage until the second volume is reached, or to stop the preparation if the volume of beverage already produced is greater of equal to the second volume. As a consequence, the user may adapt the production of the beverage to its wishes, even after the start of the preparation.

In an embodiment, the beverage preparation machine comprises a positioner arranged to hold at least one capsule out of the ingredient processing module. The machine further comprises a sensing arrangement adapted

to detect an event related to the insertion by a user of a capsule and/or the presence of the capsule on or into the positioner. The machine is configured, upon detection of the event, to transfer the capsule to the ingredient processing module by using transfer means, and then to start the preparation of the beverage. In particular, the machine may be configured to start the preparation of the beverage according to the default value and/or other default parameters. Consequently, the user has only to put a capsule in the positioner to trigger automatically the preparation of a beverage. This simple, quick and intuitive gesture replaces the traditional sequence consisting in opening the brewing unit, inserting a capsule, then closing the brewing unit and pressing a start button. Moreover, the user is free to place a capsule of its choice into the positioner: as consequence, the user can choose easily what type of capsule he wants to use to prepare its beverage, without having to fill in a cartridge or a magazine for example.

Moreover, the positioner may be placed outside the ingredient processing module, in particular outside a brewing unit of the ingredient processing module, and preferably in a position where it is visible and accessible to the user, so that the latter may have a visual feedback. Consequently, if an object is placed into the positioner and is not detected as a capsule by the sensing arrangement, the user can more easily extract it away from the positioner. Also, the preparation of the beverage will not start automatically if a capsule is not detected into the positioner, improving the level of safety of the machine. It is also possible to provide other means for feeding the positioner with capsules put down by a user, for instance guiding means or luge arranged to transfer capsules to the positioner from an additional storage area.

In particular, the sensing arrangement may be adapted to detect the event by receiving or reading information from the capsule, and/or by measuring at least one of the following characteristic of the capsule: spectral property, colour, electrical property, resistivity, capacitance, electromagnetic property, magnetic induced field, mechanical property, geometry,

weight, identifying information, code bar, emitted or reflected signal. The sensing arrangement may be further adapted to identify a type for the capsule; the machine is then configured to start the preparation of the beverage according to parameters adapted to, or depending of, the identified type of the capsule.

The default value may be computed by the controller beverage according to the recognized type. For instance, the default value may be computed by selecting the most frequently selected volume for the recognized type.

In an embodiment, the machine is further configured to transfer the capsule to the ingredient processing module upon detection of the event as soon as the machine is ready to start the preparation of a beverage with the capsule. For example, if the machine is currently preparing another beverage, the user can still position a capsule into the capsule positioner: the machine will use said capsule as soon as possible. It may be also useful to prepare one beverage with a plurality of capsules of the same type, for example to obtain a higher volume, or with a plurality of capsules of the different type, for example to obtain a beverage made of a plurality of ingredients like a cappuccino. The machine can also be not ready to prepare the beverage, for example if its water tank is empty or not filled enough to prepare the beverage: then the user can still place a capsule into the positioner, and fill the water tank with water to start automatically the preparation of the beverage.

In an embodiment, the ingredient processing module comprises a first part and a second part which are movable relatively one another. The processing module is configurable into an opened position wherein a passage is provided between the first and second part for allowing the insertion of a capsule. The machine further comprises closing means arranged to close at least partially the passage. The machine is further configured to operate the closing means so as to open the passage upon the detection of the event. Moreover, the ingredient processing module may have only one unique passage for allowing the insertion of capsule, the closing means being then capable of closing the sole possible entry to

feed the ingredient processing module. By using closing means, it is possible to physically obstruct the passage leading to the ingredient processing module, more particularly when the latter is in its opened position and whereas no capsule has been detected yet. Hence, unless the event related to the insertion of a capsule by the user into the positioner is detected, the entry into the processing module of an unexpected object is prevented. The level of safety of the machine is thus improved, the passage leading to a chamber of the processing module being closed to any object not detected as a capsule.

The positioner may be positioned relatively to the passage so as to allow the capsule to be transferred, upon the detection of the event, into the ingredient processing module at least partially under the action of the gravity force. The transfer means are then simplified since they may comprise only guiding means for guiding the capsule. In particular, the positioner may be positioned above the ingredient processing module and the passage, for instance, on top of the housing of the machine, to benefit from the action of the gravity.

The machine may also be further configured to operate the closing means so as to open the passage upon the detection of the event provided that the machine is currently ready to prepare a beverage. So, if the machine is not ready, the capsule will not leave the capsule positioner: as a consequence, the user could retrieve easily the intact capsule if he wants.

The closing means may be driven by a motorized arrangement for opening the passage upon the detection of the event. The closing means may be mechanically linked by a mechanical coupling means with the first part and/or a second part of the ingredient processing module for opening the passage upon the detection of the event.

In an embodiment, the closing means are part of the positioner. For example, the positioner may comprise a seat adapted to hold the capsule, the closing means comprising a sliding cover forming part of the seat: the machine is further configured to operate the closing means for opening the passage upon the detection of the

event by translating the sliding cover. In another example, the positioner comprises a rotating body in which a seat adapted to hold the capsule is formed, the closing means comprising a closing part: the machine is configured, upon detection of the event to transfer the capsule to the ingredient processing module by rotating the rotating body into a position in which the closing part close at least partially the passage.

Brief Description of the Drawings

The invention will now be described with reference to the schematic drawings, wherein:

- Figure 1 is a schematic view of a beverage machine according to an embodiment;
- Figure 2 is a cross section of a capsule adapted to be used by the beverage machine to prepare a beverage;
- Figure 3a is a partial cross section perspective representation of a brewing unit of the beverage machine of figure 1 in open position;
- Figure 3b shows a partial cross section perspective representation of a closed brewing unit of the beverage machine of figure 1 in an "empty closure mode";
- Figure 3c shows a partial cross section perspective representation of a closed brewing unit of the beverage machine of figure 1 in a "capsule closure mode";
- Figure 4a is a detailed view of a capsule positioner of the beverage machine of figure 1, in a closed position, according to a first embodiment;
- Figure 4b is a detailed view of a capsule positioner of the beverage machine of figure 1, in an open position, , according to a first embodiment;
- Figures 5a, 5b, 5c and 5d show an embodiment of the user-interface;
- Figure 6 shows another embodiment of the user-interface.

Detailed description

A beverage machine 1 according to an embodiment is illustrated schematically on figure 1. The beverage machine comprises a brewing unit 2 which is coupled with an electrical motor 3 driving transmission means 4 for moving the brewing unit between an opened and a closed position. The brewing unit is represented in the opened position on figure 1. The brewing unit allows the preparation of a beverage from a capsule 5 containing at least one ingredient, e.g. ground coffee or tea or chocolate.

As shown in Figure 2, the capsule has a generally cup-shaped body 51 and a covering membrane 52. Membrane is assembled to cup along a peripheral rim 54 of cup. The rim may be covered with a seal 54', e.g. made of elastomeric or plastic material. Furthermore, the capsule in particular the rim and/or the membrane may bear a ring or toroid 53, e.g. for assisting manufacturing and/or handling of the capsule. Such capsule forms a packaging for containing an ingredient 50, e.g. ground coffee, of a beverage to be prepared with the beverage preparation machine. In an embodiment, the capsule forms a gastight packaging, e.g. made of aluminium or an aluminium-alloy. Alternatively, the capsule may be more or less pervious, e.g. perforated and/or made of organic, in particular plastic material, e.g. biodegradable material. The capsule's cup and/or the capsule's membrane may be made of a monolithic material, e.g. a metallic material or a conductive ceramic and/or conducive organic material, or may be made of a structure covered or containing a conductive material, e.g. a conductive coating or track, e.g. an aluminium, iron and/or copper coating or track.

As represented on Figure 1, water supply means are also provided as a part of the machine, such means including a water reservoir 6, a water pump 7 and a water heater 8. Water circulates in a water circuit 9 which is linked to the brewing unit. Controller is also provided in the machine. The controller includes typically a control unit 11, sensors 12 and a user interface 13. The control unit includes processor(s), memories and programs

enabling to provide appropriate inputs to and receive outputs from the different activation means of the machine in particular, the pump, heater, motor and user interface.

Referring now to figures 3a, 3b, and 3c, there is shown therein an exemplary motorized embodiment of the brewing unit. The brewing unit more particularly comprises a first assembly 23 and a second assembly 24 which are movable relatively one another. In this particular mode, the rear injection assembly 23 represents the capsule cage including injection blades 25. The front assembly 24 represents the beverage delivery assembly and includes a capsule delivery plate 26. The front assembly is associated to an outer casing 27 and the whole is movable relatively to the rear injection assembly 23 which remains fixed to a frame 28. The front delivery assembly 24 comprises a beverage outlet 29. The front delivery assembly 24 is moved relatively to the rear injection assembly 23 by means of the motor 3 which drives the transmission means 4. In the opened position (figure 3b), a passage 31 is provided between the first and second assemblies 23, 24 for allowing the insertion of a capsule. In the closed position (figure 3c), a brewing chamber 39 is provided.

The beverage machine further comprises a capsule positioner 40 having a seat adapted to store at least one first capsule out of the brewing chamber, and preferably outside the brewing unit. In an embodiment, the positioner is arranged to store at least a second capsule, out of the brewing chamber, and preferably outside the brewing unit. The capsule positioner may comprise a closing apparatus operable for switching the capsule holder between at least an opened position and a closed position. In the closed position, the capsule holder is configured to store the capsule in the seat. In the opened position, the capsule holder is configured to allow a capsule, pre-positioned into the capsule seat, entering the brewing unit chamber. More particularly, the capsule positioner is arranged so as to allow a capsule entering and passing through the passage of the brewing unit before reaching the capsule chamber, when the capsule positioner is set in its opened position. The