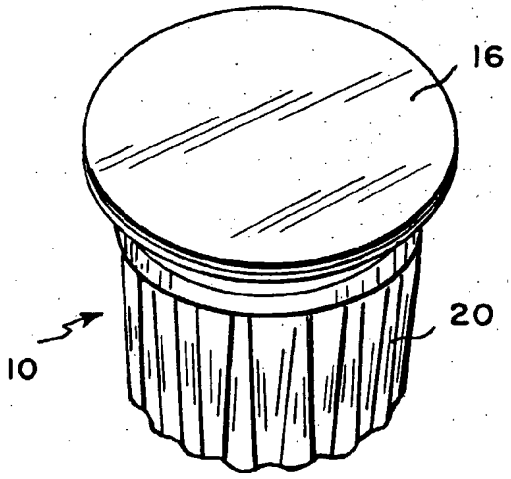


FIG. 1

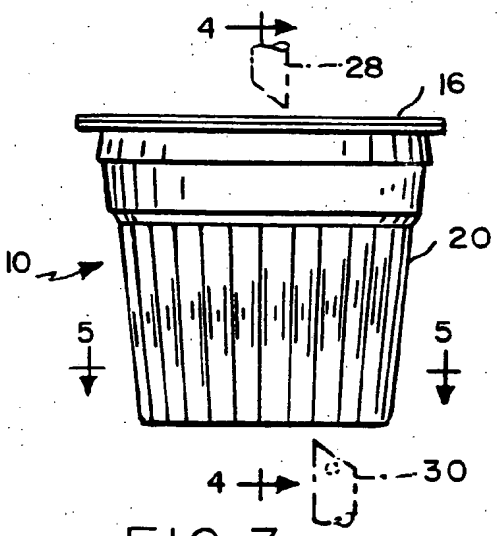


FIG. 3

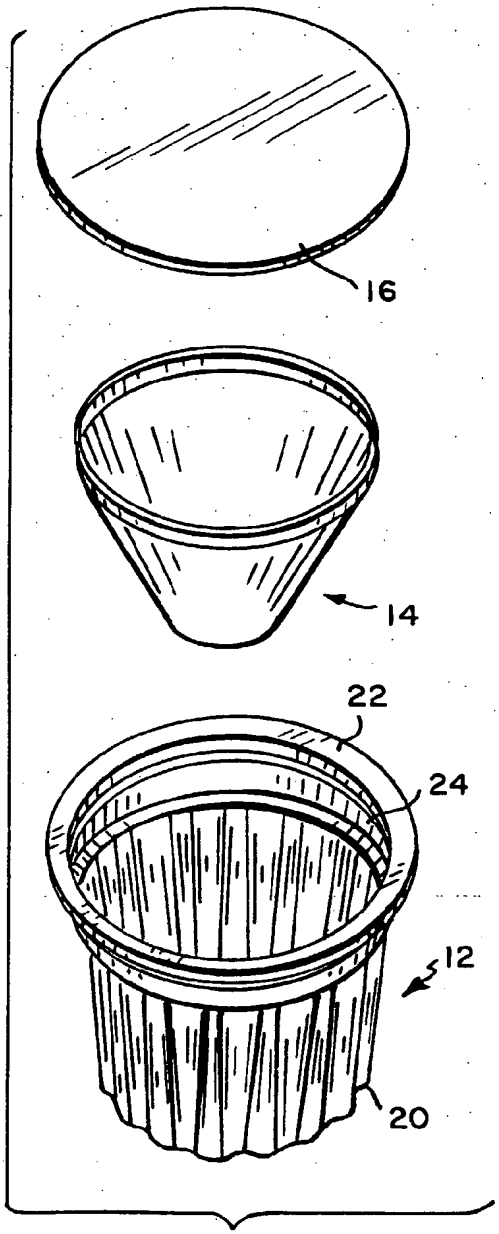


FIG. 2

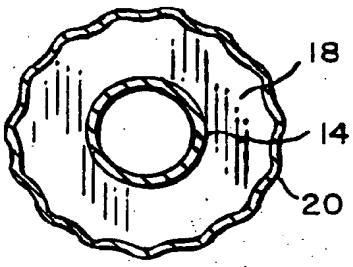


FIG. 5

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
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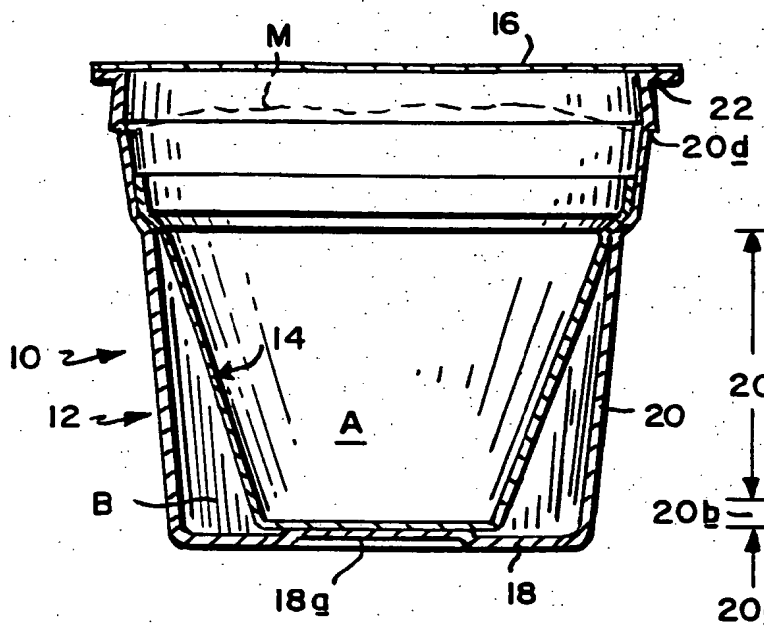


FIG. 4

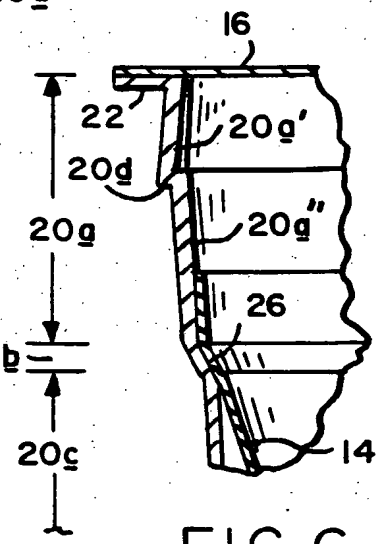


FIG. 6

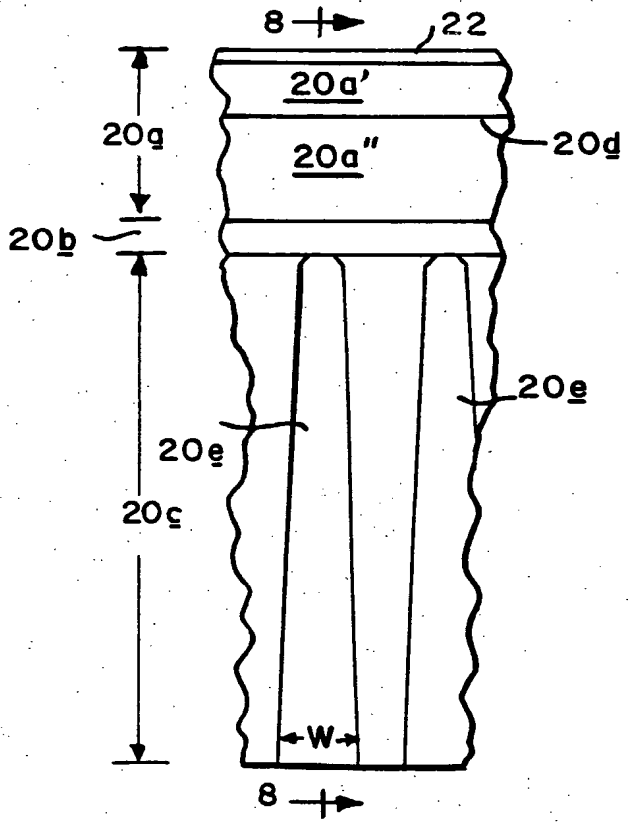


FIG. 7

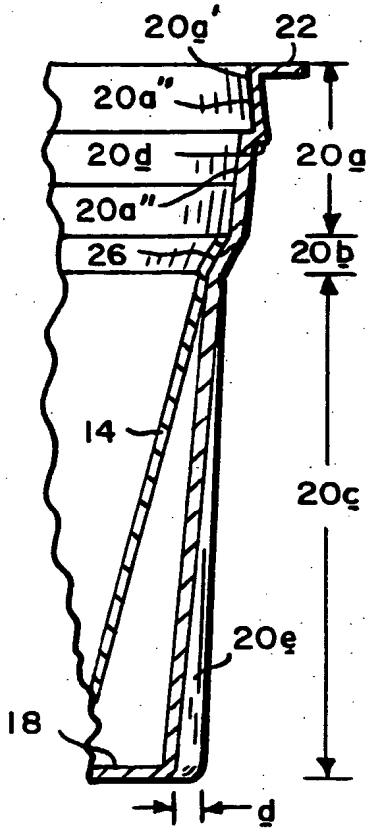


FIG. 8

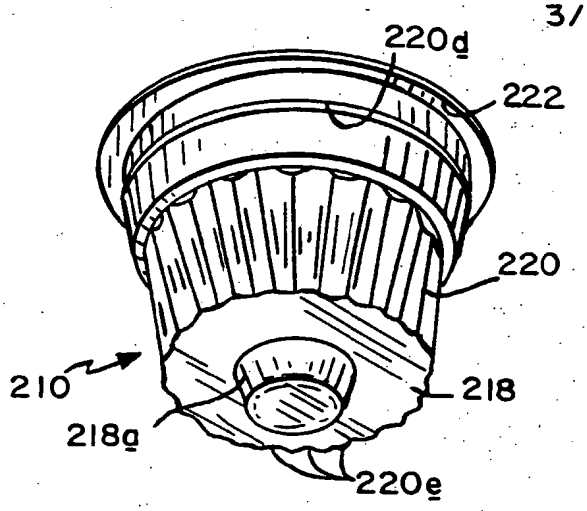


FIG. 9

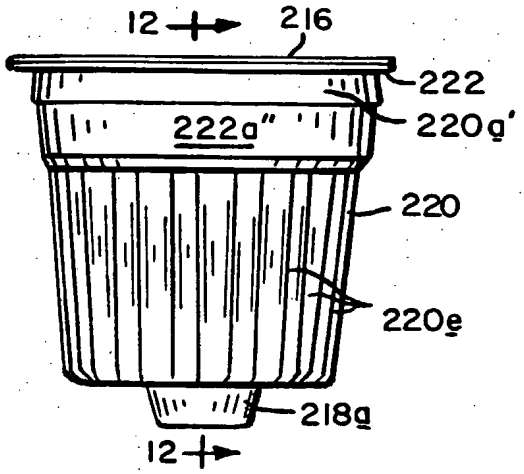


FIG. 10

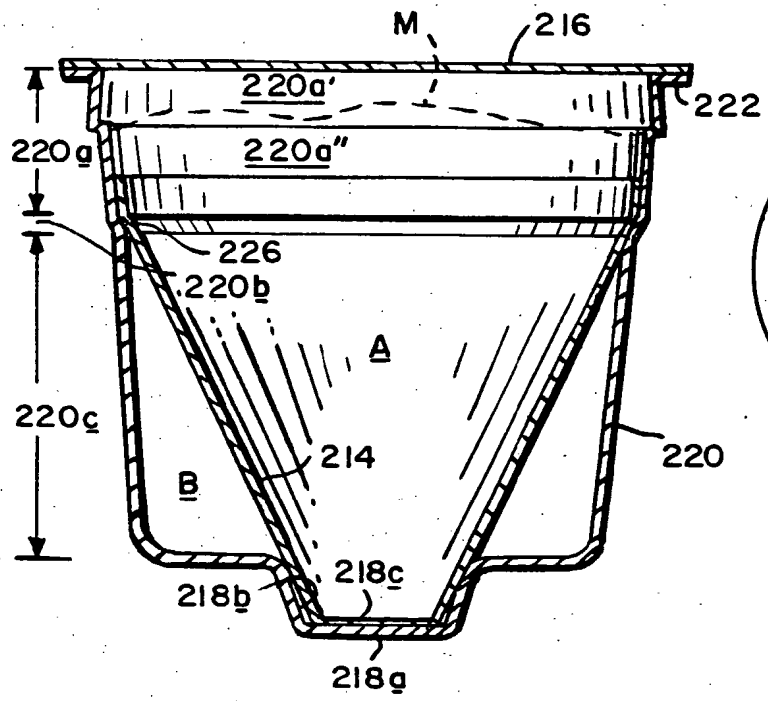


FIG. 12

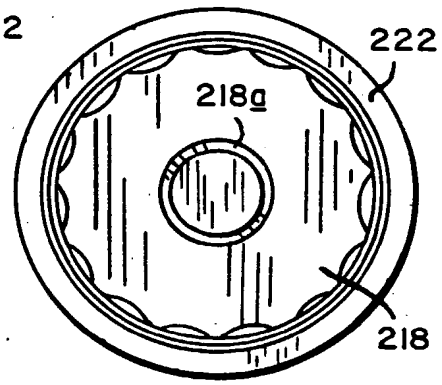


FIG. 11

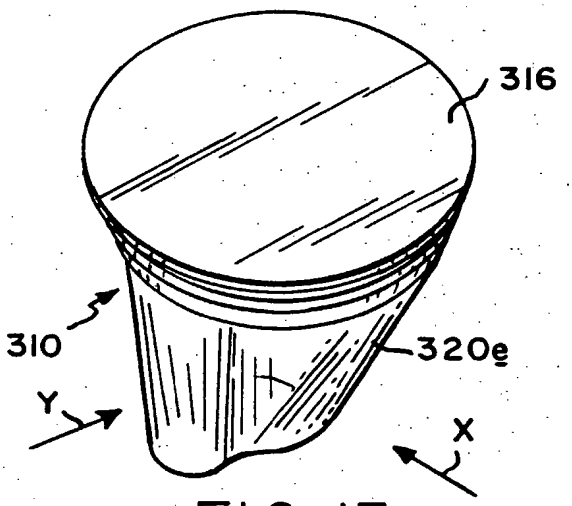


FIG. 13

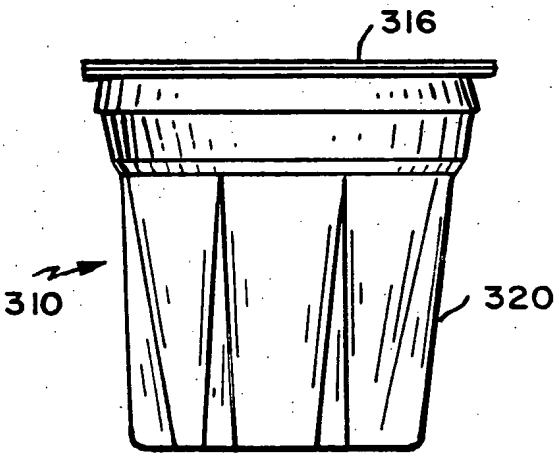


FIG. 15

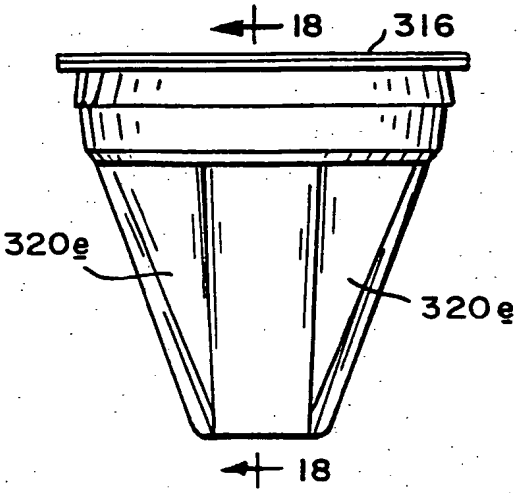


FIG. 16

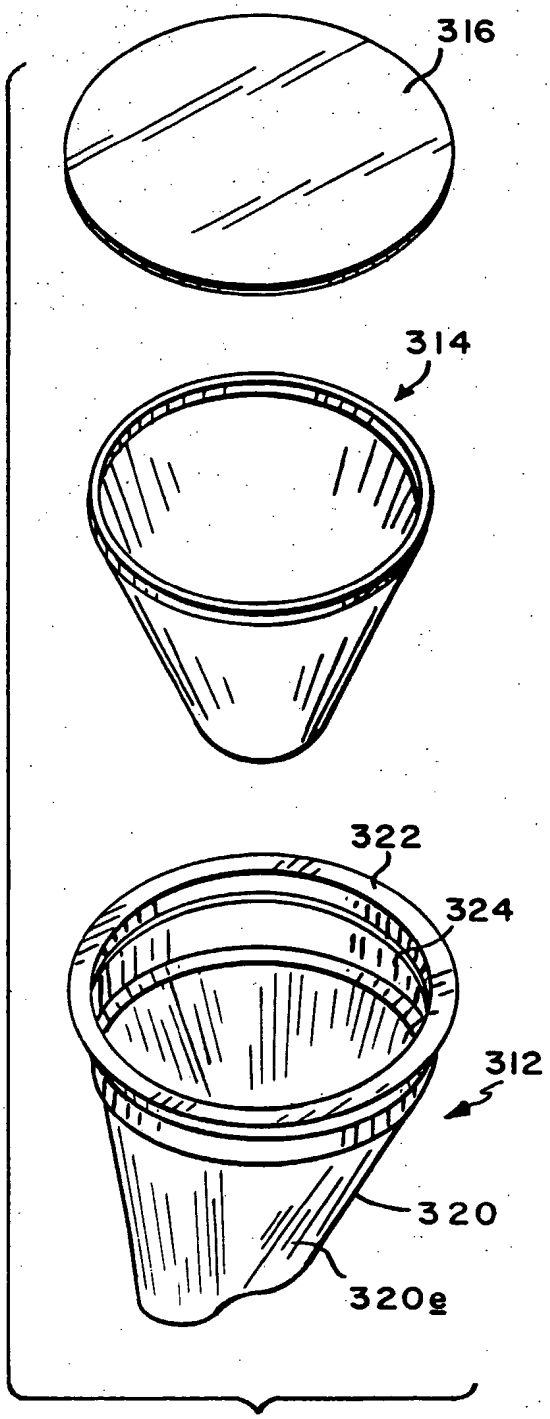


FIG. 14

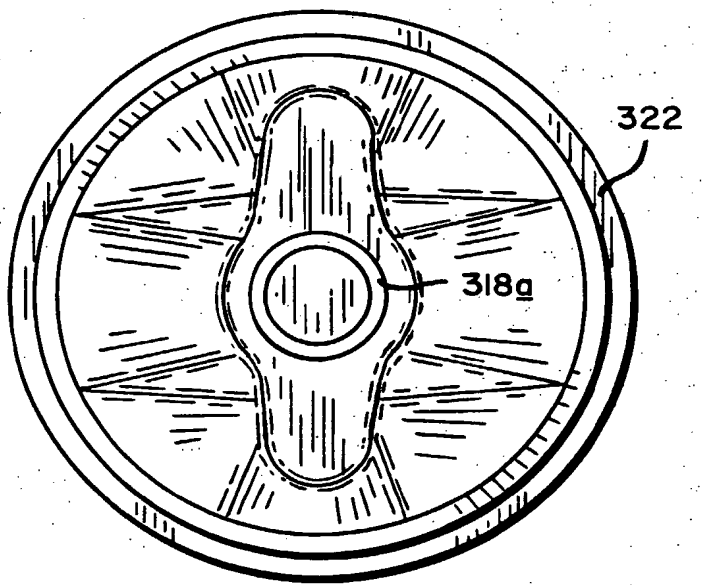


FIG. 17

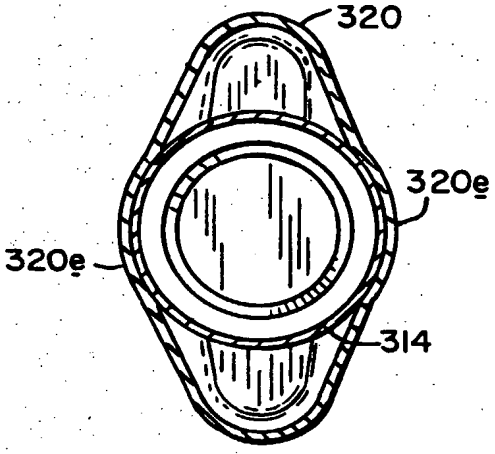


FIG. 20

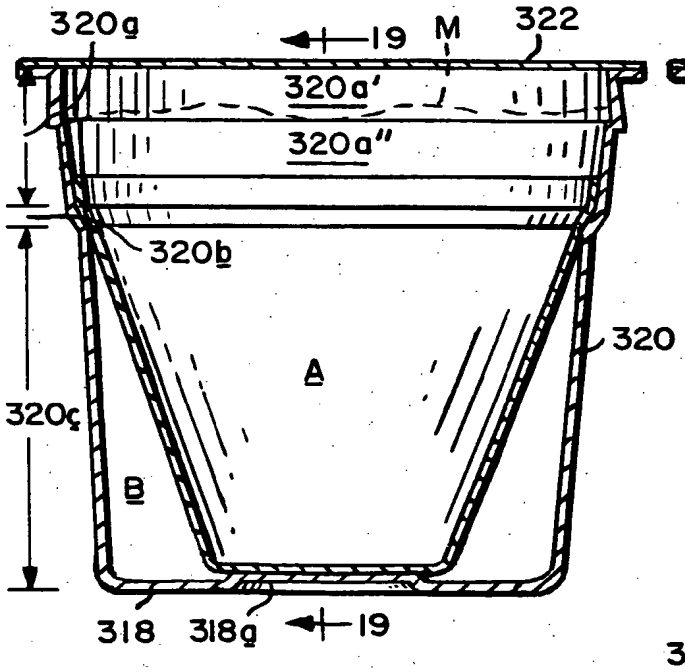


FIG. 18

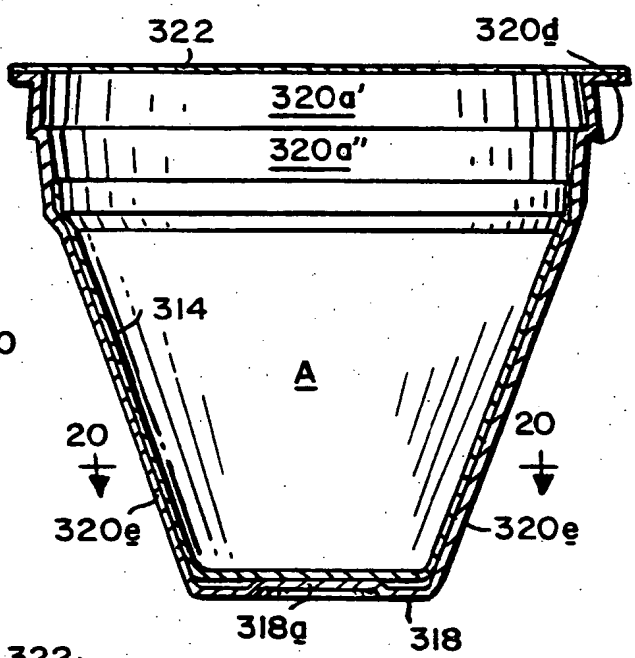


FIG. 19

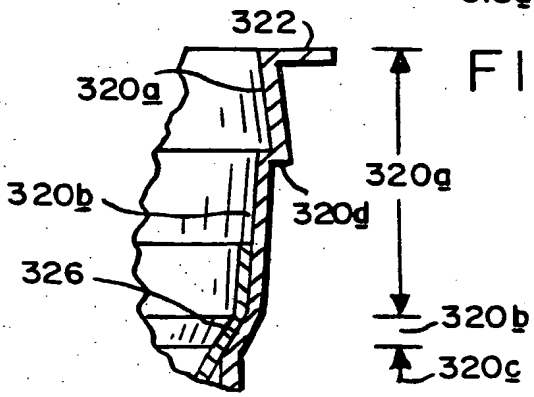


FIG. 21

INTERNATIONAL SEARCH REPORT

tional Application No
PCT/US 01/04881

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65D81/00

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 B65D

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.
Y	US 5 840 189 A (SYLVAN JOHN E ET AL) 24 November 1998 (1998-11-24) cited in the application	1,6,7, 15-17
A	column 2, line 66 -column 3, line 58; claims 1-5; figures 1,2,5	10,18
Y	DE 15 36 372 A (WEBER, W.) 15 January 1970 (1970-01-15)	1,6,7, 15-17
A	page 3, line 17-21 page 6	12

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

☒ 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

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"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

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Date of the actual completion of the international search	Date of mailing of the international search report
18 July 2001	30/07/2001

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	Novelli, B

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

tional Application No
PCT/US 01/04881

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5840189 A	24-11-1998	US 5325765 A	05-07-1994
DE 1536372 A	15-01-1970	CH 448878 A	15-12-1967

Form PCT/ISA/210 (patent family annex) (July 1992)

(19) BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENTAMT

(12) **Offenlegungsschrift**

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(51) Int. Cl. 4: **A47J 31/06**

(21) Aktenzeichen: P 34 32 339.2
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(43) Offenlegungstag: 13. 3. 86

DE 3432339 A1

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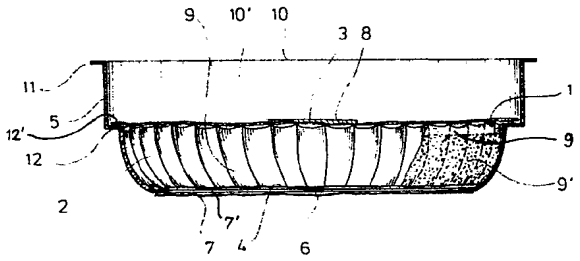
(72) Erfinder:

gleich Anmelder

Prüfungsantrag gem. § 44 PatG ist gestellt

(54) Kaffee-Kompaktfilter

Kaffee-Kompaktfilter, bestehend aus einem oben und unten offenen Filtergehäuse mit je einer darin fest angebrachten oberen und unteren Filterpapierlage, zwischen denen eine bestimmte Menge gemahlenen Kaffees eingebracht ist, wobei zwischen oberer und unterer Filterpapierlage (1 und 4) randseitig entlang der Innenseite des Filtergehäuses (10') ein Filterpapiereinsatz (2) angeordnet ist, der mit der Innenseite des Gehäuses (10') nicht oder nur teilweise in Berührung steht und mit der unteren Filterpapierlage (4) verbunden oder einstückig ist, und Kaffee-Maschine für die Verwendung des Kaffee-Kompaktfilters (10), die eine bewegbar mit dem Gehäuse der Maschine verbundene Aufnahmevorrichtung mit einer Öffnung zur Aufnahme des Kaffee-Kompaktfilters (10) aufweist.



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BUNDESDRUCKEREI 01. 86 608 011/295 7/60

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Patentansprüche:

1. Kaffee-Kompaktfilter, bestehend aus einem oben und unten offenen Filtergehäuse mit je einer darin fest angebrachten oberen und unteren Filterpapierlage, zwischen denen eine bestimmte Menge gemahlenen Kaffees eingebracht ist,
dadurch gekennzeichnet, daß zwischen oberer und unterer Filterpapierlage (1 und 4) randseitig entlang der Innenseite des Filtergehäuses (10') ein Filterpapiereinsatz (2) angeordnet ist, der mit der Innenseite des Gehäuses (10') nicht oder nur teilweise in Berührung steht und mit der unteren Filterpapierlage (4) verbunden oder einstückig ist.

2. Kaffee-Kompaktfilter nach Anspruch 1, dadurch gekennzeichnet, daß der randseitig angeordnete Filterpapiereinsatz (2) aus geriffeltem, gewelltem, zickzack-förmig gefaltetem oder ähnlich geformtem Filterpapier besteht, so daß zwischen dem randseitig angeordneten Filterpapiereinsatz (2) und der Innenseite des Gehäuses (10') ein Ringkanal bzw. mehrere etwa parallele Kanäle (13) mit einer im wesentlichen vertikalen Achse gebildet werden, die nach unten offen sind.

3. Kaffee-Kompaktfilter nach den Ansprüchen 1 und 2, dadurch gekennzeichnet, daß die das Kaffeemehl (9') abdeckende obere Filterpapierlage (1) eine automatische Entlüftung (3) aufweist, die sich unter dem Einfluß von heißem Wasser oder Wasserdampf öffnet.

4. Kaffee-Kompaktfilter nach den Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß die automatische Entlüftung (3) durch wenigstens einen Schnitt, eine Perforation oder ähnliches in der oberen Filterpapierlage (1), die mit wenigstens einem Klebestreifen (8) oder

ähnlichen abgedeckt ist, der sich unter der Einwirkung von heißem Wasser oder Wasserdampf wenigstens teilweise ablöst, gebildet wird.

5. Kaffee-Kompaktfilter nach den Ansprüchen 1 bis 4, dadurch gekennzeichnet, daß das Filtergehäuse 10' einen für die Aufnahme von heißem, zu Einfüllbeginn noch nicht durch die Filterpapierlagen (1 und 4) und den gemahlenen Kaffee (9') gelaufenem Wasser ausreichend hohen Rand (5) oberhalb der oberen Filterpapierlage (1) des Kompaktfilters (10) aufweist.

6. Kaffee-Kompaktfilter nach den Ansprüchen 1 bis 5, dadurch gekennzeichnet, daß die untere Filterpapierlage (4) des Kompaktfilters (10) durch ein darunterliegendes, mit dem Filtergehäuse (10') verbundenes oder einstückiges Trag- und Abstandselement (6) in Form eines Kreuzes, eines Sterns, eines Gitters oder ähnliches unterstützt wird.

7. Kaffee-Kompaktfilter nach den Ansprüchen 1 bis 6, dadurch gekennzeichnet, daß das Filtergehäuse (10') unterhalb des Trag- und Abstandselementes (6) eine weitere Filterlage (7) in Form eines Kunststoffgazefilters, eines Papierfilters oder ähnliches aufweist, die durch das Trag- und Abstandselement (6) von der unteren Filterpapierlage (4) des Kompaktfilters (10) auf Abstand gehalten wird.

8. Kaffee-Maschine für die Verwendung des Kaffee-Kompaktfilters (10) nach den Ansprüchen 1 bis 7, dadurch gekennzeichnet, daß die Maschine (14) eine bewegbar mit dem Gehäuse der Maschine (14) verbundene Aufnahmevorrichtung (15) mit einer Öffnung zur Aufnahme des Kaffee-Kompaktfilters (10) aufweist.

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9. Kaffee-Maschine nach Anspruch 8, dadurch gekennzeichnet, daß die Maschine (14) eine Führung (15') zum Einschieben oder Einlegen des Filters (10) aufweist.

10. Kaffee-Maschine nach Anspruch 9, dadurch gekennzeichnet, daß sie unterhalb der Führung (15') eine mit dieser verbundene oder einstückige, etwa trichterförmige Sammel- und Ableitvorrichtung (16) für den aus dem Kaffee-Kompaktfilter (10) austretenden Kaffeesud aufweist.

11. Kaffee-Maschine nach Anspruch 8, dadurch gekennzeichnet, daß die Aufnahmevorrichtung (15) für die Aufnahme des Kaffee-Kompaktfilters (10) in ihrem unteren Bereich, d. h. bei eingelegtem Kompaktfilter (10) unter diesem, eine etwa trichterförmige Sammel- und Ableitvorrichtung (16) für den austretenden Kaffeesud aufweist, die mit der Aufnahmevorrichtung (15) verbunden oder einstückig ist.

12. Kaffee-Maschine nach den Ansprüchen 8 bis 11, dadurch gekennzeichnet, daß die Aufnahmevorrichtung (15) für die Aufnahme des Kaffee-Kompaktfilters (10) eine nur geringfügig größere Höhe als der Kaffee-Kompaktfilter (10) selbst aufweist.

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Kaffee-Kompaktfilter

Die Erfindung bezieht sich auf ein Kaffee-Kompaktfilter, bestehend aus einem oben und unten offenen Filtergehäuse mit je einer darin fest angebrachten oberen und unteren Filterpapierlage, zwischen denen eine bestimmte Menge gemahlenen Kaffees eingebracht ist, sowie aus einer Kaffee-Maschine für die Aufnahme des Kaffee-Kompaktfilters.

Neben herkömmlichen Filtertüten, die in ein etwa trichterförmiges Filtergefäß eingesetzt und von Hand mit gemahlenem Kaffee gefüllt werden, sind schon seit längerem sogenannte Kaffee-Kompaktfilter gebräuchlich, die aus einem oben und unten offenen Filtergehäuse mit je einer darin fest angebrachten oberen und unteren Filterpapierlage bestehen, zwischen denen eine bestimmte Menge gemahlenen Kaffees eingebracht ist und die als Einsatz in speziellen, dafür geeigneten Kaffeemaschinen verwendet werden und nach einmaligem Gebrauch komplett fortgeworfen werden. Kompaktfilter werden vor allem dort verwendet, wo größere Mengen Kaffeesud in kurzer Zeit erzeugt werden sollen, d. h. vor allem im gastronomischen Bereich.

In der Praxis haben derartige Kompaktfilter jedoch einige Nachteile, sowohl aus der Sicht des Verbrauchers als auch des Herstellers, gezeigt.

Als wirksame Filterfläche steht nur die untere Filterpapierlage zur Verfügung, was zur Folge hat, daß der Filtriervorgang, vor allem bei feiner gemahlenem Kaffee, relativ lange dauert, obwohl gerade auch eine kurze Zubereitungszeit gefordert ist.

Ein weiteres Problem stellt das ungleichmäßige Eindringen des aufgegebenen heißen Wassers in die Kaffeemehlfüllung dar. Bei Aufgabe des heißen Wassers wird zuerst die obere Filterpapierlage durchfeuchtet und dadurch sehr wenig durchlässig für gasförmige Stoffe. Während des weiteren Eindringens des Heißwassers in die Kaffeemehlfüllung werden die zwischen den Kaffeepartikeln verbliebene Luft und der entstehende Wasserdampf verdrängt und sammeln sich in einer Blase unterhalb der oberen Filterpapierlage. Die Folge ist eine unerwünschte Verringerung der Fläche, durch die das Heißwasser in die Kaffeemehlfüllung eintritt und damit sowohl eine Verlangsamung des Filtriervorganges als auch eine Verschlechterung der Auslaugung der Kaffeemehlfüllung. Im schlimmsten Fall kann es sogar zum Überlaufen von heißem Wasser und dadurch zu einer Verbrühungsgefahr für den Benutzer kommen, wenn das heiße Wasser nicht schnell genug durch den Filter abfließen kann.

Nachteilig aus der Sicht des Herstellers ist, daß solche Kompaktfilter, die für einmaligen Gebrauch gedacht sind, mehrmals verwendet werden können, indem für die untere Filterpapierlage handelsübliche Filterpapiere eingelegt werden und Kaffeemehl von Hand aufgegeben wird. Häufig sind derartige Kaffee-Maschinen Teil eines sogenannten "Service-Paketes", d. h. für die Maschine selbst entstehen dem Verbraucher keine Kosten, er ist jedoch verpflichtet, regelmäßig eine bestimmte Mindestmenge an Kaffee-Kompaktfiltern eines bestimmten Herstellers zu kaufen. Der Bedarf, der über diese Mindestmenge hinausgeht, wird aber oft nicht bei dem Hersteller des Kom-

paktfilters gedeckt, sondern in Form von preiswerterem Fremd-Kaffee in handelsüblichen Verpackungsformen gekauft. Hierdurch entstehen dem Kompaktfilter-Hersteller bzw. Lieferanten des "Service-Paketes" nicht zu unterschätzende Umsatzverluste.

Es stellt sich daher die Aufgabe, ein Kaffee-Kompaktfilter sowie eine Kaffee-Maschine für die Verwendung des Kompaktfilters zu schaffen, die die oben genannten Nachteile vermeiden, und einerseits insbesondere eine schnelle Zubereitung, eine gute Auslaugung des Kaffeemehls und eine sichere Handhabung für den Verbraucher bieten und andererseits eine Mehrfachverwendung des Kompaktfilters ausschließen.

Die Lösung dieser Aufgabe gelingt erfindungsgemäß durch ein Kaffee-Kompaktfilter, bestehend aus einem oben und unten offenen Filtergehäuse mit je einer fest darin angebrachten oberen und unteren Filterpapierlage, zwischen denen eine bestimmte Menge gemahlenen Kaffees angebracht ist, dadurch gekennzeichnet, daß zwischen oberer und unterer Filterpapierlage randseitig entlang der Innenseite des Filtergehäuses ein Filterpapiereinsatz angeordnet ist, der mit der Innenseite des Gehäuses nicht oder nur teilweise in Berührung steht.

Durch einen derartigen zusätzlichen Filterpapiereinsatz wird die Fläche, durch die der Kaffeesud austreten kann, wesentlich vergrößert. Dies gilt insbesondere dann, wenn der Einsatz aus geriffeltem, gewelltem, zick-zack-förmig gefaltetem oder ähnlich geformtem Filterpapier besteht. Zwischen der Innenwand des Filtergehäuses und dem Filterpapiereinsatz wird bei einem z. B. glatten Einsatz ein Ringkanal gebildet, bei z. B. gewelltem Einsatz ergibt sich eine Anzahl von etwa parallelen Kanälen mit im wesentlichen vertikalen Achsen, die nach unten offen sind und den austretenden Kaffeesud ableiten. Der rand-

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seitige Filtereinsatz ist, um ein unerwünschtes Austreten von Kaffeemehl zu verhindern, mit der unteren Filterpapierlage verbunden oder einstückig.

Das Problem der Luft- und Dampfblasenbildung im Inneren des Filters wird dadurch gelöst, daß der erfindungsgemäße Kompaktfilter eine automatische Entlüftung aufweist, die sich erst unter dem Einfluß von heißem Wasser oder Wasserdampf öffnet. Sie besteht beispielsweise aus wenigstens einem Schnitt oder einer Perforation in der oberen Filterpapierlage, die mit einem Klebestreifen oder ähnlichem abgedeckt ist, der sich unter der Einwirkung von heißem Wasser oder Dampf wenigstens teilweise ablöst und so die darunter befindlichen Öffnungen freigibt. Durch diese entweichen zunächst die vom eindringenden Wasser aus dem Kaffeemehl verdrängte Luft und der dort entstehende Wasserdampf. Nach dem Entlüftungsvorgang fließt dann das aufgegebene Heißwasser außer durch die obere Filterpapierlage selbst zum Teil auch durch die darin befindlichen Öffnungen in das Kaffeemehl. Dieser so vergrößerte Durchfluß trägt ebenfalls zu einer kurzen Zubereitungszeit bei, während gleichzeitig durch das vorherige Entlüften das Kaffeemehl gleichmäßiger und intensiver ausgelaugt wird, was nach ersten praktischen Erfahrungen mit dem erfindungsgemäßen Kompaktfilter zu einer Kaffeemehlersparnis von etwa 20 % bei gleichbleibender Qualität des Kaffeesuds führt. Auch das Überlaufen des Filters bei Aufgabe von Heißwasser ist durch den verbesserten Durchfluß praktisch ausgeschlossen, zumal das Kompaktfiltergehäuse nach dieser Erfindung einen für die Aufnahme von heißem, zu Einfüllbeginn noch nicht durch die Filterpapierlagen und den gemahlenen Kaffee gelaufenem Wasser ausreichend hohen Rand oberhalb der oberen Filterpapierlage aufweist.

Die Reißfestigkeit von Filterpapier im feuchten Zustand ist relativ gering. Um die Zugspannungen in der unteren

Filterpapierlage, die das Gewicht von Kaffeemehl und aufgegebenem Wasser aufnehmen muß, gering zu halten, wird diese durch ein darunterliegendes Tragelement, das beispielsweise die Form eines Kreuzes, eines Sterns oder eines Gitters hat und mit dem Filtergehäuse verbunden oder einstückig ist, unterstützt. Ein Einreißen der unteren Filterpapierlage ist so nicht mehr möglich.

Das Tragelement dient gleichzeitig als Abstandselement, das eine unterhalb dieses Trag- und Abstandselementes befindliche weitere Filterlage in Form eines Kunststoffgazefilters, eines Papierfilters oder ähnliches von der unteren Filterpapierlage des Filters zur Sicherung der vollen Durchlässigkeit auf Abstand hält. Durch diese weitere Filterlage werden über die randseitige Filterpapierlage eventuell übergetretene oder durch Beschädigung der unteren Filterpapierlage ausgetretene Kaffeemehlpartikel zurückgehalten, so daß der Kaffeesud sicher fei bleibt von Kaffeemehlanteilen, was sowohl dem Geschmack als auch der Bekömmlichkeit des Getränkes zugute kommt.

Eine Kaffee-Maschine für die Verwendung des erfindungsgemäßen Kaffee-Kompaktfilters weist eine bewegbar mit dem Gehäuse der Maschine verbundene Aufnahmevorrichtung mit einer Öffnung zur Aufnahme des Kaffee-Kompaktfilters auf. Hierdurch wird sowohl ein einfaches Einlegen und Herausnehmen des Kompaktfilters wie auch eine sichere Handhabung gewährleistet, da keine Manipulationen des Benutzers in unmittelbarer Nähe des Heißwasseraustrittes der Maschine erforderlich sind. Die Öffnung in der Aufnahmevorrichtung ist so bemessen und gelegen, daß der Kompaktfilter beispielsweise auf einem vorstehenden Kragen oder einem Vorsprung seines Gehäuses rundum- bzw. allseitig aufliegt.

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Um den aus dem Kompaktfilter austretenden Kaffeesud zu sammeln und in ein darunter befindliches Auffanggefäß zu leiten, weist die Kaffee-Maschine nach der Erfindung eine etwa trichterförmige Sammel- und Ableitvorrichtung auf, die beispielsweise unterhalb der Führung zum Einschieben oder Einlegen des Filters mit der Führung verbunden oder einstückig ist oder mit der Aufnahmevorrichtung in deren unterem Bereich, d. h. bei eingelegtem Kompaktfilter unter diesem, verbunden oder einstückig ist. Mit dieser Sammel- und Ableitvorrichtung wird erreicht, daß der Kaffeesud auch in Auffanggefäße, wie z. B. Glaskannen, mit relativ kleiner Einfüllöffnung eingeleitet wird, ohne daß ein Teil des Kaffeesuds neben die Einfüllöffnung gerät.

Eine Mehrfachverwendung des Kompaktfilters bzw. Verwendung von Fremdprodukten wird durch folgende Merkmale des erfindungsgemäßen Kompaktfilters und der Kaffee-Maschine weitgehend ausgeschlossen:

Filterpapiereinsätze, bestehend aus einer flachen Filterpapierlage mit einem daran anschließenden randseitigen Filterpapierteil, sind nicht im Handel, d. h. der Filterpapiereinsatz kann nicht durch einen mehr oder weniger ähnlichen handelsüblichen Einsatz ersetzt werden. Wird lediglich die untere Filterpapierlage durch einen z. B. handelsüblichen Papierrundfilter ersetzt, kommt es wegen des verringerten Durchflusses infolge verkleinerter Filterfläche zu einem Überlaufen des aufgegebenen Heißwassers aus dem Filtergehäuse, was, wenn es mehrmals geschieht, den Benutzer von dieser Mehrfachverwendung abbringen wird.

Bekannte, im Handel befindliche Kompaktfilter, wie eingangs beschrieben, scheiden ebenfalls für einen Einsatz in der erfindungsgemäßen Kaffeemaschine aus, da diese Filter keinen erhöhten Rand für noch nicht durch Filter-

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papierlagen und Kaffeemehl gelaufenes Wasser aufweisen und auch die Schublade für die Aufnahme des Kompaktfilters keinen entsprechenden Raum für die Wasseraufnahme bietet.

Die Verwendung schließlich von Kompaktfiltern, die eine größere Höhe aufweisen als der erfindungsgemäße Kompaktfilter, ist wegen der begrenzten Höhe der Schublade unterbunden, da die Schublade mit einem solchen höheren Kompaktfilter nicht mehr in die Kaffeemaschine einschiebbar ist.

Die Erfindung wird im folgenden anhand der Zeichnung eines bevorzugten Ausführungsbeispieles des erfindungsgemäßen Kaffee-Kompaktfilters sowie der erfindungsgemäßen Kaffee-Maschine für die Aufnahme des Kompaktfilters näher erläutert. Es zeigen im einzelnen:

Figur 1 einen erfindungsgemäßen Kaffee-Kompaktfilter, teils in Seitenansicht, teils in Vertikalschnitt,

Figur 2 eine Draufsicht auf einen Querschnitt in horizontaler Ebene des Kompaktfilters,

Figur 3 eine Seitenansicht einer Kaffeemaschine für die Aufnahme des Kompaktfilters.

Wie aus den Figuren 1 und 2 zu entnehmen ist, besteht das hier dargestellte Ausführungsbeispiel des Kompaktfilters 10 aus einem Filtergehäuse 10', das einen vorstehenden Kragen 11 im oberen Bereich, einen erhöhten Rand 5 und eine zurückspringende Stufe 12 aufweist. Im Inneren des Filtergehäuses 10' ist auf der durch die zurückspringende Stufe 12 gebildeten Fläche 12' eine obere Filterpapierlage 1 angebracht, was durch Kleben oder Verschweißen oder ähnliches erfolgt. Die obere

Filterpapierlage 1 weist einen Schnitt bzw. eine Perforation 3 auf, die mit einem Klebestreifen 8 abgedeckt ist. Unterhalb der oberen Filterpapierlage 1 befindet sich randseitig angeordnet ein Filterpapiereinsatz 2, der zur Vergrößerung der Filterfläche gewellt oder gefaltet oder ähnlich geformt ist. Unterhalb des Einsatzes 2 liegt die untere Filterpapierlage 4, die mit dem Einsatz 2 verbunden oder einstückig ist. Der Raum 9, der durch obere und untere Filterpapierlage 1 und 4 und den Filterpapiereinsatz 2 gebildet wird, ist wenigstens teilweise mit Kaffeemehl 9' gefüllt. Durch die randseitige Lage des oberflächenvergrößernd geformten Einsatzes 2 in dem Filtergehäuse 10' entstehen Kanäle 13 mit etwa parallelen und vertikalen Achsen. Die untere Filterpapierlage 4 wird von Trag- und Abstandselementen 6 unterstützt, die mit dem Filtergehäuse 10' verbunden oder einstückig sind. Gleichzeitig halten die Trag- und Abstandselemente 6 eine weitere Filterlage 7, vorzugsweise ein Kunststoffgazefilter, von der unteren Filterpapierlage 4 auf Abstand, so daß zwischen beiden ein Raum 7' gebildet wird, in den der durch die Kanäle 13 abgeleitete Kaffeesud vor dem Durchströmen der Filterlage 7 zunächst einströmt und wo eventuell ausgetretene Kaffeemehlpartikel zurückgehalten werden.

Figur 3 zeigt eine Seitenansicht einer Kaffeemaschine 14, die für die Aufnahme des erfindungsgemäßen Kompaktfilters 10 ausgerüstet ist. Eine bewegbare Aufnahmevorrichtung 15, im Ausführungsbeispiel eine Schublade, enthält den Kompaktfilter 10, der eine nur geringfügig kleinere Höhe als die Aufnahmevorrichtung 15 selbst hat. Gestrichelt eingezeichnet ist die Lage der Schublade in herausgezogenem Zustand. Unterhalb des Kompaktfilters 10 bzw. der Aufnahmevorrichtung 15 ist ein trichterförmiges Sammel- und Ableitelement 16 vorhanden, das den aus dem Kompaktfilter 10 austretenden Kaffeesud in ein Auffanggefäß 17 leitet.

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Fig.1

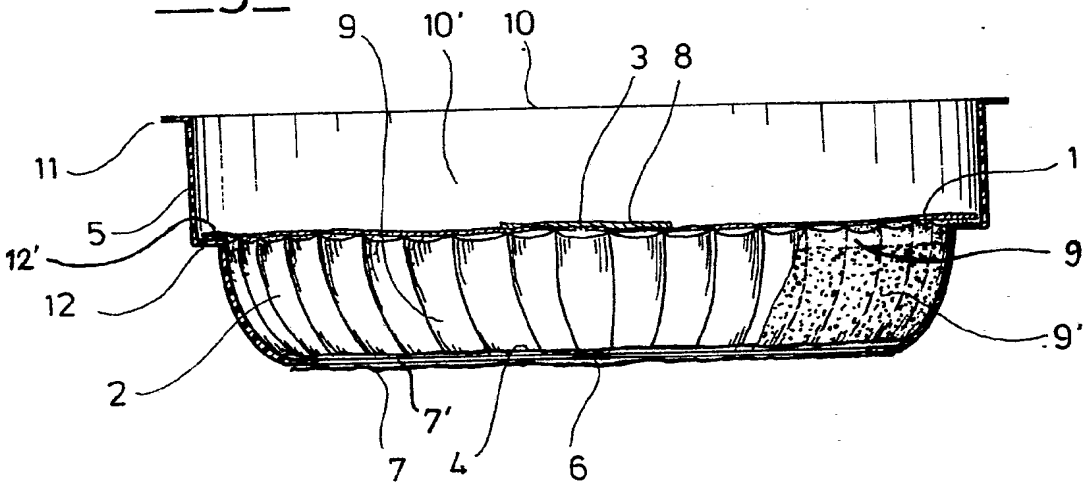
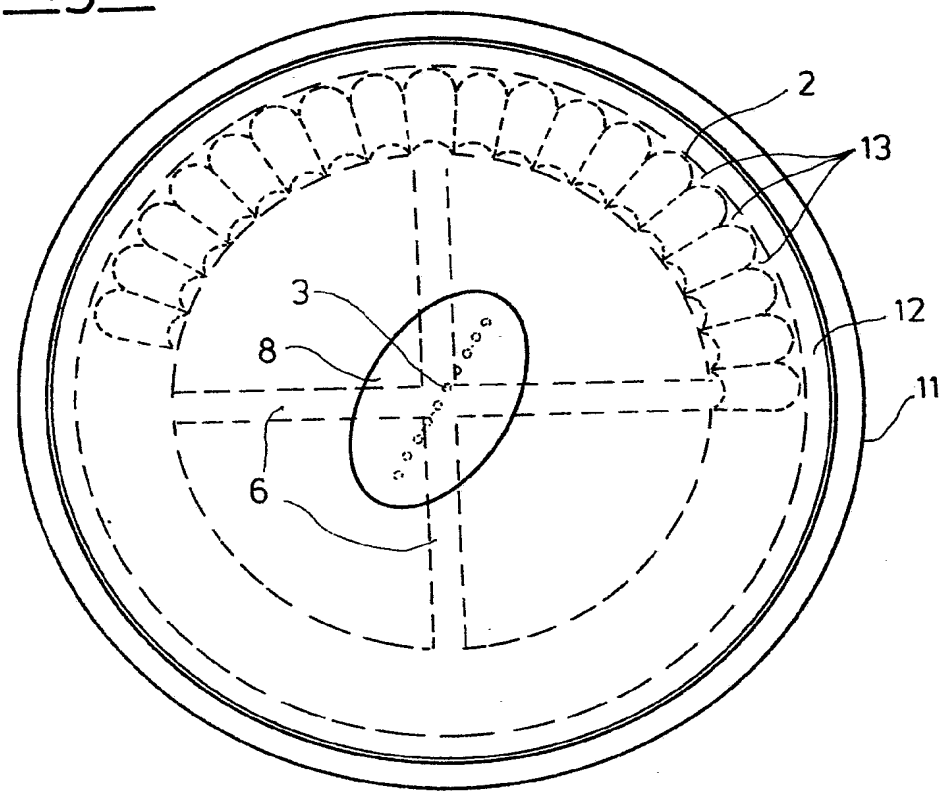


Fig.2



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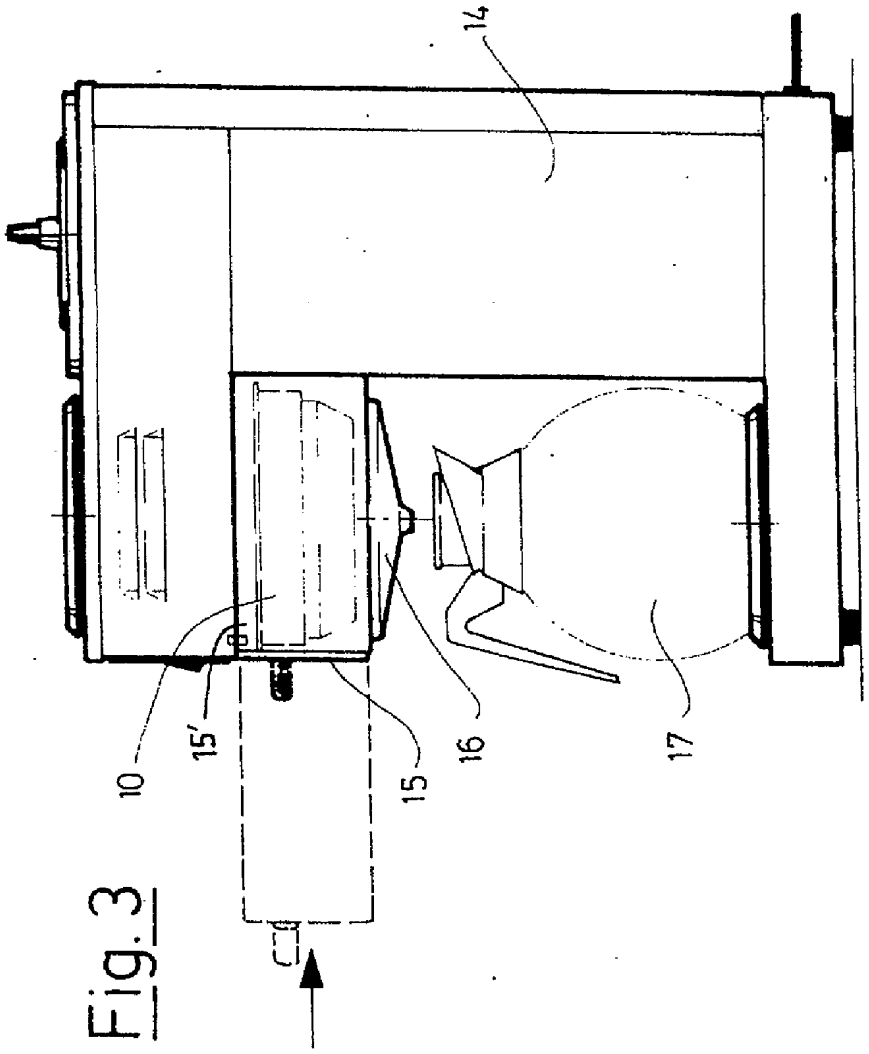


Fig. 3

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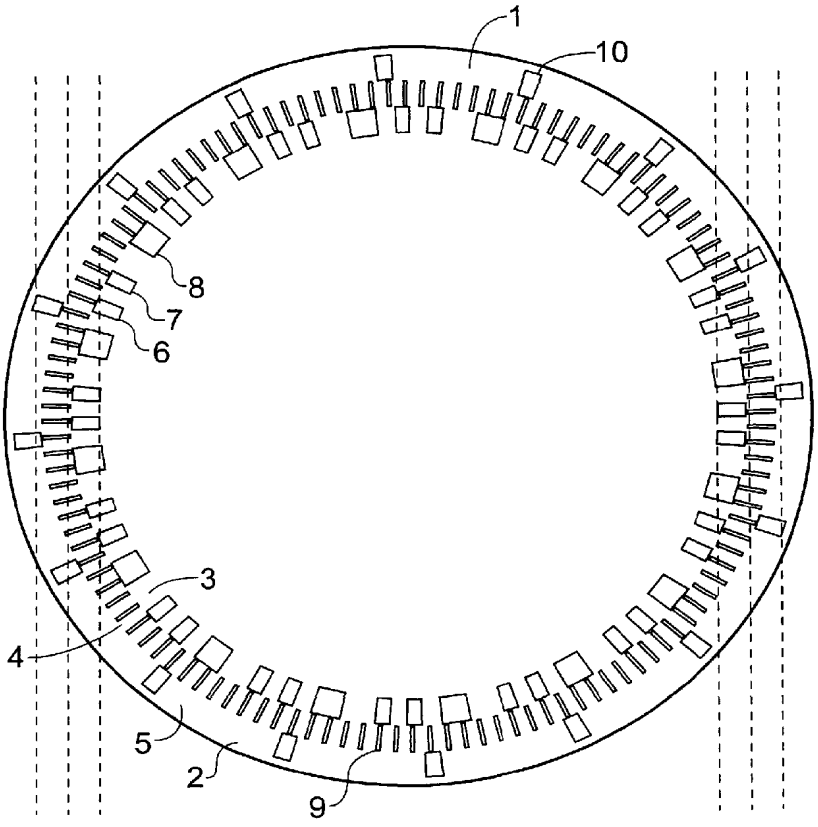
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(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.

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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.

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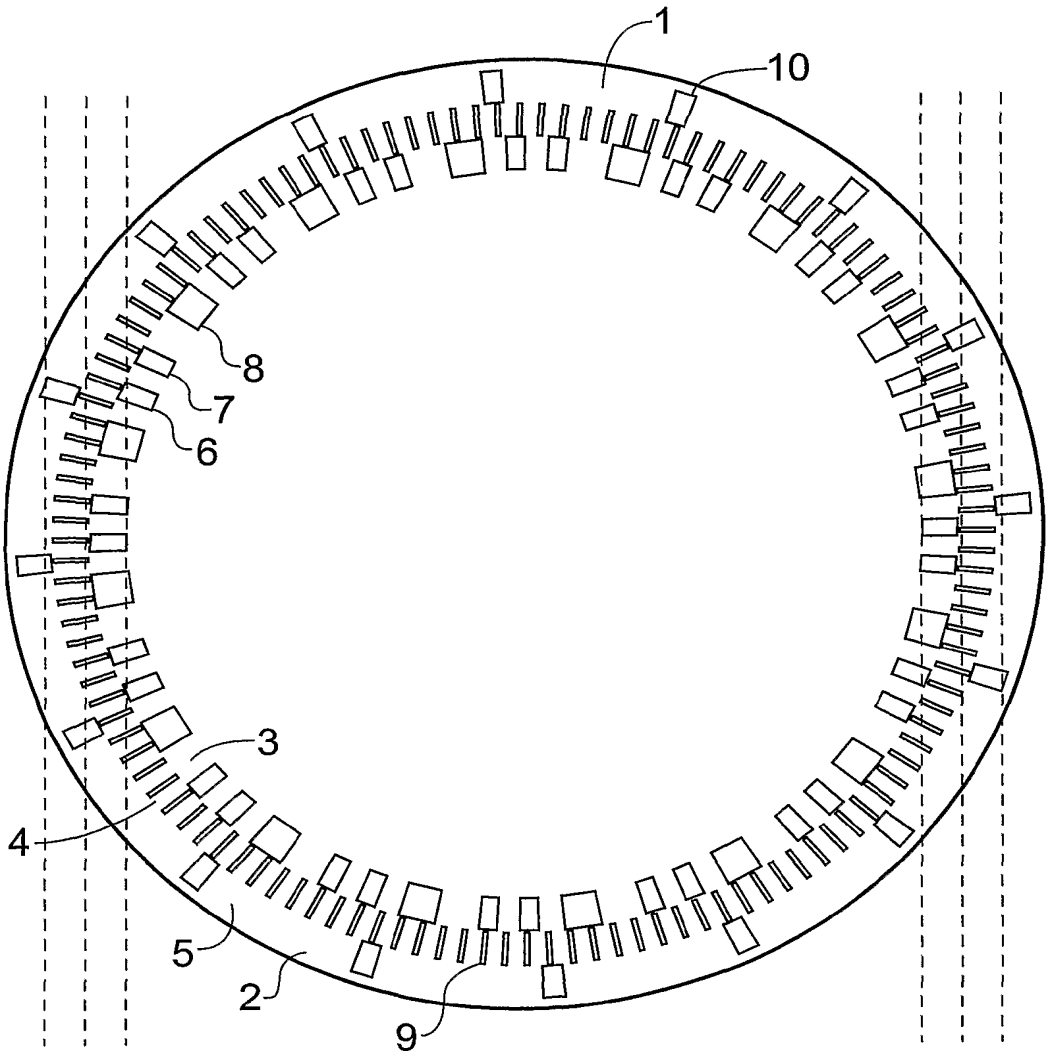


Fig. 1

K-FEE SYSTEM GMBH, EX2009, page 5332
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
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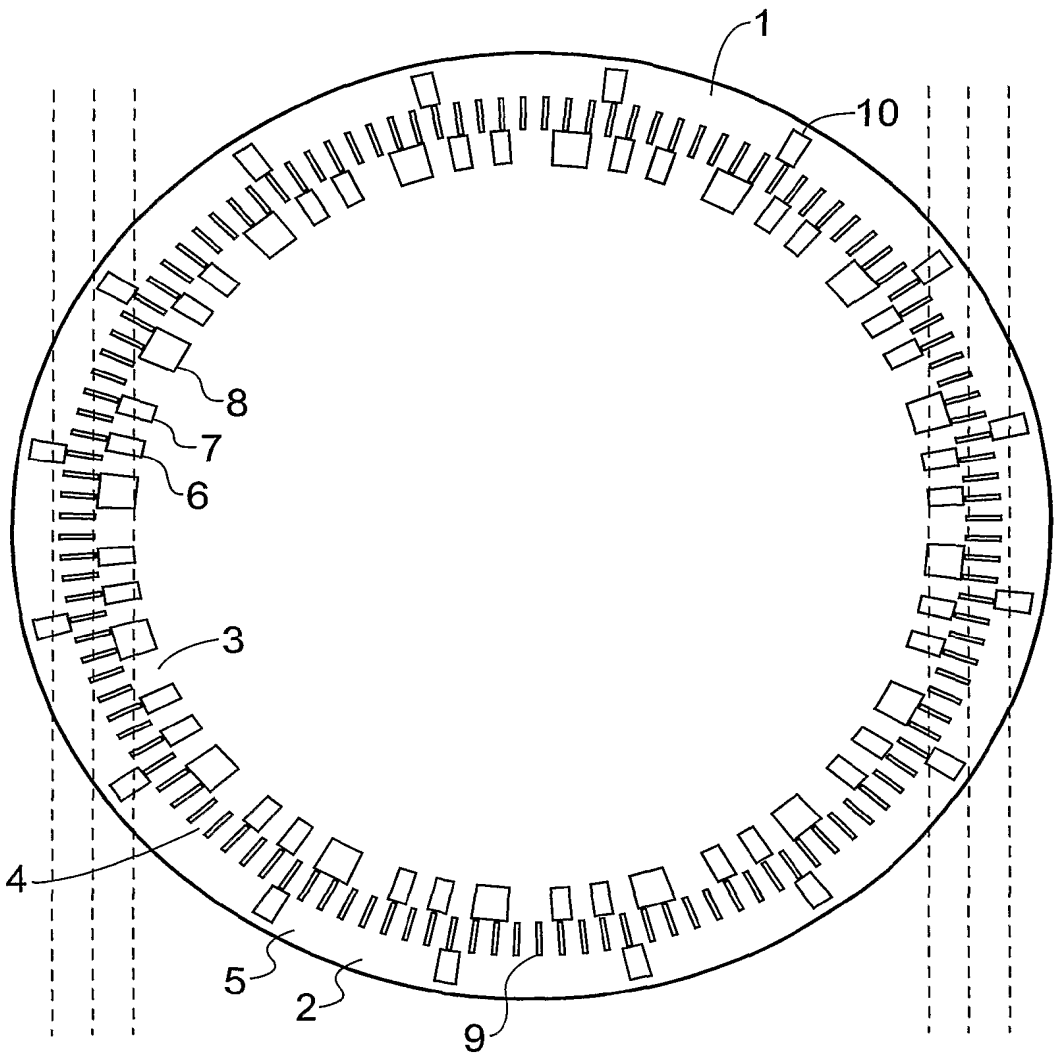


Fig. 2

K-FEE SYSTEM GMBH, EX2009, page 5333
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

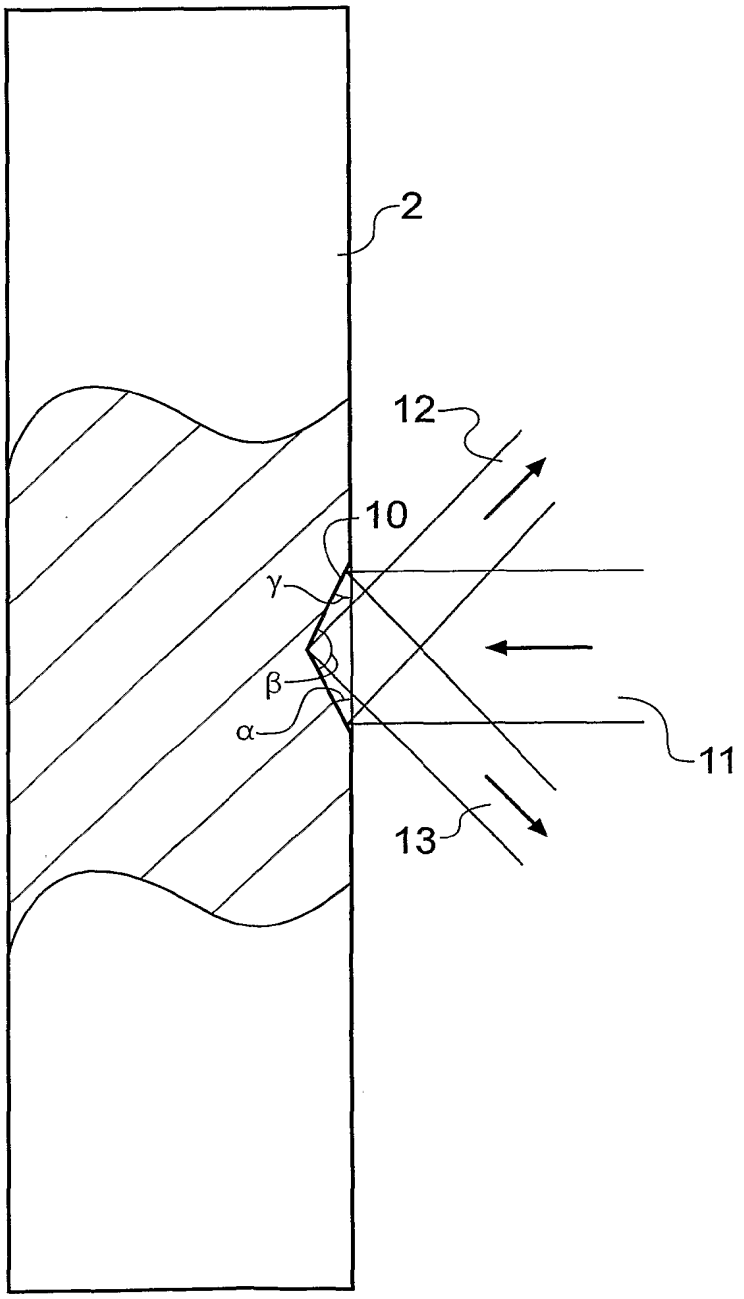


Fig. 3

K-FEE SYSTEM GMBH, EX2009, page 5334
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IPR2023-00502, U.S. PATENT 10,994,923

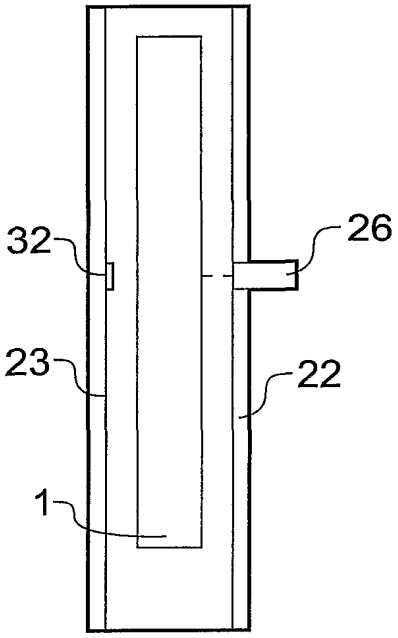


Fig. 4

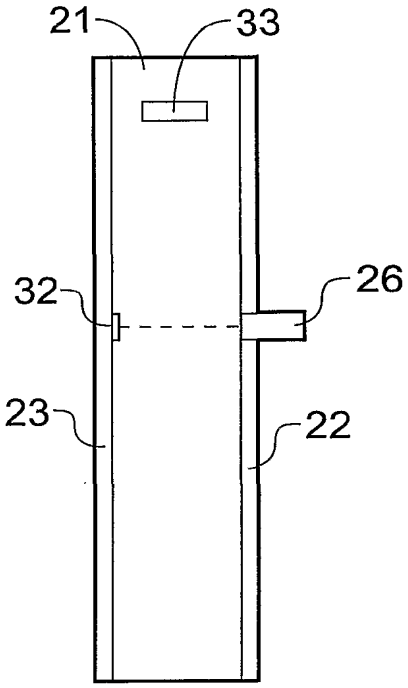


Fig. 5

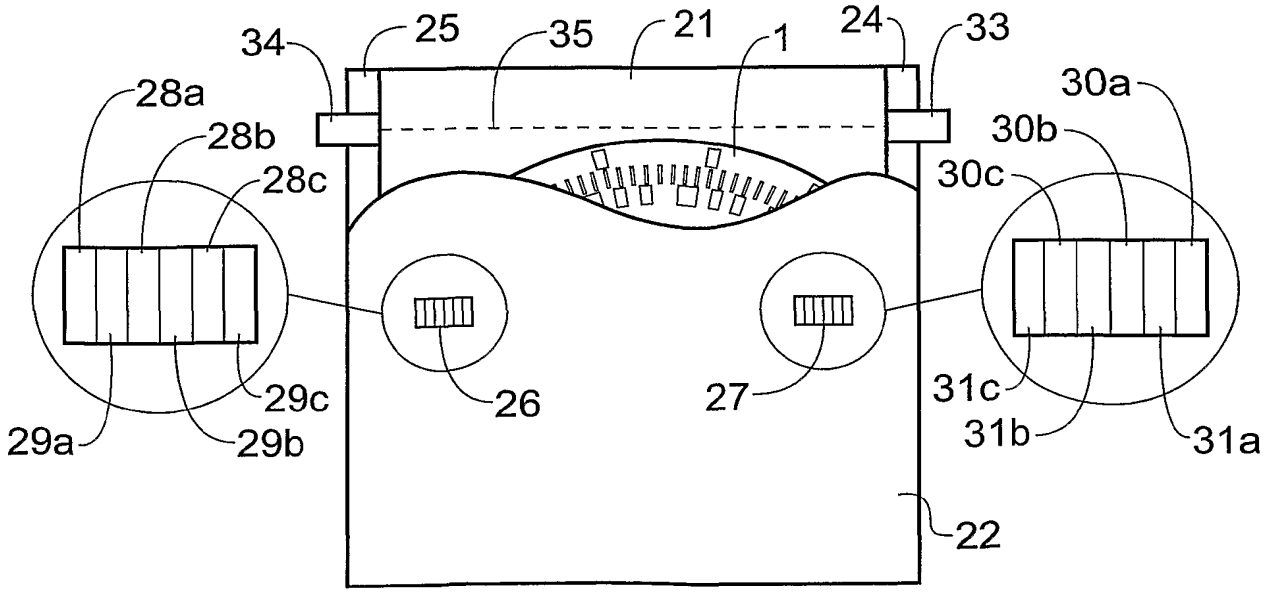


Fig. 6

K-FEE SYSTEM GMBH, EX2009, page 5335
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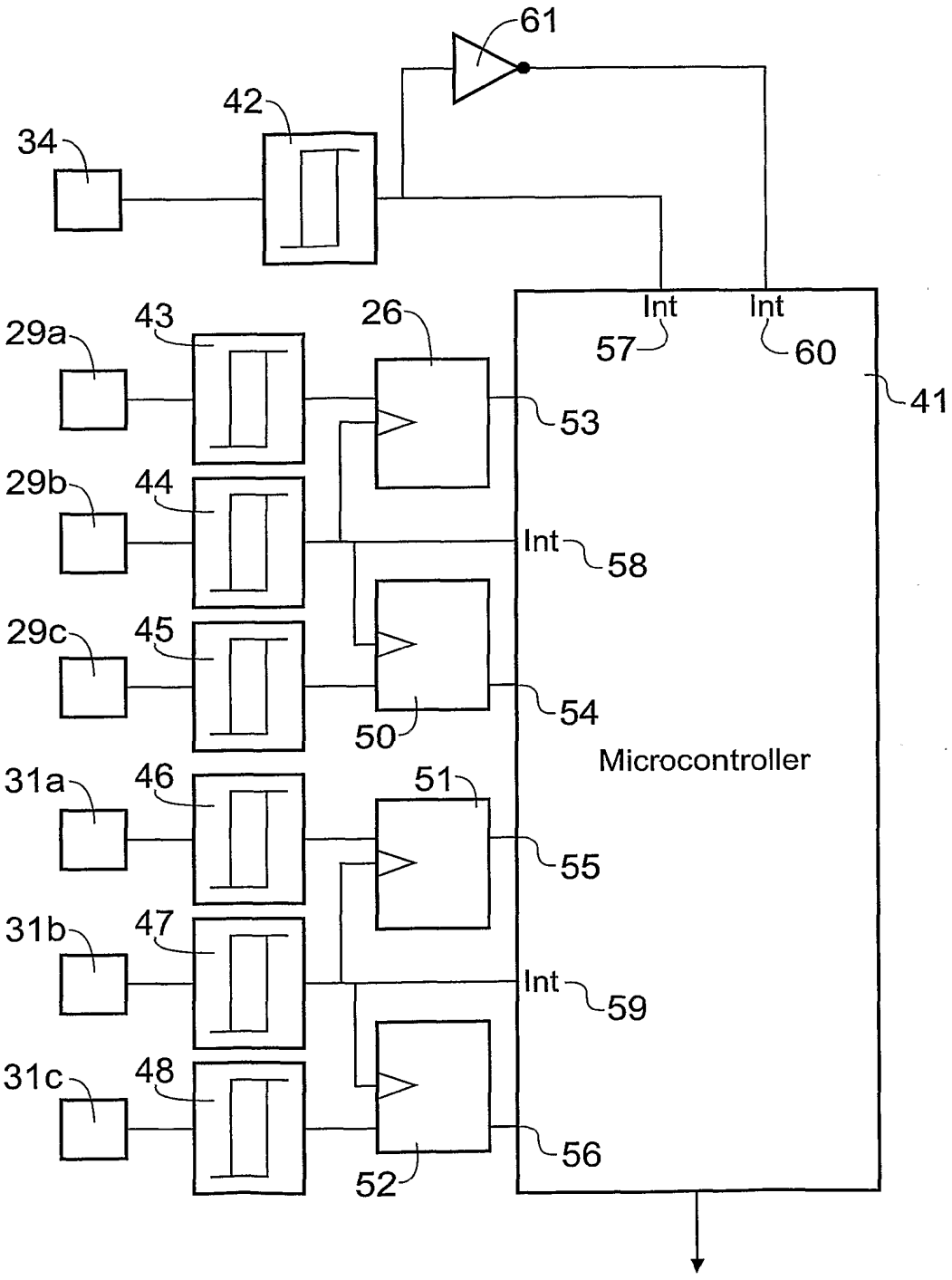


Fig. 7

K-FEE SYSTEM GMBH, EX2009, page 5336
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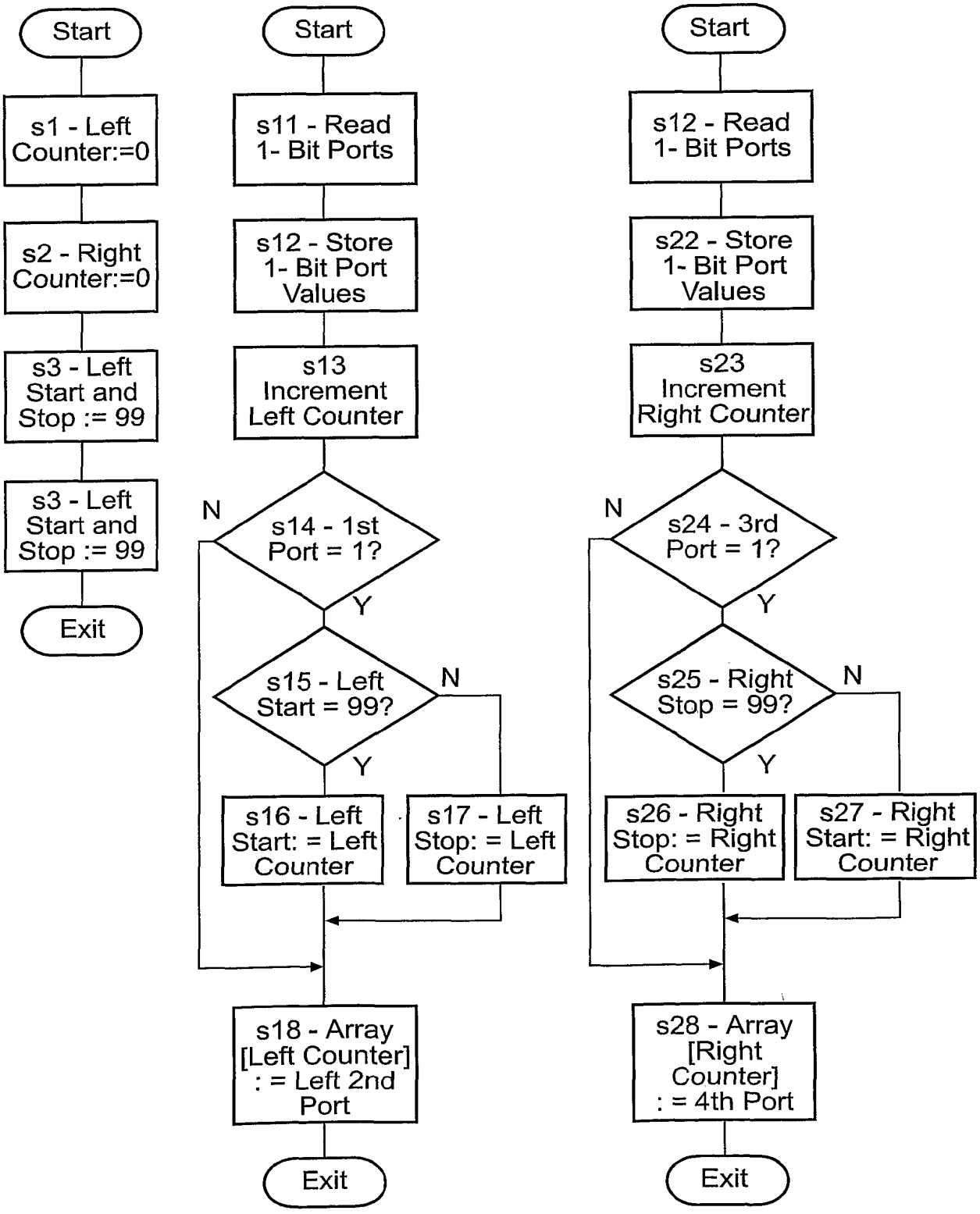
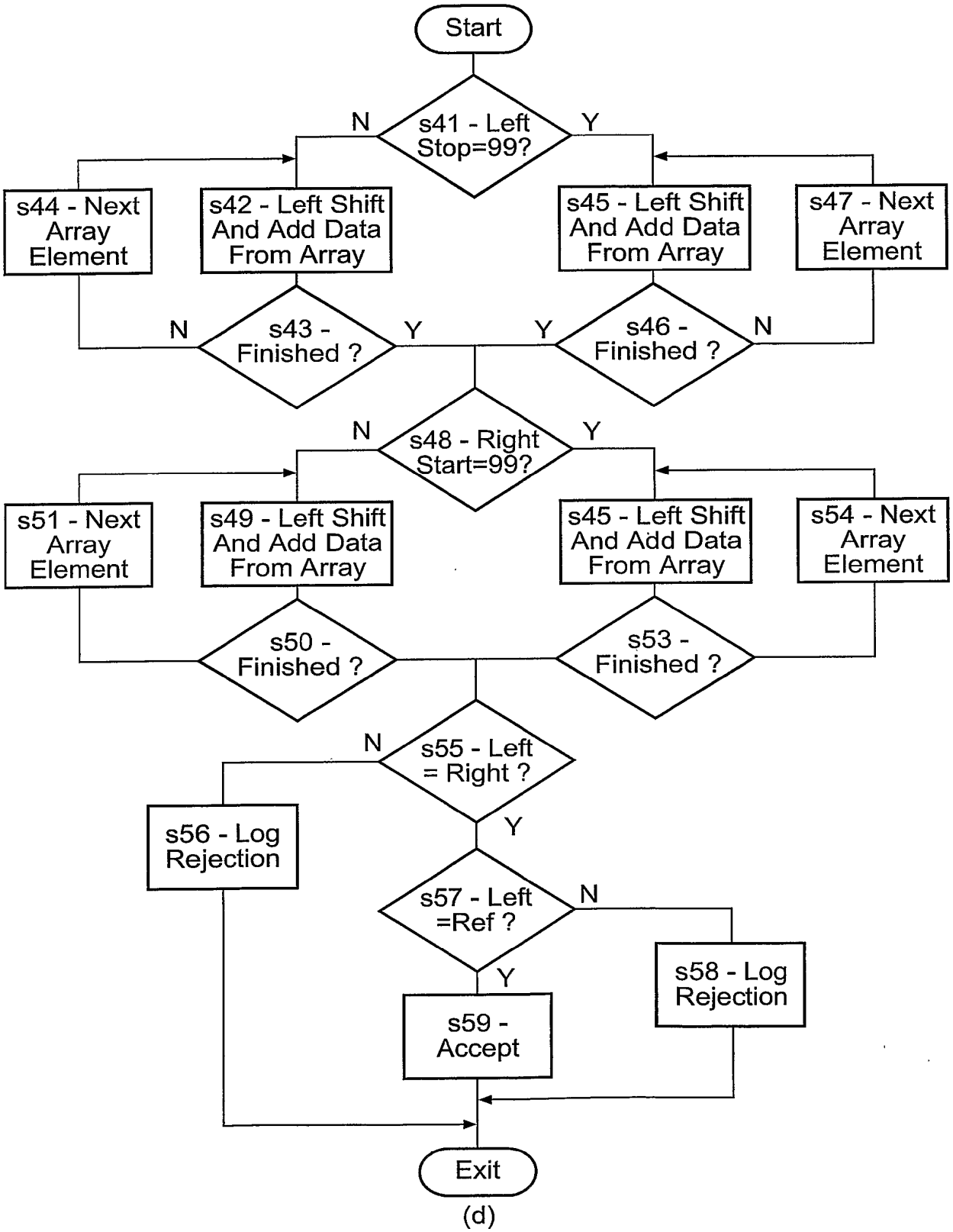


Fig. 8

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(d)

Fig. 8 (continued)

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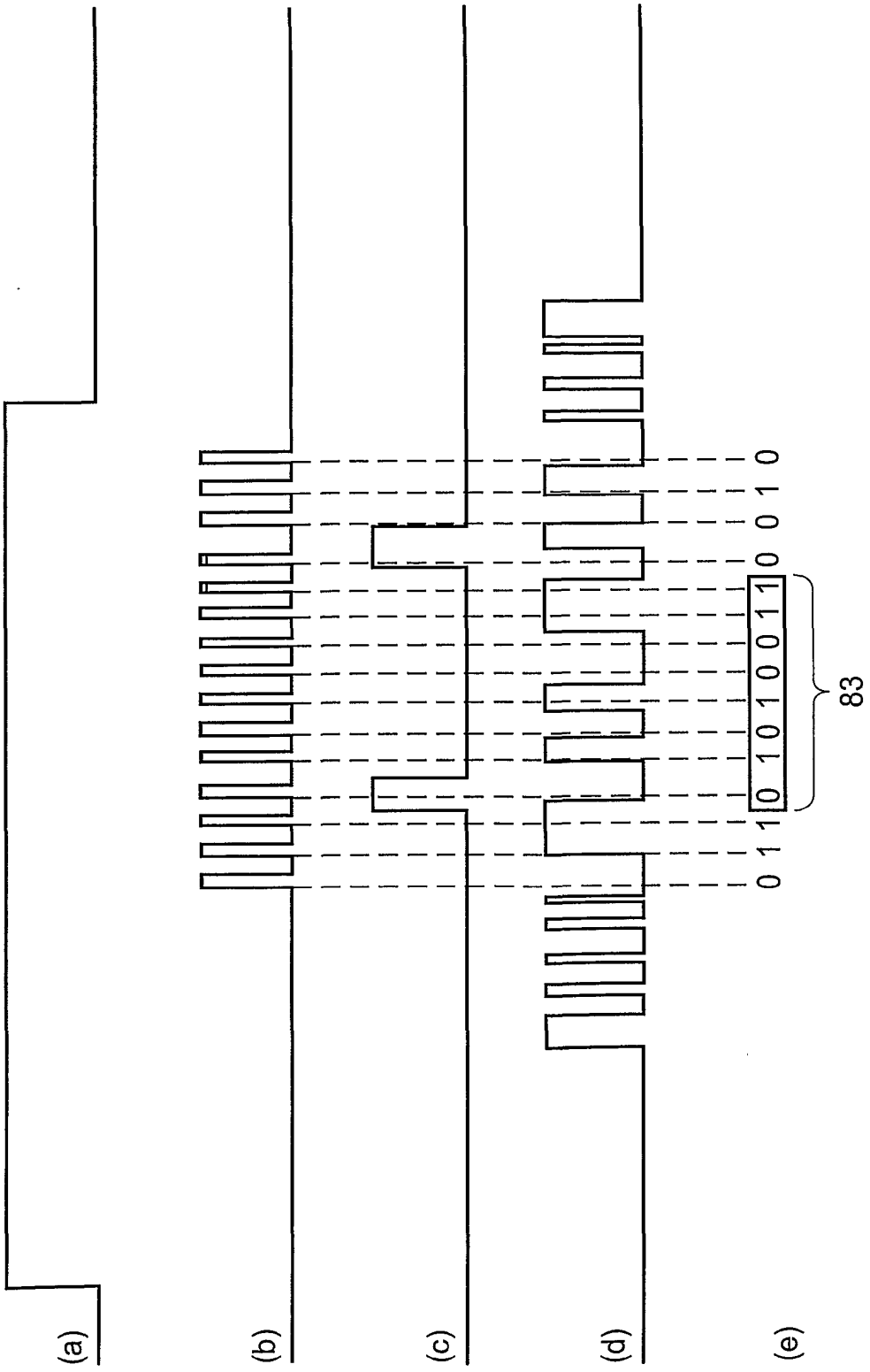


Fig. 9

K-FEE SYSTEM GMBH, EX2009, page 5339
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
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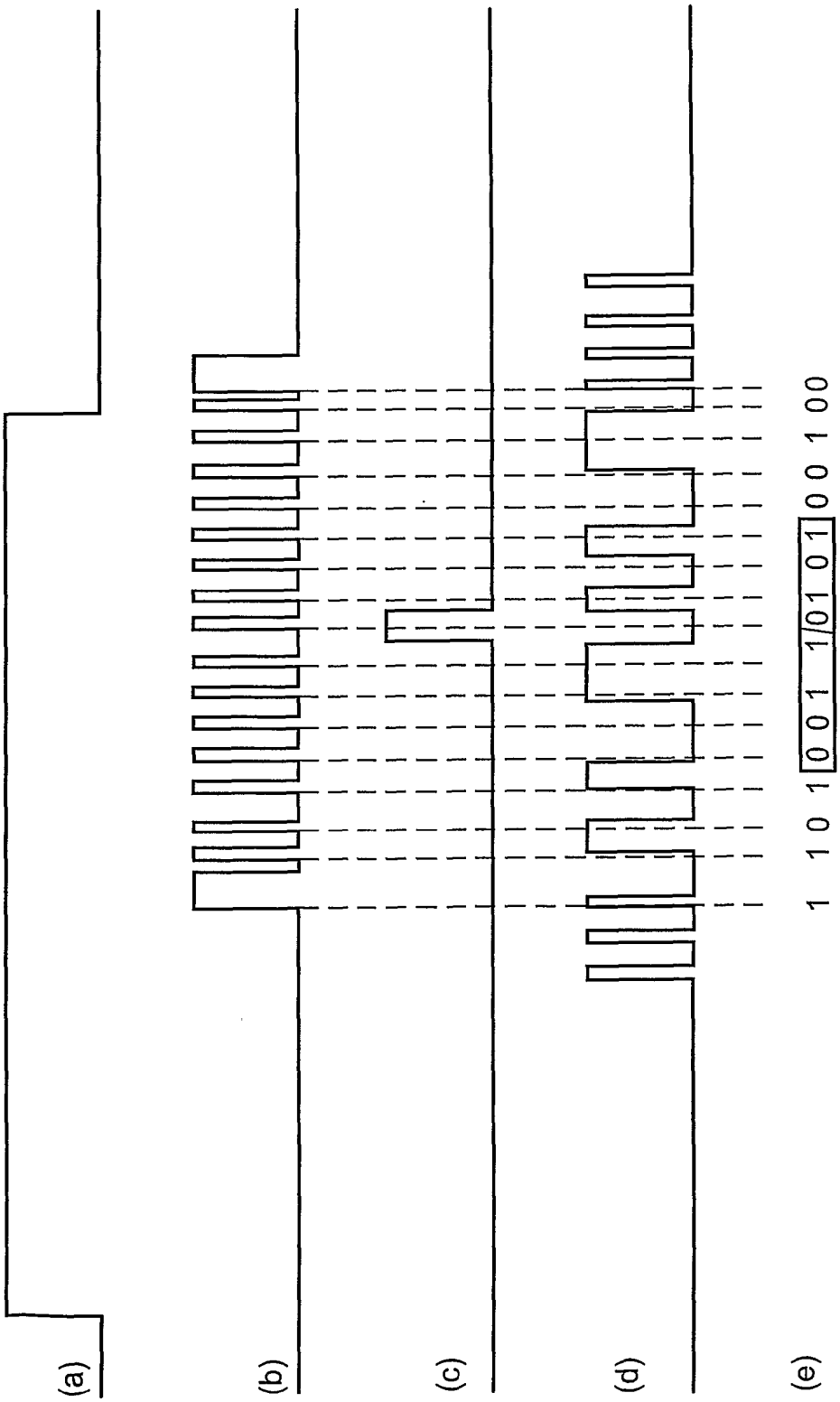


Fig. 10

K-FEE SYSTEM GMBH, EX2009, page 5340
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

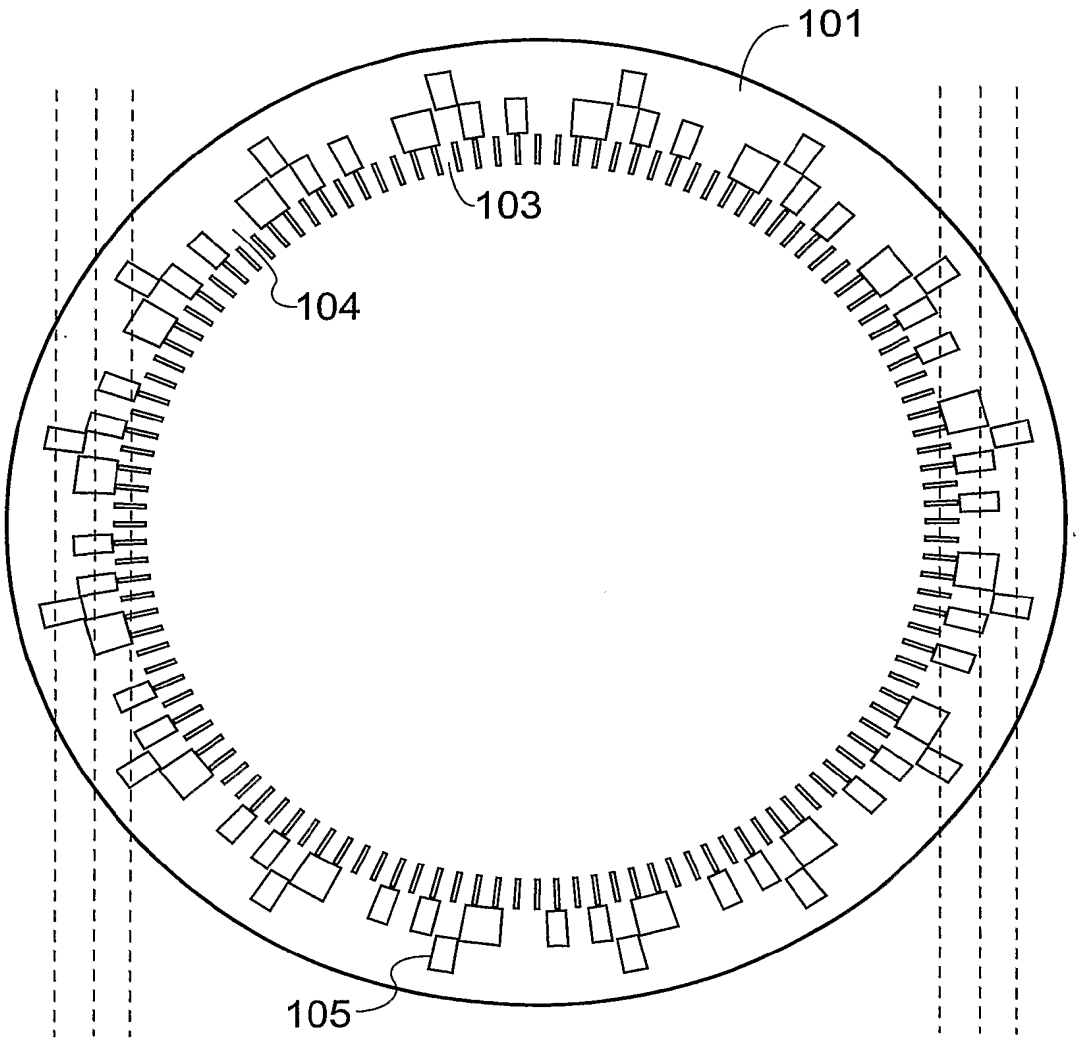


Fig. 11

K-FEE SYSTEM GMBH, EX2009, page 5341
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IPR2023-00502, U.S. PATENT 10,994,923

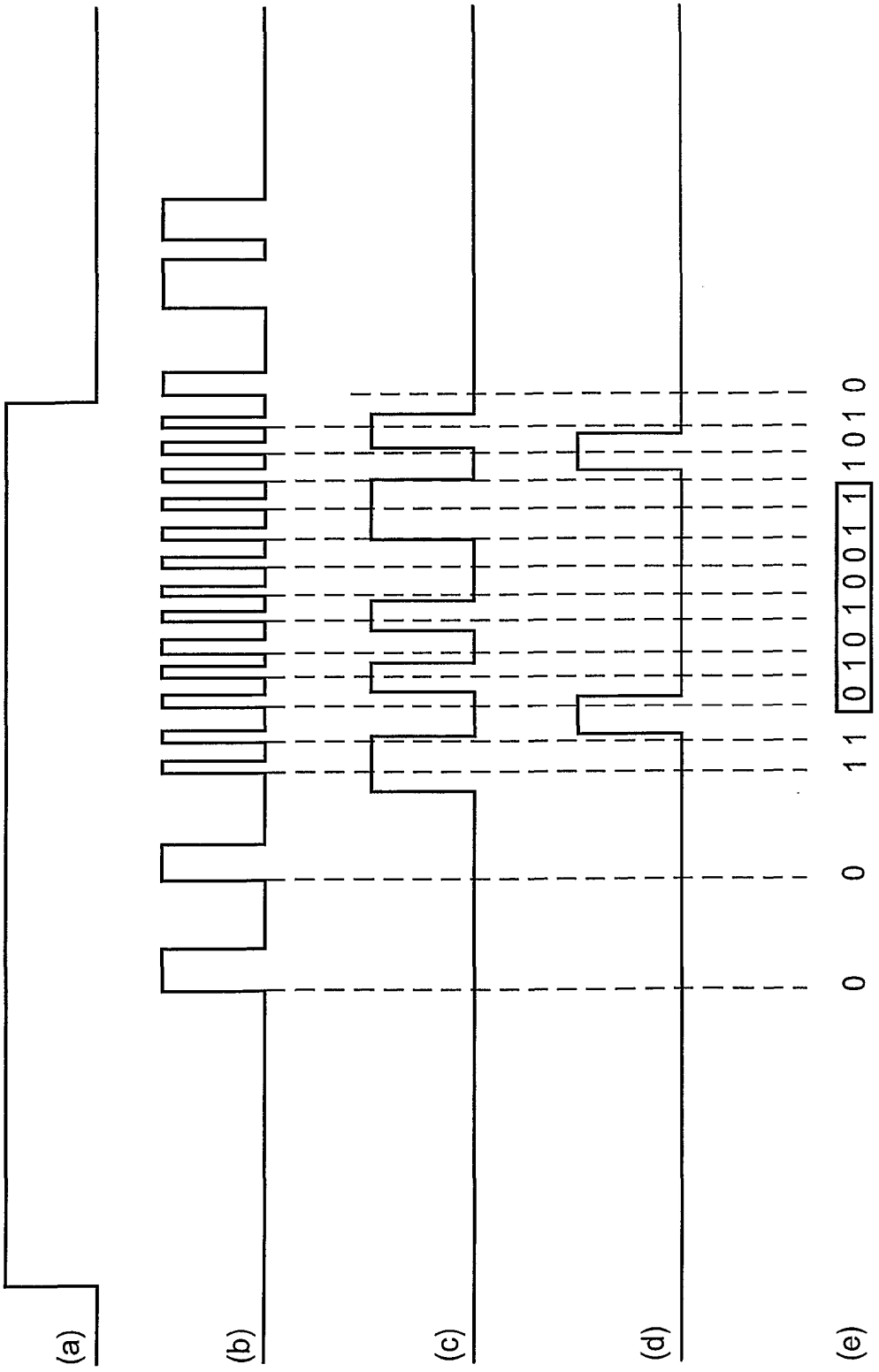


Fig. 12

K-FEE SYSTEM GMBH, EX2009, page 5342
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

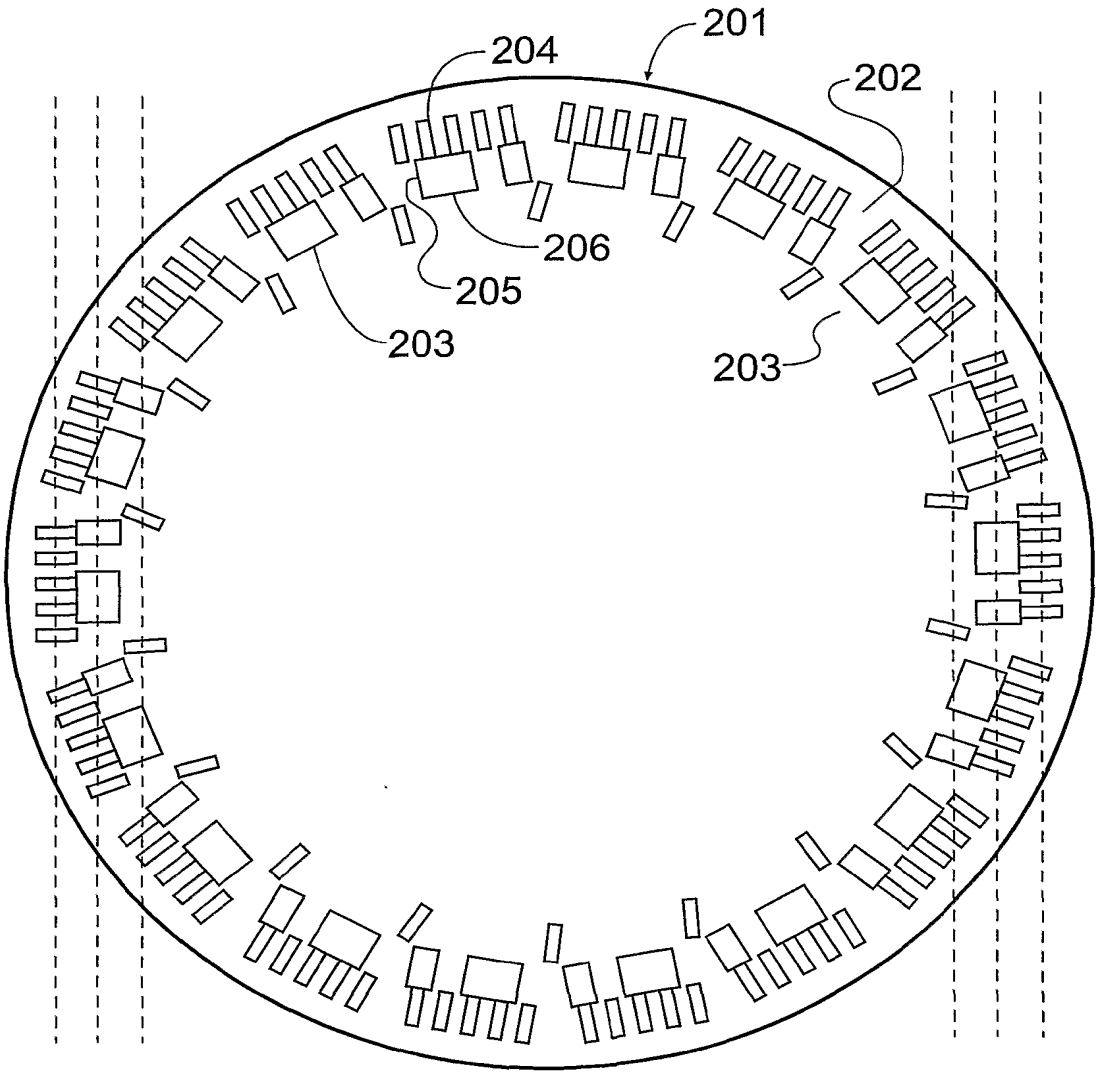


Fig. 13

K-FEE SYSTEM GMBH, EX2009, page 5343
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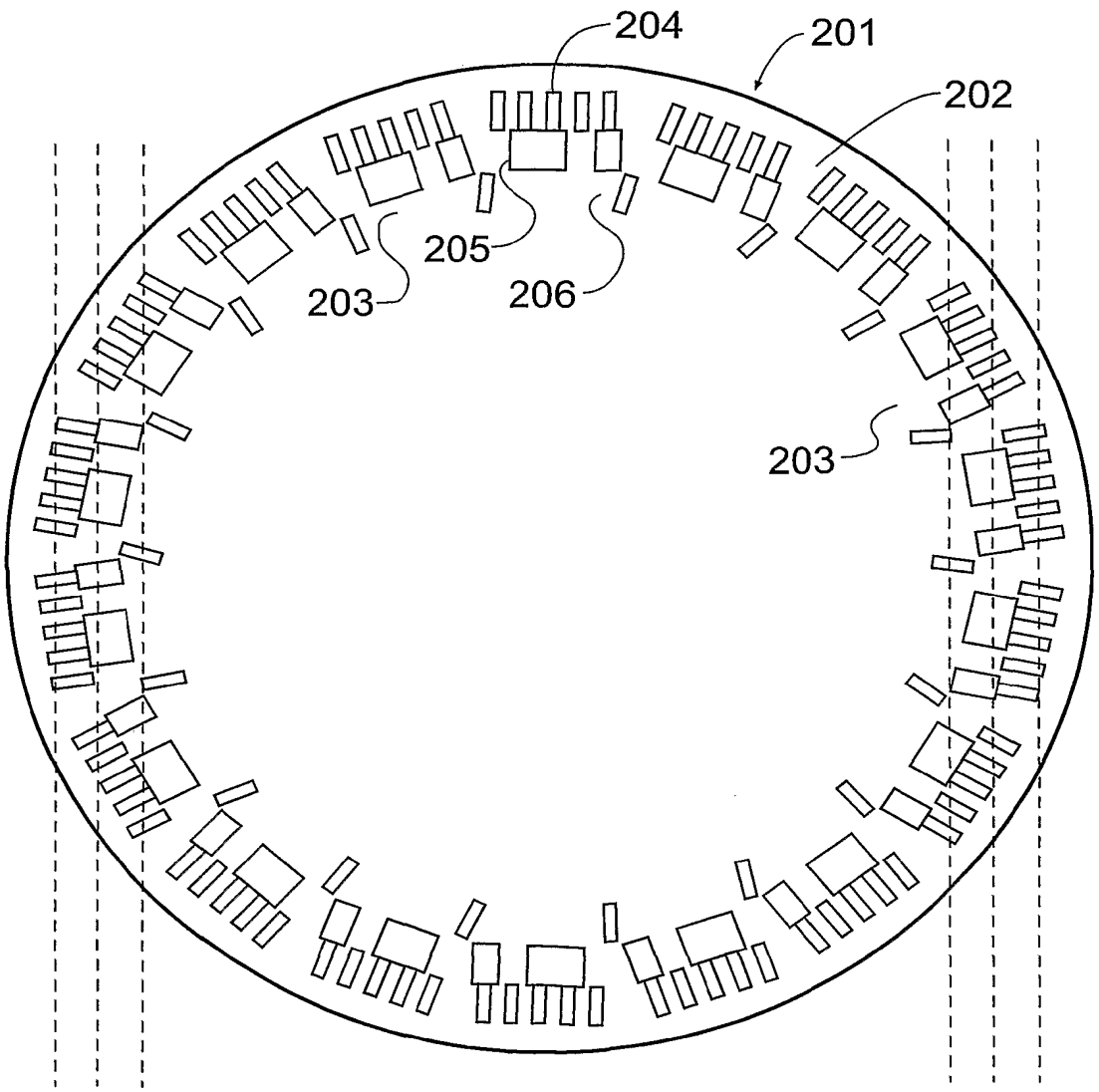


Fig. 14

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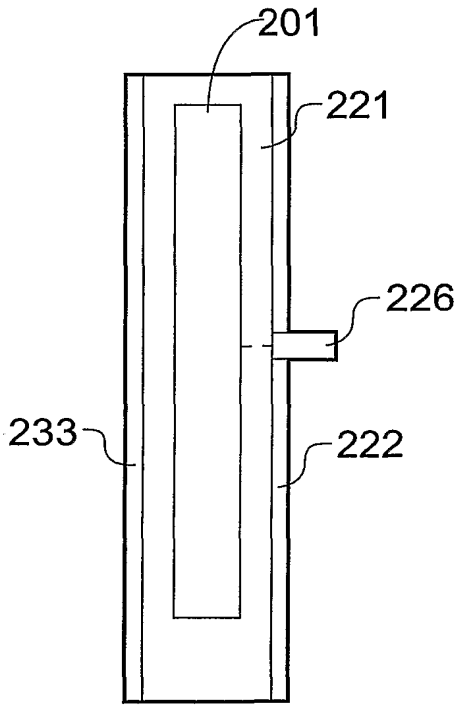


Fig. 15

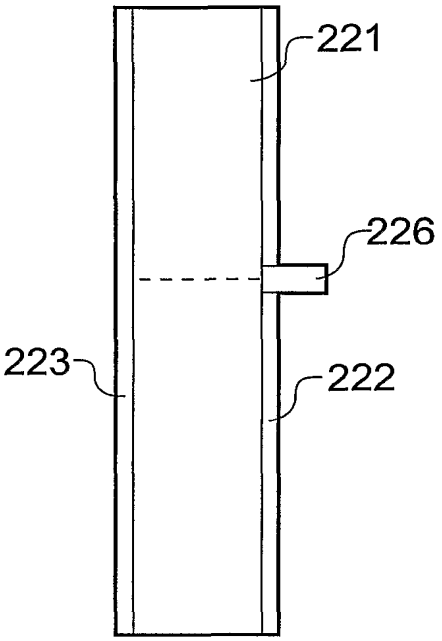


Fig. 16

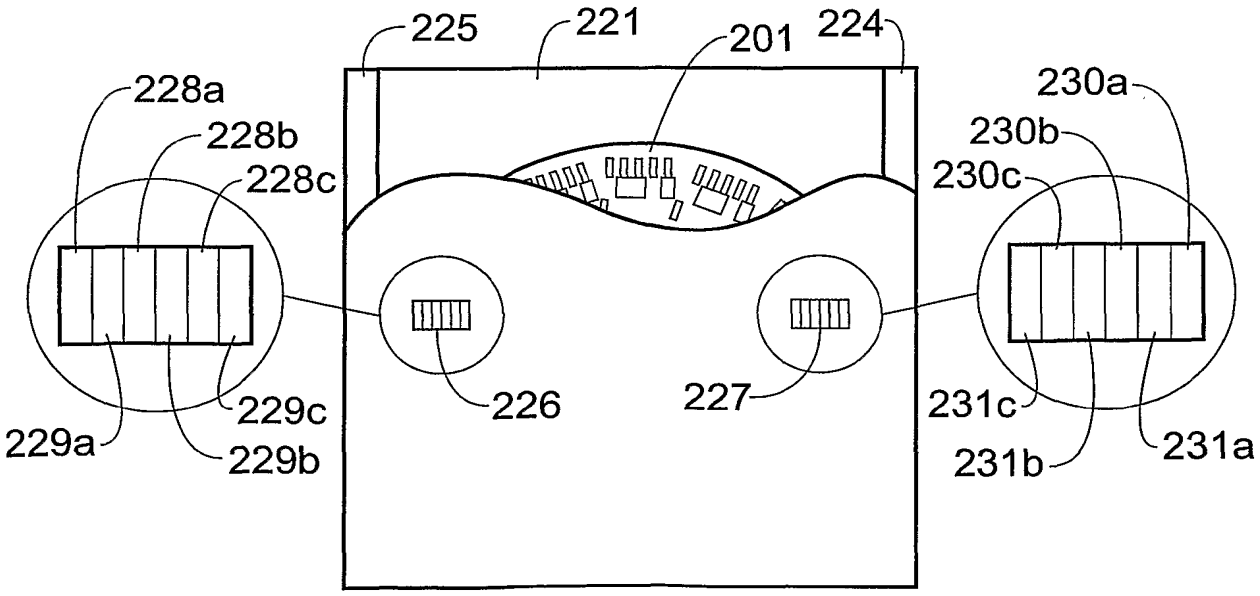


Fig. 17

K-FEE SYSTEM GMBH, EX2009, page 5345
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
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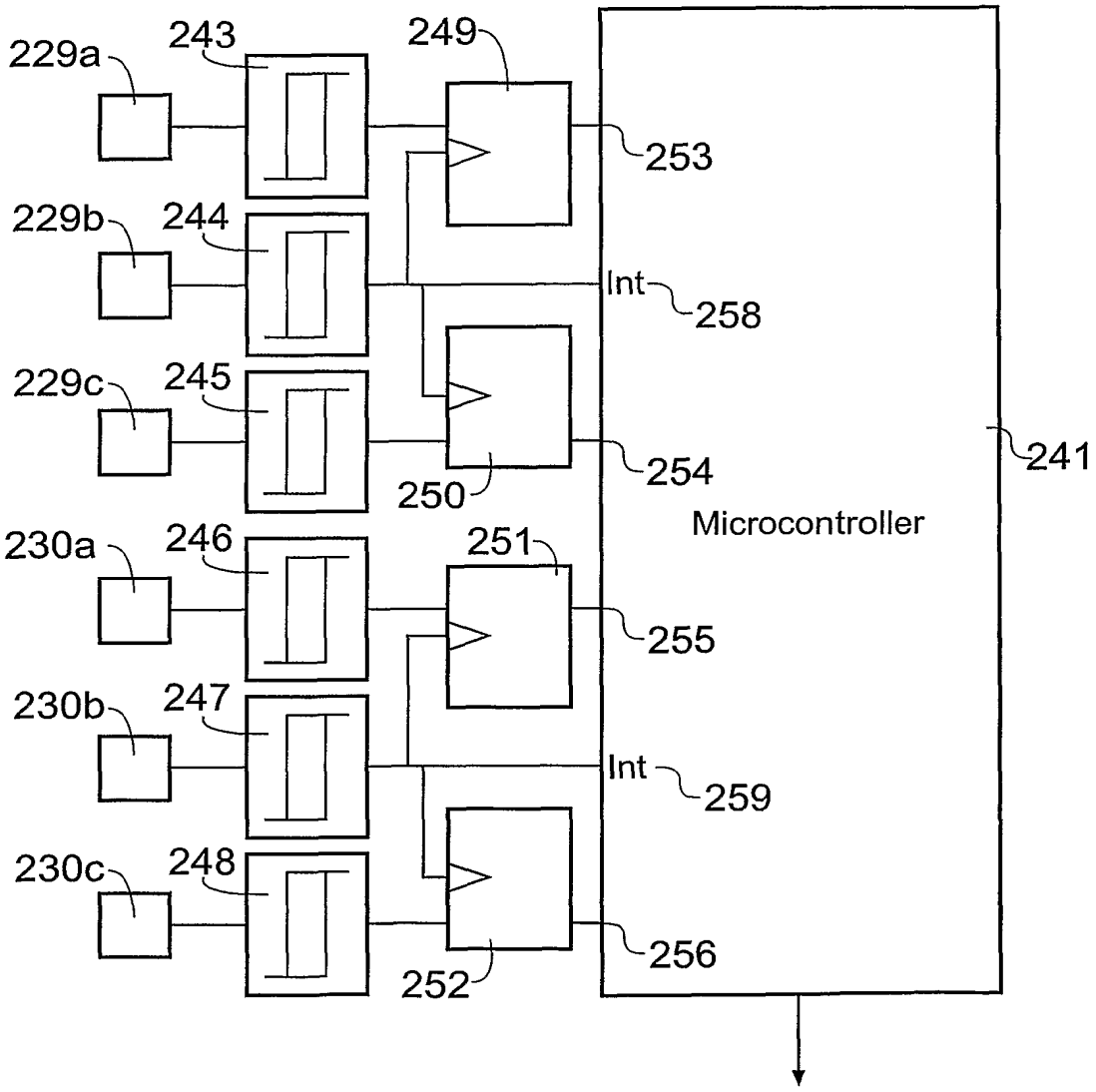


Fig. 18

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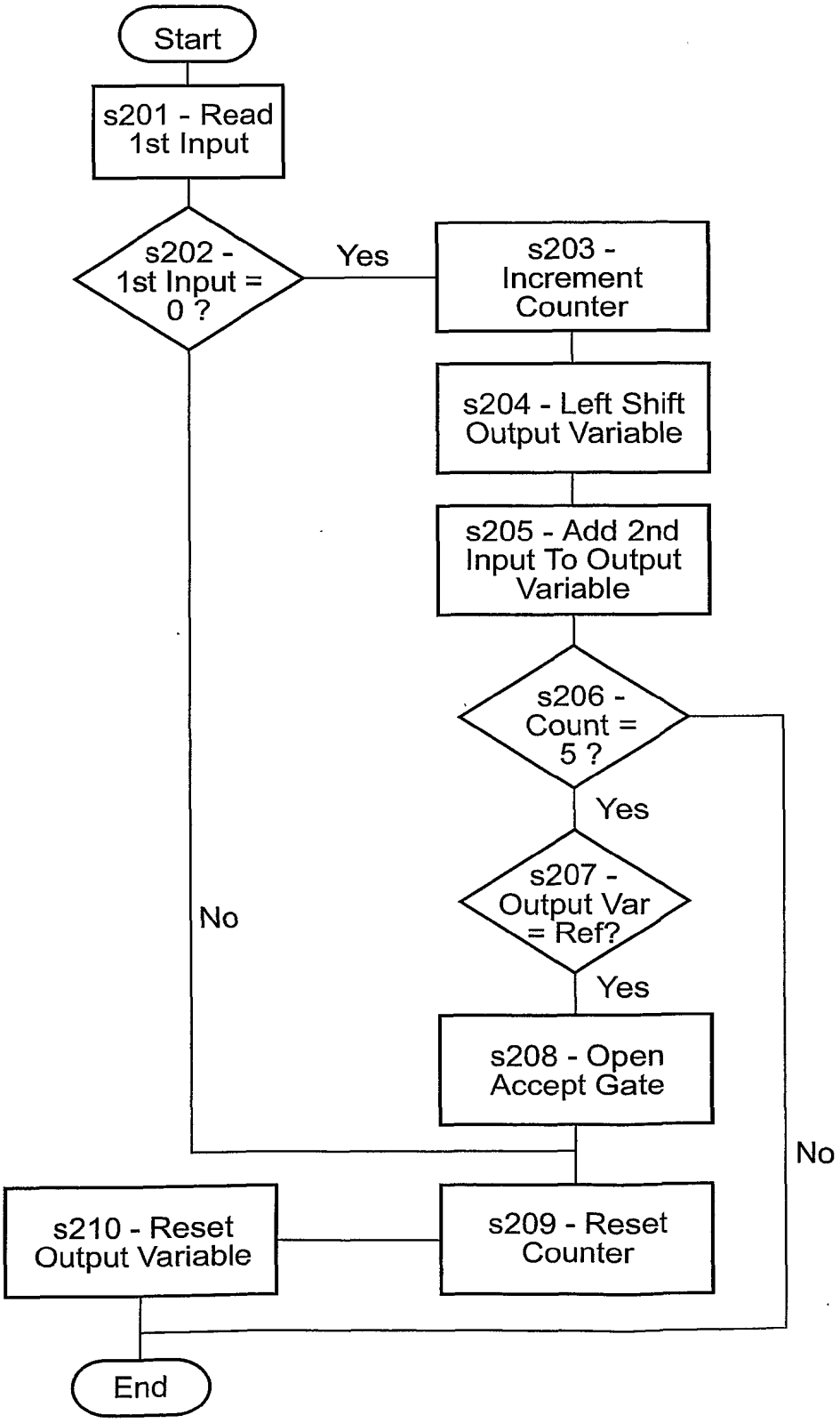


Fig. 19

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
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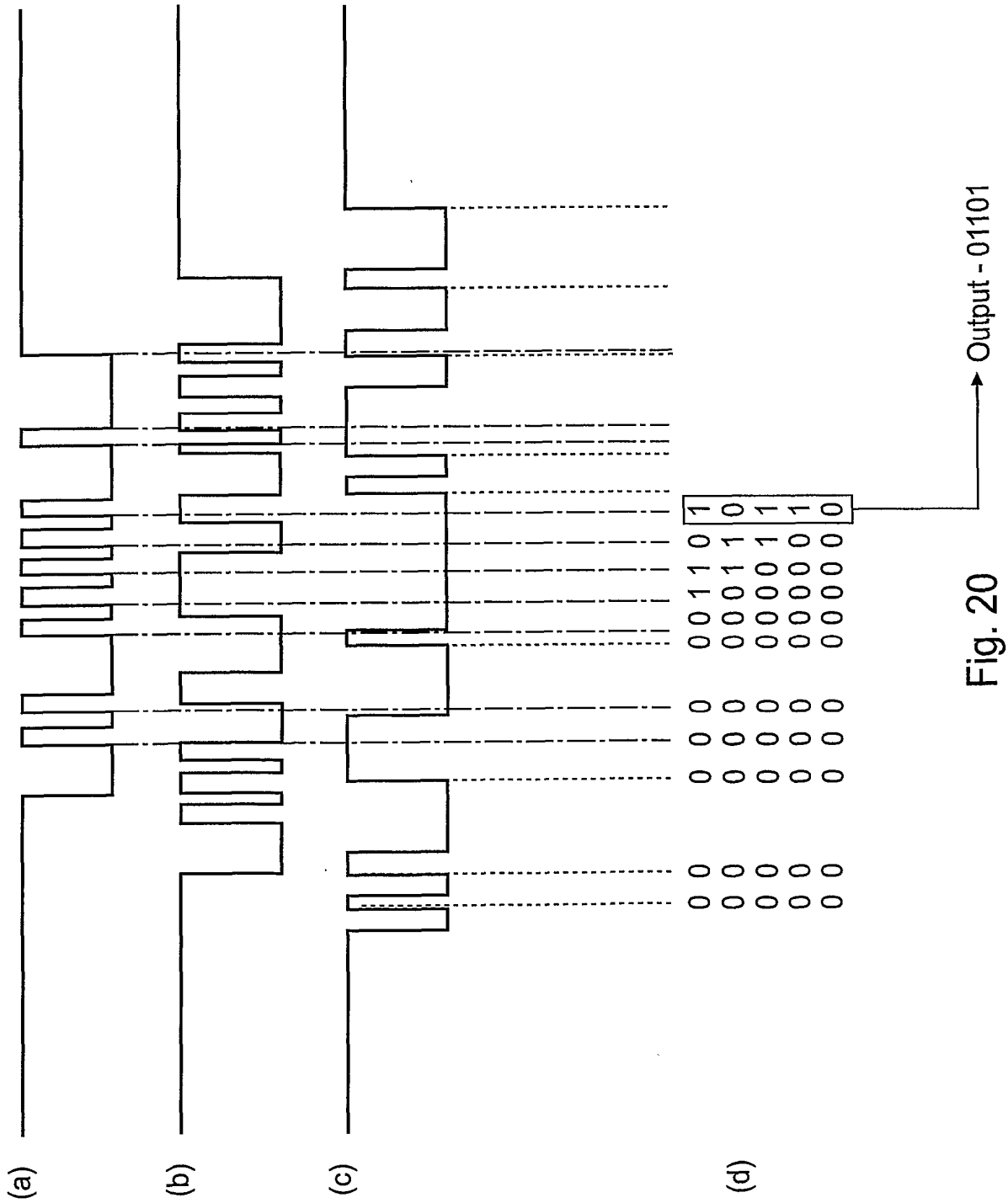


Fig. 20

K-FEE SYSTEM GMBH, EX2009, page 5348
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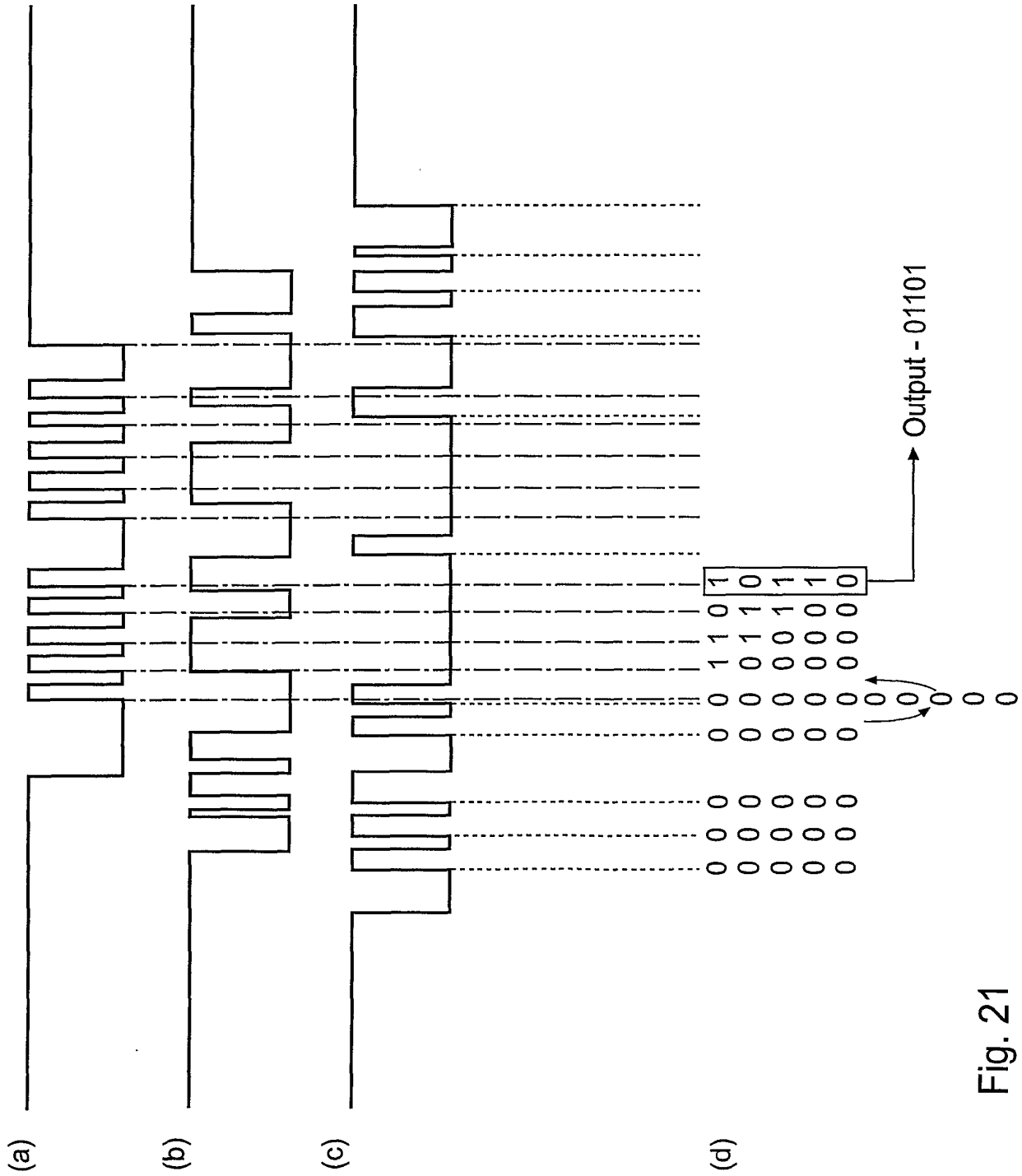


Fig. 21

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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

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

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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
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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

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INTERNATIONAL SEARCH REPORT

International 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

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(72) Inventor; and
(71) Applicant : **RAPPARINI, Gino** [IT/IT]; Via Croara 3/5, I-40068 Bologna (IT).

(74) Agent: **TORTI, Carlo**; Grünecker, Kinkeldey, Stockmair & Schwanhäusser, Leopoldstrasse 4, 80802 München (DE).

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

(54) Title: FILTERING AND PERMEABLE CONTAINER FOR SUBSTANCES SUITABLE FOR THE PREPARATION OF BEVERAGES

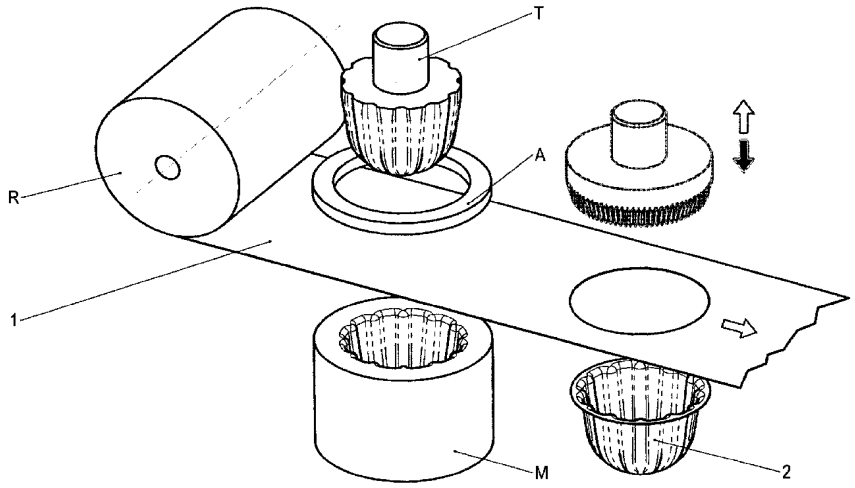


FIG. 5

(57) Abstract: Filtering and permeable container for substances (6) suitable for the preparation of beverages, the container being made by means of thermoforming starting from a flat strip (1) of permeable, filtering and thermoformable material, wherein the body (2) of the container comprises longitudinal stiffening ribs (4) wherein the length of the ribs (4) is variable along the surface of the body (2). The container can be adapted to contain water-soluble products or coffee, tea, herbal tea, or similar substances adapted to obtain hot or cold beverages.

WO 2011/047836 A1

FILTERING AND PERMEABLE CONTAINER FOR SUBSTANCES SUITABLE FOR THE PREPARATION OF BEVERAGES

FIELD OF THE INVENTION

The present invention relates to the field of containers for substances suitable for the preparation of beverages. In particular, the present invention relates to the field of filtering and permeable containers for substances such as water-soluble substances, coffee, tea, herbal tea or the like.

STATE OF THE ART

Several kinds of bags or flexible pads are known in the art for obtaining beverages such as tea, herbal teas, coffee or similar beverages such as water-soluble substances based beverages.

These kinds of bags or pads are easily deformed so that the handling of same is complicated and particularly critical, especially in the case of filling and/or packaging machines working at high production rates.

In order to try to overcome these problems, capsule packages have been provided such as those described for example in EP 0 521 186 A1 and in US 2005/0051478 A1.

EP 0 521 186 A1 describes a capsule package containing roast and ground coffee for the preparation of a coffee beverage. The capsule package described in EP 0 521 186 A1 has body and membrane components. The body has a frusto conical shape with base portion capable of allowing flow of a coffee beverage therethrough, an annular sidewall portion which extends transversely from the base about a package body interior space and defines an opening which opposes the base portion, and a rim portion which extends about the opening and transversely from the sidewall portion in a direction away from the opening. The body and the membrane are made of a permeable flexible plastic material. The stability of the system described in EP 0 521 186 A1 is not optimized. In particular, the capsule packages according to EP 0 521 186 A1 are still easily deformed, especially when they are handled by filling and/or packaging machines working at very high production rates.

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US 2005/0051478 A1 describes a beverage filter cartridge having an impermeable cup-shaped out container internally subdivided by a generally cup-shaped filter element into a first chamber inside the filter and a second chamber located between the filter bottom and the container bottom. The upper rim of the filter is joined at a peripheral juncture to the container side wall, and the filter side wall has exterior channels that face the container side wall and lead downwardly from the peripheral juncture to the second chamber. In particular, the channels are provided by forming the filter side wall with a fluted configuration or by pleats in the filter side wall so that the channels increase in width from a minimum at the upper rim of the filter to a maximum at the filter bottom. The channels formed in the filter sidewall according to US 2005/0051478 A1 are not provided for improving the stability of the structure of the system especially for its handling in filling and/or packaging machines working at very high production rates. Accordingly, the structure of these channels is not optimized for the purpose of improving the stability of the structure but rather for encouraging through flow in upper regions of the filter wall. The cartridges described in US 2005/0051478 A1 still exhibit therefore a low stability and render the handling procedures in packaging and/or filling machines extremely industrious, time consuming and costly.

The present invention allows overcoming the problems and drawbacks of the systems known in the prior art. In particular, the present invention guarantees stability of the structure of filtering and permeable containers so that they can easily be handled in packaging and/or filling machines even when these machines operate at very high rates. Moreover, the present invention provides containers which are easily employed in automatic machines both for domestic and industrial use.

SUMMARY

The present invention relates to filtering and permeable containers for substances suitable for the preparation of beverages, such as water-soluble substances or coffee, tea, herbal tea or the like.

The present invention is based on the idea of providing the body of the container with longitudinal stiffening ribs wherein the length of the ribs is variable along the surface of the body. The presence of ribs having different lengths on the body of the container allows the optimization of the stability of the container. The modulation of the length of the ribs along the surface of the container allows improving the stability and rigidity of the system.

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According to an embodiment of the present invention, a filtering and permeable container for substances suitable for the preparation of beverages is provided, the container being made by means of thermoforming starting from a flat strip of permeable, filtering and thermoformable material, wherein the body of the container comprises longitudinal stiffening ribs, wherein the length of the ribs is variable along the surface of the body.

According to a further embodiment of the present invention, a container is provided, wherein long and short ribs are alternated along the surface of the body. The stability of the container is accordingly optimized by providing for example long ribs extending at least partially in the bottom region of the container alternated to short ribs extending only along the side region of the container.

According to a further embodiment of the present invention, a container is provided, wherein the depth of one or more of the ribs decreases toward the bottom of the container. In particular, since one or more of the ribs have a depth which is decreasing toward the bottom of the container, the stability and handling of the container are optimized.

According to a further embodiment of the present invention, a container is provided, wherein at least along a portion of one or more of the ribs, the width of the ribs decreases toward the bottom of the container, so that said one or more of the ribs have a pointed shape. In this way the stability of the container is further optimized. In particular, the side portion of the body is stiffened by the presence of the stiffening ribs and the bottom portion is minimally altered by the presence of those ribs having a pointed shape pointing toward the bottom of the container.

According to a further embodiment of the present invention, a container is provided, wherein the stiffening ribs increase the filtering surface of the body.

According to a further embodiment of the present invention, a container is provided, further comprising an upper annular rim adapted to stiffen the structure of the body.

According to a further embodiment of the present invention, a container is provided, wherein the rim is substantially flat and has a thickness substantially corresponding to the thickness of the flat strip.

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According to a further embodiment of the present invention, a container is provided, wherein the container is sealed by means of a filtering film after having been filled with a substance suitable for the preparation of beverages.

According to a further embodiment of the present invention, a container is provided, wherein the container is hermetically contained into a hermetic and impermeable capsule so as to guarantee the preservation of the organoleptic properties of the substances contained in the container.

According to a further embodiment of the present invention, a container is provided, wherein the container is adapted to be employed in automatic espresso machines. In particular, the container can be adapted to be employed for example for automatic domestic espresso machines or for industrial espresso machines.

According to a further embodiment of the present invention, a container is provided, wherein the container is adapted to be employed in moka pots. For example, the total height of the container can be adapted to insert the container in the basket of existing moka pots.

According to a further embodiment of the present invention, a container is provided, wherein the container further comprises a suspension wire comprising a label so that the container can be introduced into a pot containing boiling water, such as a tea pot or the like.

According to a further embodiment of the present invention, a container is provided, wherein the container further comprises a suspension tab, the suspension tab being adapted to support writings, signs or the like.

According to a further embodiment of the present invention, a method for the production of a filtering and permeable container for substances suitable for the preparation of beverages is provided, the container being made by means of thermoforming starting from a flat strip of permeable, filtering and thermoformable material, the method comprising the step of the formation of longitudinal stiffening ribs on the body of the container, wherein the length of the ribs is variable along the surface of the body.

According to a further embodiment of the present invention, a method for the production of a filtering and permeable container for substances suitable for the preparation of beverages is provided, wherein the formation of the body of the container is performed

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by means of a thermoforming punch and a matrix, the thermoforming punch comprising longitudinal ribs on its outer surface adapted to shape the longitudinal stiffening ribs of the body of the container, the matrix being adapted to house the thermoforming punch so as to form simultaneously the body and the stiffening ribs starting from the flat strip.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be described with reference to the enclosed drawings wherein the same reference numbers refer to the same and/or similar parts of the system. In the drawings:

Figure 1 schematically displays the starting phase of the thermoforming process for the formation of a container according to an embodiment of the present invention;

Figure 2 schematically displays an operative phase of the thermoforming process for the formation of a container according to an embodiment of the present invention;

Figure 3 schematically displays a further operative phase of the thermoforming process for the formation of a container according to an embodiment of the present invention;

Figure 4 schematically displays a further operative phase of the thermoforming process for the formation of a container according to an embodiment of the present invention;

Figure 5 schematically displays a further operative phase of the process for the formation of a container according to an embodiment of the present invention wherein the formed container is cut from the strip of permeable, filtering and thermoformable material;

Figure 6 schematically displays a 3D view of the inner region of the container according to an embodiment of the present invention;

Figure 6bis schematically displays a 3D view of the outer region of the container shown in figure 6;

Figure 7 schematically displays a 3D view of the container according to an embodiment of the present invention filled with a substance suitable for the preparation of beverages;

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Figure 8 schematically displays a 3D view of the container shown in figure 7 sealed by means of a filtering film;

Figure 9 schematically displays a 3D view of the upper region of a container according to an embodiment of the present invention adapted to be employed in a moka pot and sealed by means of a filtering film;

Figure 10 schematically displays a 3D view of the bottom region of the container shown in figure 9;

Figure 11 schematically displays a 3D cut of the bottom region of the container shown in figures 9 and 10;

Figure 12 schematically displays a 3D exploded view of a moka pot employing a container according to an embodiment of the present invention;

Figure 13 schematically displays a vertical cross section of a moka pot employing a container according to an embodiment of the present invention;

Figure 14 schematically displays a 3D view of a hermetic and impermeable capsule containing the container according to an embodiment of the present invention;

Figure 15 schematically displays a 3D view of a cut of the hermetic and impermeable capsule shown in figure 14;

Figure 16 schematically displays a container comprising a suspension wire according to an embodiment of the present invention;

Figure 17 schematically displays a container comprising a suspension tab according to an embodiment of the present invention.

DETAILED DESCRIPTION

In the following, the present invention is described with reference to particular embodiments as shown in the enclosed drawings. Nevertheless, the present invention is not limited to the particular embodiments described in the following detailed description and shown in the figures, but, instead, the embodiments described simply exemplify several aspects of the present invention, the scope of which is defined by the appended claims.

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Further modifications and variations of the present invention will be clear for the person skilled in the art. Therefore, the present description has to be considered as including all the modifications and/or variations of the present invention, the scope of which is defined by the appended claims.

Figure 1 schematically displays the starting phase of the thermoforming process for the formation of a container according to an embodiment of the present invention. The figure displays a reel R of permeable, filtering and thermoformable material. A flat strip 1 of this material is unwound from the roll R. The system for forming the container comprises a thermoforming punch T, a stabilizing ring A and a matrix M.

The outer surface of the apex portion of the punch T comprises ribs adapted to form ribs in the body of the container as described in detail below. The matrix M is adapted to house the punch T. In particular, as can be seen in figure 1, the matrix M comprises an inner cavity with a lateral surface provided with grooves adapted to engage the ribs of the apex portion of the punch T.

As can be seen in figure 2, the stabilizing ring A is employed to press the strip 1 against the upper portion of the matrix M. Accordingly, by means of the stabilizing ring A, the strip 1 is safely kept in place for the formation of the container.

In figure 3, the punch T is lowered through the ring A into the matrix M so as to insert a portion of the strip 1 into the matrix M. The action of the thermoforming punch T in cooperation with the matrix M allows the formation of the body 2 of the container. In other words, both the bottom and the side portion of the container are simultaneously formed in this step. Moreover, since the punch T is provided with ribs and the matrix M is provided with corresponding grooves adapted to engage the ribs of the punch T, the body 2 is formed with stiffening ribs 4 with the optimized stiffening structure as described below. In particular, the body 2 and the stiffening ribs 4 are formed simultaneously.

Figure 4 displays the situation of the system when the punch T and the ring A are lifted. As can be seen, the body 2 of the container is formed with stiffening ribs 4 due to the combined action of the matrix M and of the punch T. Moreover, the region of the strip 1 located below the stabilizing ring A is not deformed. In particular, the portion of the strip 1 located below the stabilizing ring A is substantially flat and has substantially the same thickness as the strip 1.

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Figure 5 schematically displays a further operative phase of the process for the formation of the container wherein the formed body 2 is cut from the strip 1 of permeable, filtering and thermoformable material. In particular, a cutting tool is employed to detach the formed body 2 from the strip 1. By means of the cutting tool, in particular by properly choosing the diameter of the cutting tool or by selecting an appropriate line of cutting, the container is provided with an upper annular rim 3. Since the upper annular rim 3 corresponds to the region of the strip below the stabilizing ring A, the annular rim 3 is substantially flat and has a thickness substantially corresponding to the thickness of the strip 1.

Figures 6 and 6bis schematically display 3D views of the container according to an embodiment of the present invention. The container is provided with longitudinal stiffening ribs 4, and the length L of the stiffening ribs 4 is variable along the surface of the body 2 of the container. In particular, long and short ribs are alternated along the surface of the body 2. The long ribs extends toward the bottom region 5 of the container. In particular, the long ribs occupy a portion of the bottom region 5 of the container. The container has a cup-shaped bottom region 5. The long stiffening ribs occupy, therefore, a portion of the cup-shaped bottom region 5. Each short rib is placed between two long ribs and extends along the lateral region of the container. Accordingly, the stabilization of the structure is optimized and, at the same time, the filtering surface of the container is increased.

Further, as can be seen in figures 6 and 6bis, both the long and short stiffening ribs 4 have a depth which decreases toward the bottom of the container. In particular, the ribs 4 have maximum depth in correspondence to the upper annular rim 3 and minimum depth at their opposed end, i.e. toward the bottom region 5 of the container. This allows improving the stability of the container and, at the same time, increasing the filtering surface of the system. The varying depth of the ribs 4 allows to integrate them in the structure of the container so as to penetrate even in the bottom region of the container. In particular, since toward the bottom of the container the depth of the ribs 4 is minimal, the bottom region can be easily provided with the ribs 4.

Moreover, as can be seen in figures 6 and 6bis, the width of the ribs decreases toward the bottom 5 of the container so that the ribs 4 have a pointed shape. In particular, the pointed end of the ribs 4 points toward the bottom region 5 of the container. This allows inserting a large number of stiffening ribs 4 even if the container is cup-shaped as

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shown in figures 6 and 6bis. In particular, even the narrow bottom region 5 of the cup shaped container can be provided with ribs 4 because the width of the ribs 4 is reduced in this region with respect to the width of the ribs 4 in their upper portion.

As can be further seen in figures 6 and 6bis, the container is provided with an upper annular rim 3 adapted to further stiffen the structure of the body of the container. The annular rim 3 is substantially flat and has substantially the same thickness as the flat strip 1 of permeable, filtering and thermoformable material.

The annular rim 3 and the stiffening ribs 4 guarantee the rigidity of the body 2 of the container so that it can be easily and quickly handled even at very high automated filling and/or production speeds.

Figure 7 schematically displays a 3D view of the container according to an embodiment of the present invention filled with a substance suitable for the preparation of beverages. The substance can be suitable for the preparation of hot or cold beverages. Examples of such substances are water-soluble substances such as milk powder or tea powder for ice tea. Further examples of such substances are infusion substances such as tea or herbal tea. Further examples of such substances are granular substances such as ground coffee or the like.

Figure 8 schematically displays a 3D view of the container shown in figure 7 sealed by means of a filtering film 1'. The filtering film 1' is permeable. Moreover, the filtering film 1' is sealed to the upper annular rim 3 of the container.

Figure 9 schematically displays a 3D view of the upper region of a container 2A according to an embodiment of the present invention adapted to be employed in a moka pot and sealed by means of a filtering film. Figure 10 schematically displays a 3D view of the bottom region of the container 2A shown in figure 9. Figure 11 schematically displays a 3D cut of the bottom region of the container shown in figure 9.

The height of the container shown in figures 9, 10 and 11 is lower than the height of the container shown in figures 6 and 6bis. In particular, the height of the container shown in figures 9, 10 and 11 is adapted to employ the container in the basket of existing moka pots.

As can be seen in figure 10, the alternate length of the stiffening ribs 4 is particularly advantageous in the present case. In particular, in the present case, the container 2A

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has substantially a cylindrical shape with a substantially flat bottom. The short ribs run only along the side wall of the container 2A. In particular, the short ribs run along the entire height of the side wall of the container 2A. The long ribs extend beyond the side wall of the container 2A in the bottom portion of same so as to meet substantially at the centre of the bottom portion of the container 2A. In particular, the pointed endings of the long ribs point toward the centre of the bottom portion of the container 2A. Moreover, the depth of the long ribs decreases toward the centre of the bottom 5 of the container 2A so as to maintain the stability of the central portion. The short ribs have substantially constant depth along their entire length. Moreover, the short ribs have substantially constant width along their entire length and do not exhibit pointed endings.

Figure 12 schematically displays a 3D exploded view of a moka pot employing a container 2A according to an embodiment of the present invention, and figure 13 schematically displays a vertical cross section of the system. As can be seen in the figures, the container 2A is fitted into the basket of the moka pot. Moreover, the moka pot is a traditional existing moka pot, and no modifications are necessary for employing the container 2A according to an embodiment of the present invention.

Figure 14 schematically displays a 3D view of a hermetic and impermeable capsule 10 containing the container according to an embodiment of the present invention. Figure 15 schematically displays a 3D view of a cut of the system shown in figure 14. The container is hermetically contained into the hermetic and impermeable capsule 10 so as to guarantee the preservation of the organoleptic properties of the substances 6 contained in the container.

Figure 16 schematically displays a container 2 comprising a suspension wire 7 according to an embodiment of the present invention. The suspension wire 7 is provided with a label 8. Accordingly, the container according to this embodiment of the present invention can be employed in a similar way to common tea bags. In particular, the container 2 can be easily inserted into pots containing boiling water, such as tea pots or the like. According to the present invention, also the container 2A having reduced height and substantially cylindrical shape can be provided with a suspension wire.

Figure 17 schematically displays a container 2 comprising a suspension tab 9 according to an embodiment of the present invention. The suspension tab 9 is adapted to support

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writings, signs or the like. The suspension tab 9 is formed as an extension of the filtering film 1' sealing the container 2. According to the present invention, also the container 2A having reduced height and substantially cylindrical shape can be provided with a suspension tab.

While the invention has been described with respect to the preferred physical embodiments constructed in accordance therewith, it will be apparent to those skilled in the art that various modifications, variations and improvements of the present invention may be made in the light of the above teachings and within the purview of the appended claims without departing from the spirit and intended scope of the invention.

For instance, several kinds of materials can be employed for realizing the containers according to the present invention. Moreover, the containers according to the present invention can have several dimensions. For example, the containers can be adapted to be employed for domestic machines such as moka pots or automatic espresso machines. Alternatively, the containers can be adapted to be employed for industrial machines.

In addition, those areas in which it is believed that those of ordinary skill in the art are familiar have not been described herein in order not to unnecessarily obscure the invention described. Accordingly, it has to be understood that the invention is not to be limited by the specific illustrative embodiments, but only by the scope of the appended claims.

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CLAIMS

1. Filtering and permeable container for substances (6) suitable for the preparation of beverages, said container being made by means of thermoforming starting from a flat strip (1) of permeable, filtering and thermoformable material,

characterized in that:

the body (2) of said container comprises longitudinal stiffening ribs (4), wherein the length of said ribs (4) is variable along the surface of said body (2).

2. Container according to claim 1, wherein long and short ribs (4) are alternated along the surface of said body (2).

3. Container according to one of claims 1 or 2, wherein the depth of one or more of said ribs (4) decreases toward the bottom (5) of said container.

4. Container according to one of claims 1 to 3, wherein at least along a portion of one or more of said ribs (4), the width of said ribs (4) decreases toward the bottom (5) of said container, so that said one or more of said ribs (4) have a pointed shape.

5. Container according to one of claims 1 to 4, wherein said stiffening ribs (4) increase the filtering surface of said body (2).

6. Container according to one of claims 1 to 5, further comprising an upper annular rim (3) adapted to stiffen the structure of said body (2).

7. Container according to claim 6, wherein said rim (3) is substantially flat and has a thickness substantially corresponding to the thickness of said flat strip (1).

8. Container according to one of claims 1 to 7, wherein said container is sealed by means of a filtering film (1') after having been filled with a substance (6) suitable for the preparation of beverages.

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9. Container according to one of claims 1 to 8, wherein said container is hermetically contained into a hermetic and impermeable capsule (10) so as to guarantee the preservation of the organoleptic properties of the substances (6) contained in said container.

10. Container according to one of claims 1 to 9, wherein said container is adapted to be employed in automatic espresso machines.

11. Container according to one of claims 1 to 10, wherein said container is adapted to be employed in moka pots.

12. Container according to one of claims 1 to 11, wherein said container further comprises a suspension wire (7) comprising a label (8) so that said container can be introduced into a pot containing boiling water, such as a tea pot or the like.

13. Container according to one of claims 1 to 11, wherein said container further comprises a suspension tab (9), said suspension tab (9) being adapted to support writings, signs or the like.

14. Method for the production of a filtering and permeable container for substances (6) suitable for the preparation of beverages, said container being made by means of thermoforming starting from a flat strip (1) of permeable, filtering and thermoformable material, said method comprising the following steps:

formation of longitudinal stiffening ribs (4) on the body (2) of said container, wherein the length of said ribs (4) is variable along the surface of said body (2).

15. Method according to claim 14, wherein the formation of the body (2) of said container is performed by means of a thermoforming punch (T) and a matrix (M), said thermoforming punch (T) comprising longitudinal ribs on its outer surface adapted to shape said longitudinal stiffening ribs (4), said matrix (M) being adapted to house said thermoforming punch (T) so as to form simultaneously said body (2) and said stiffening ribs (4) starting from said flat strip (1).

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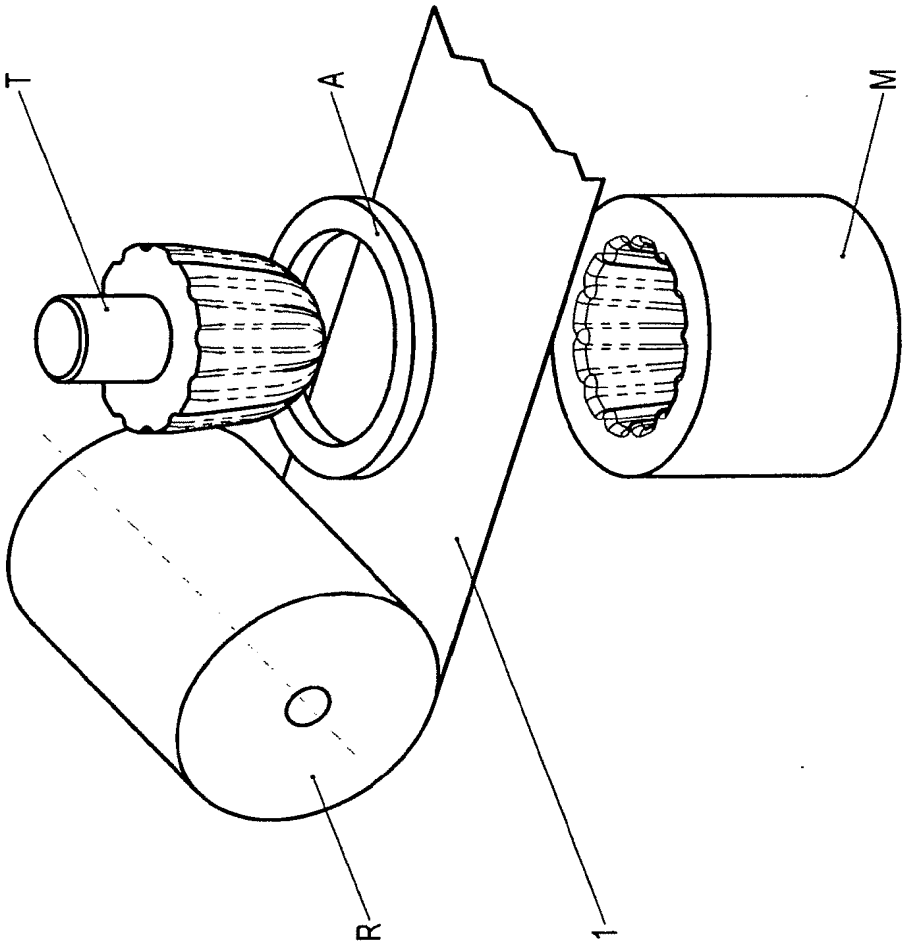


FIG. 1

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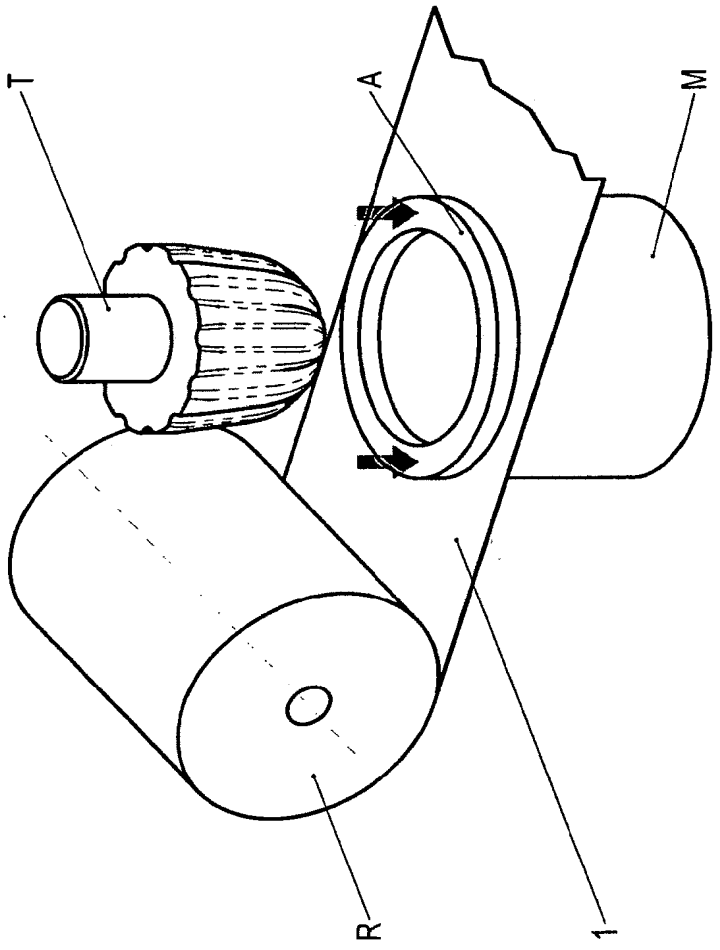


FIG. 2

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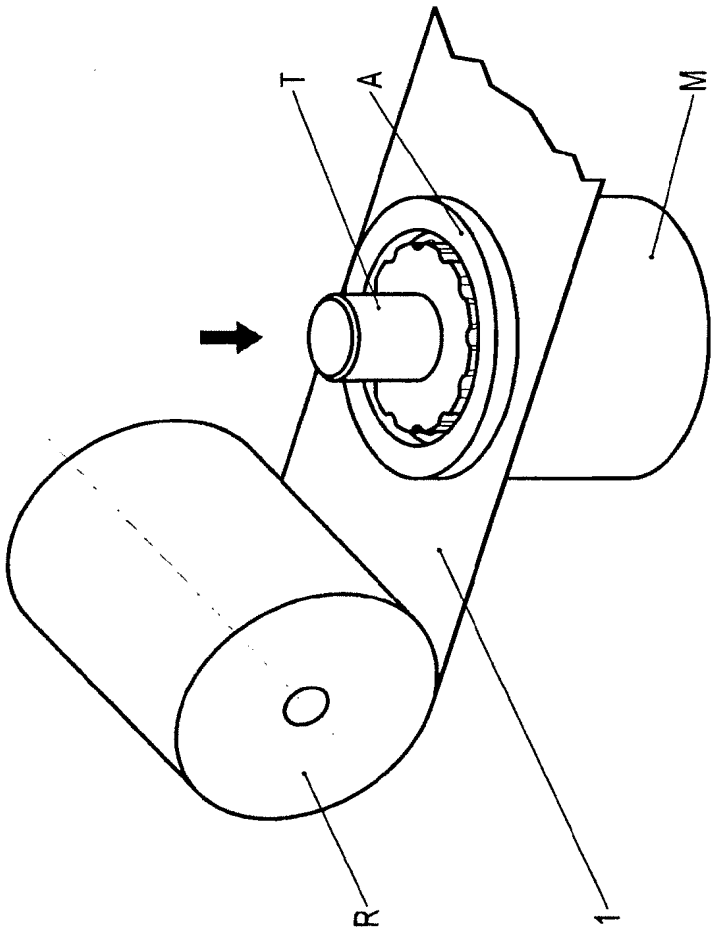


FIG. 3

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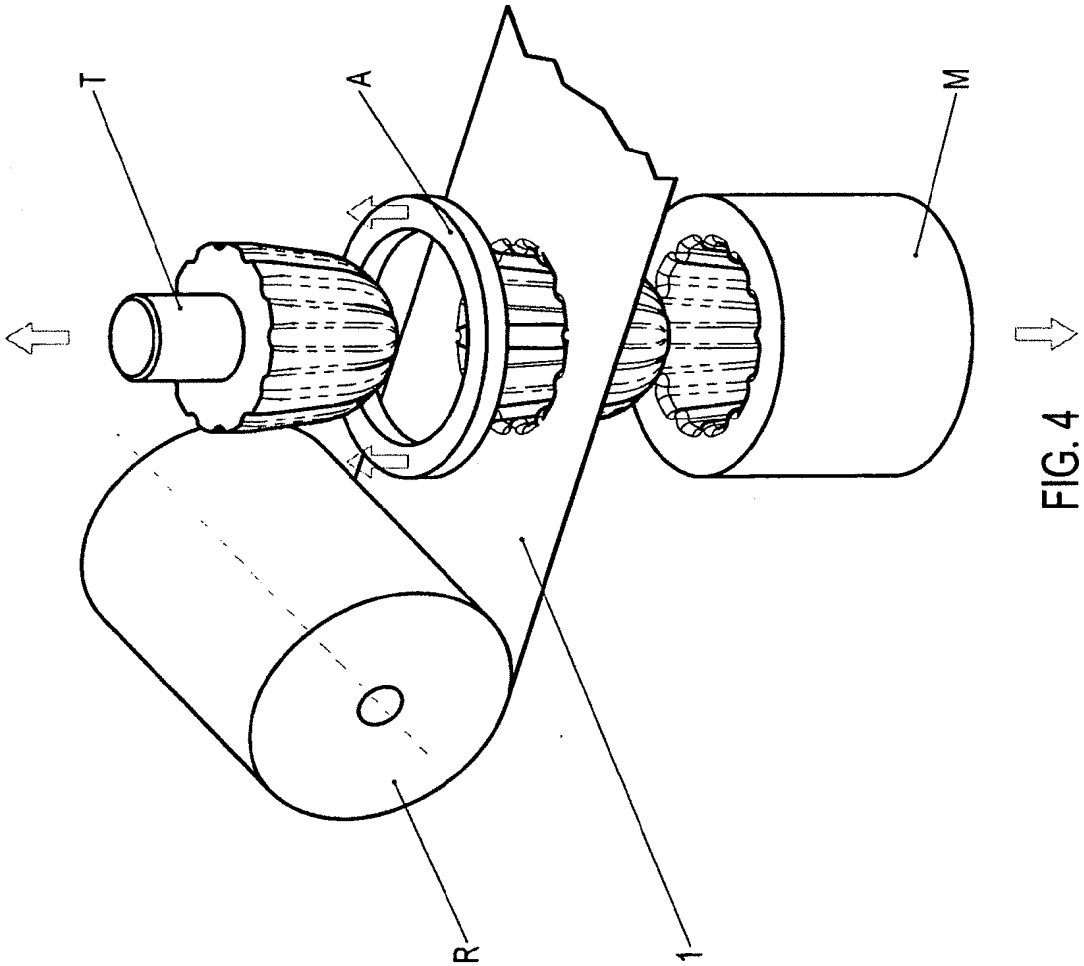


FIG. 4

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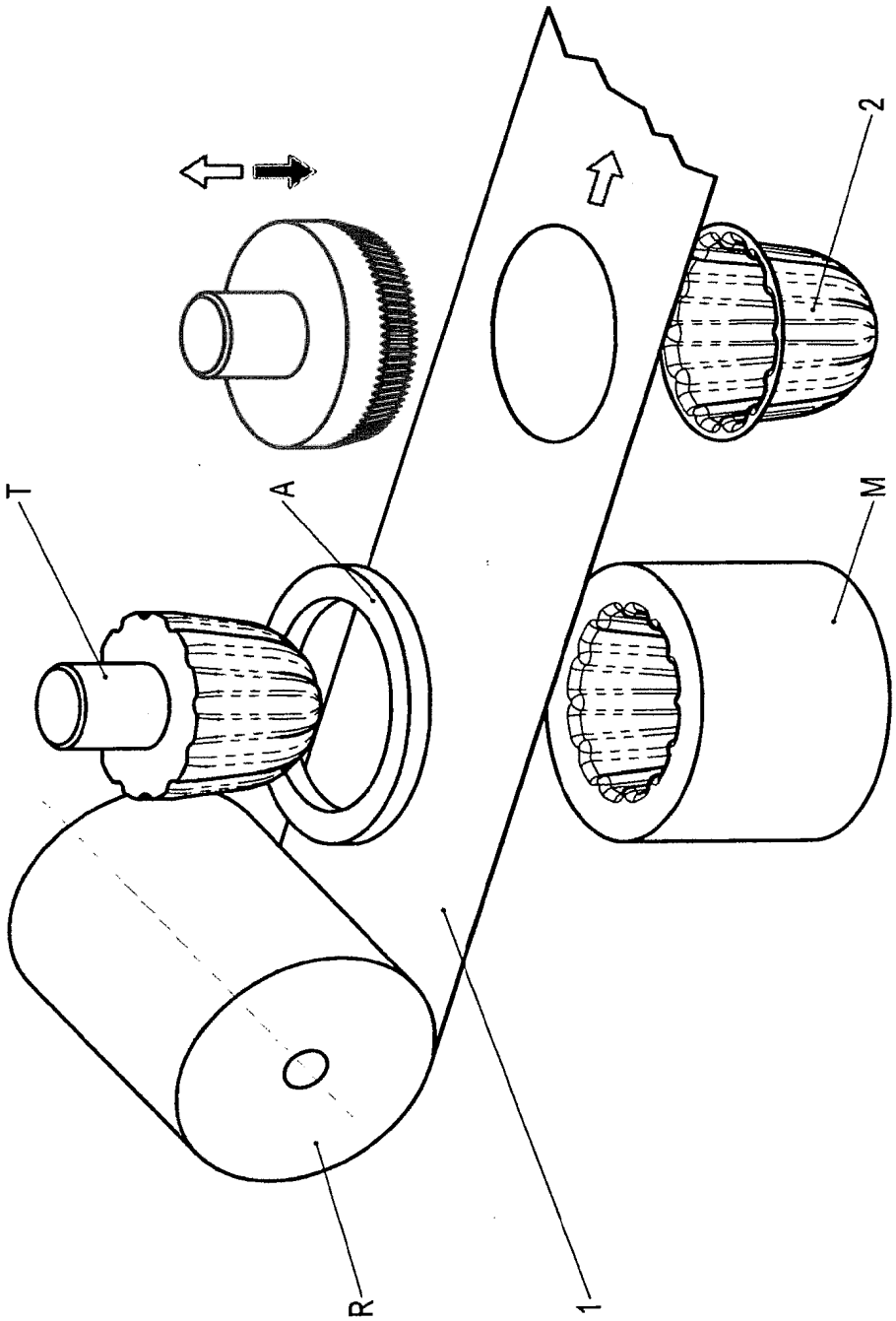


FIG. 5

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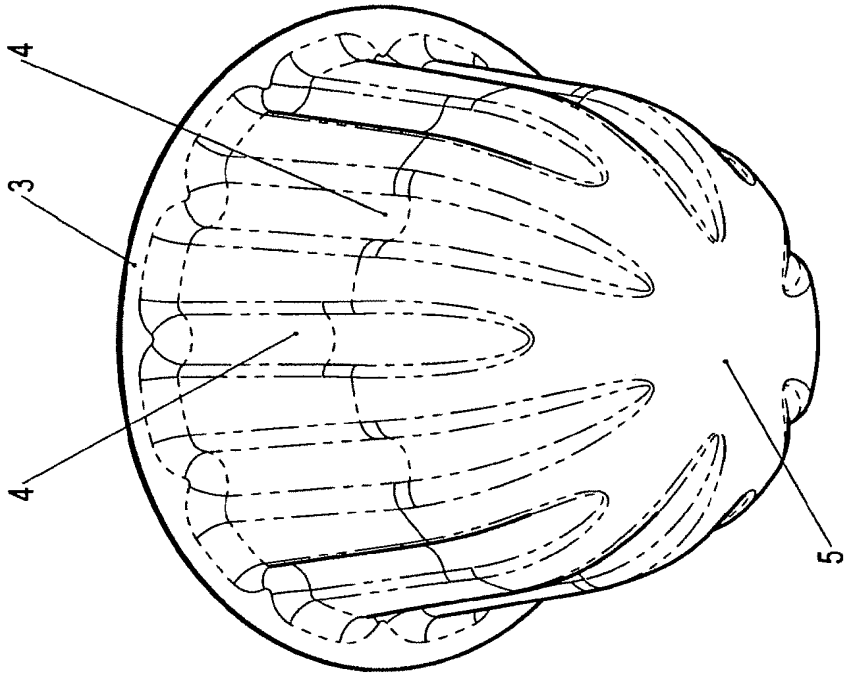


FIG. 6 bis

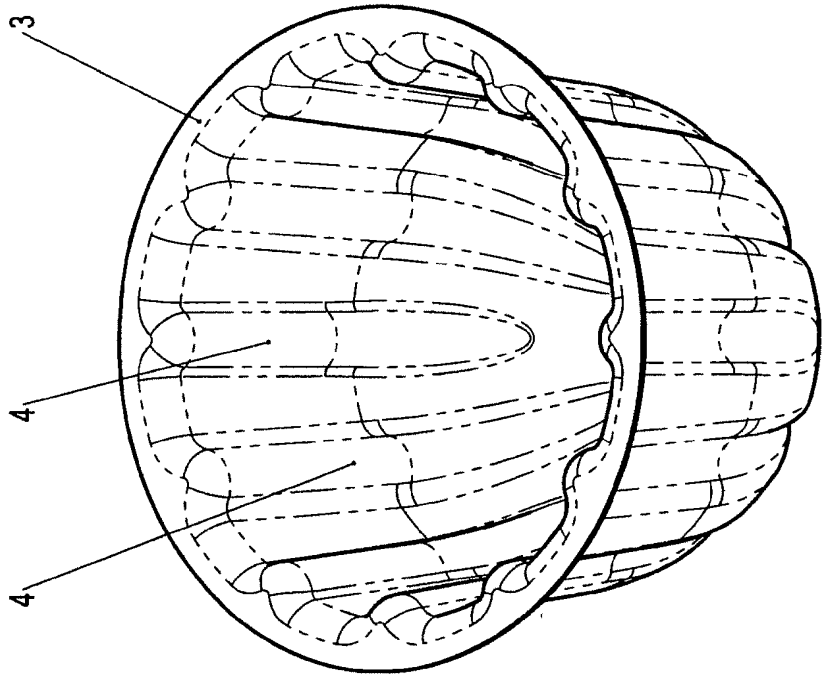


FIG. 6

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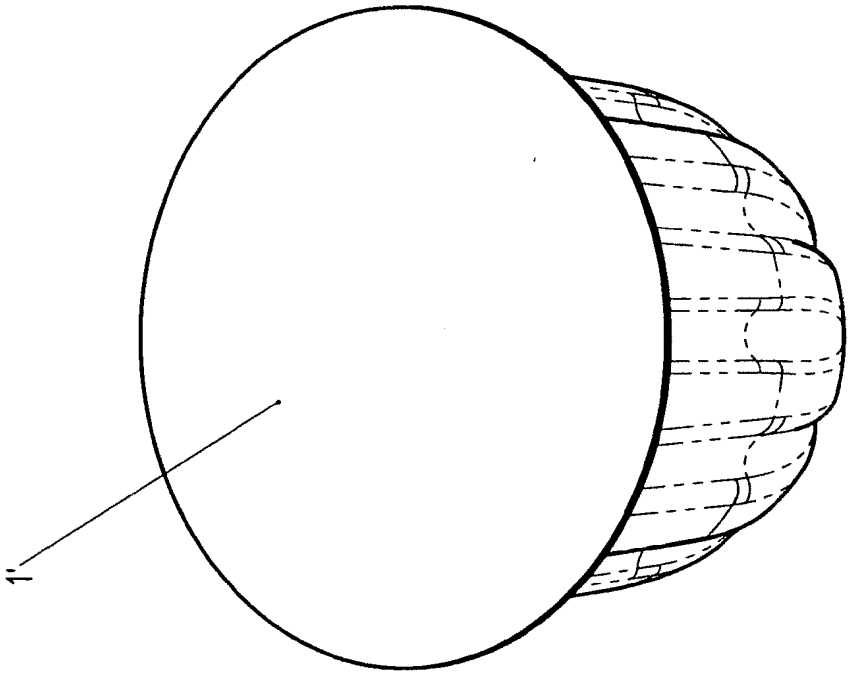


FIG. 8

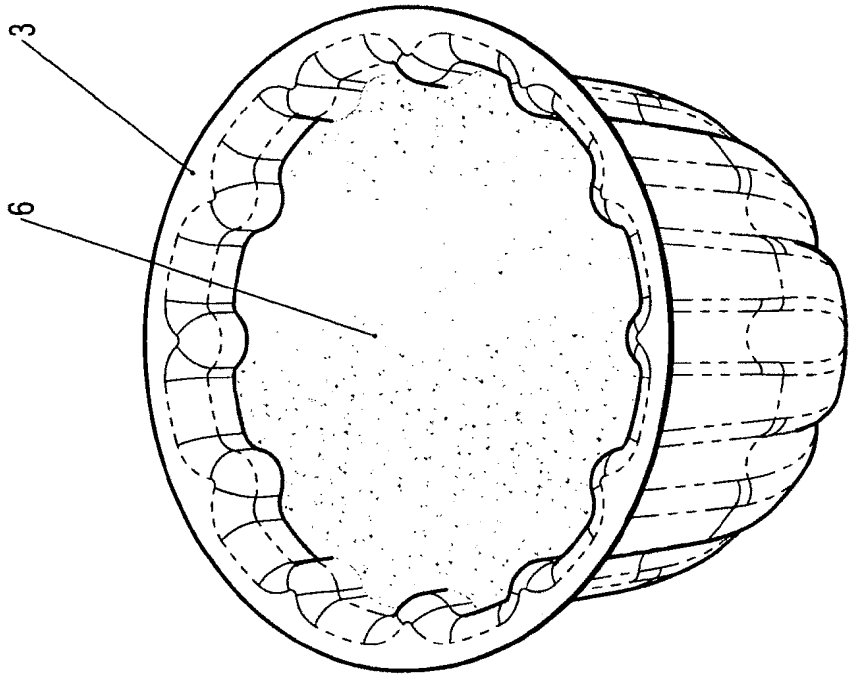


FIG. 7

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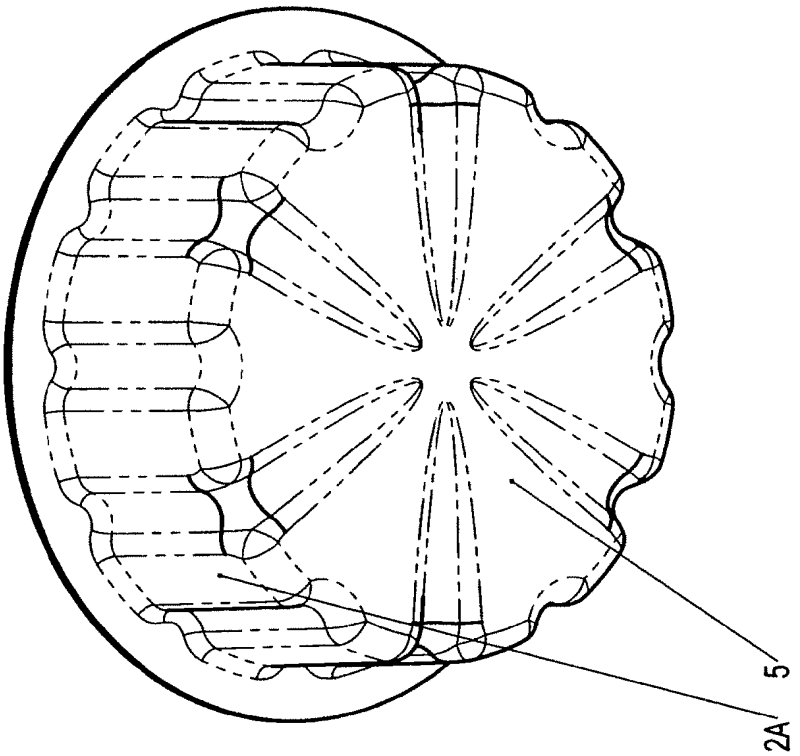


FIG. 10

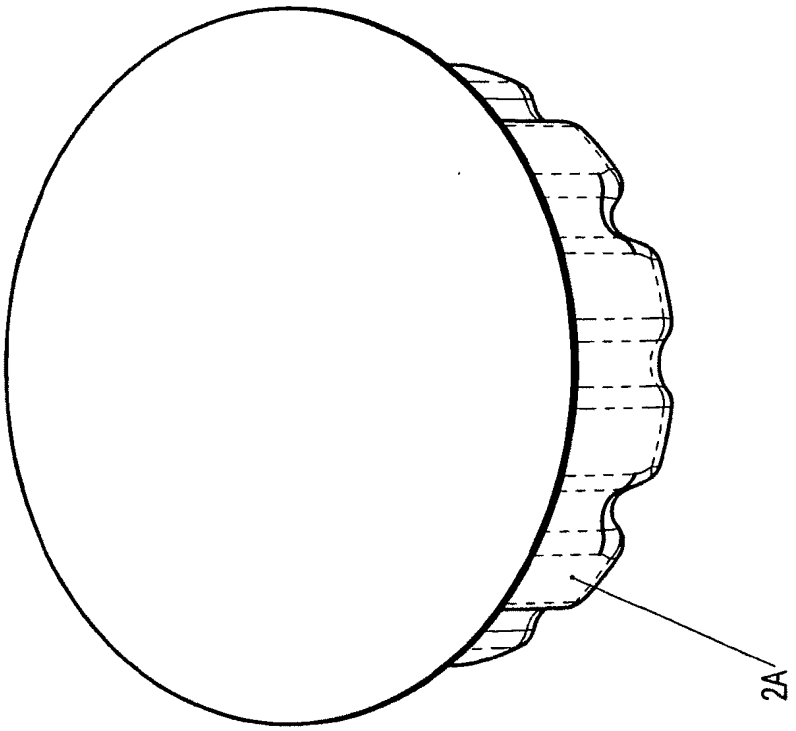


FIG. 9

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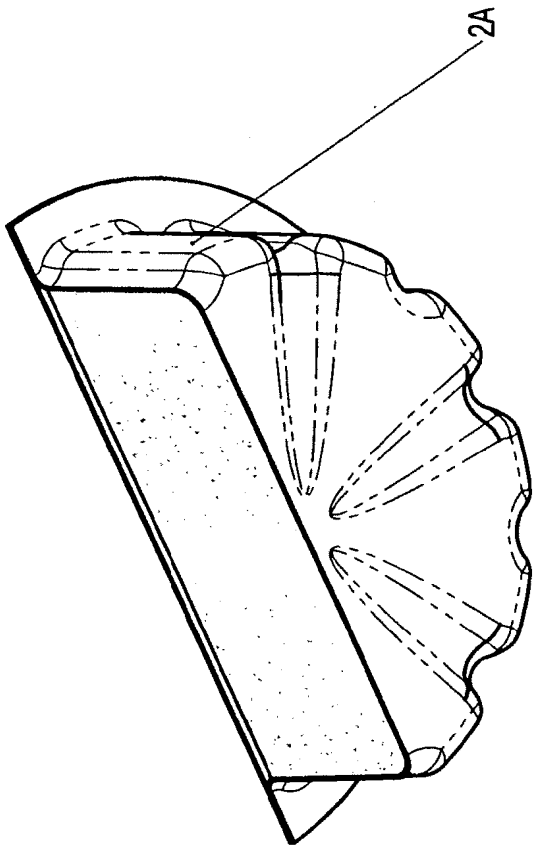
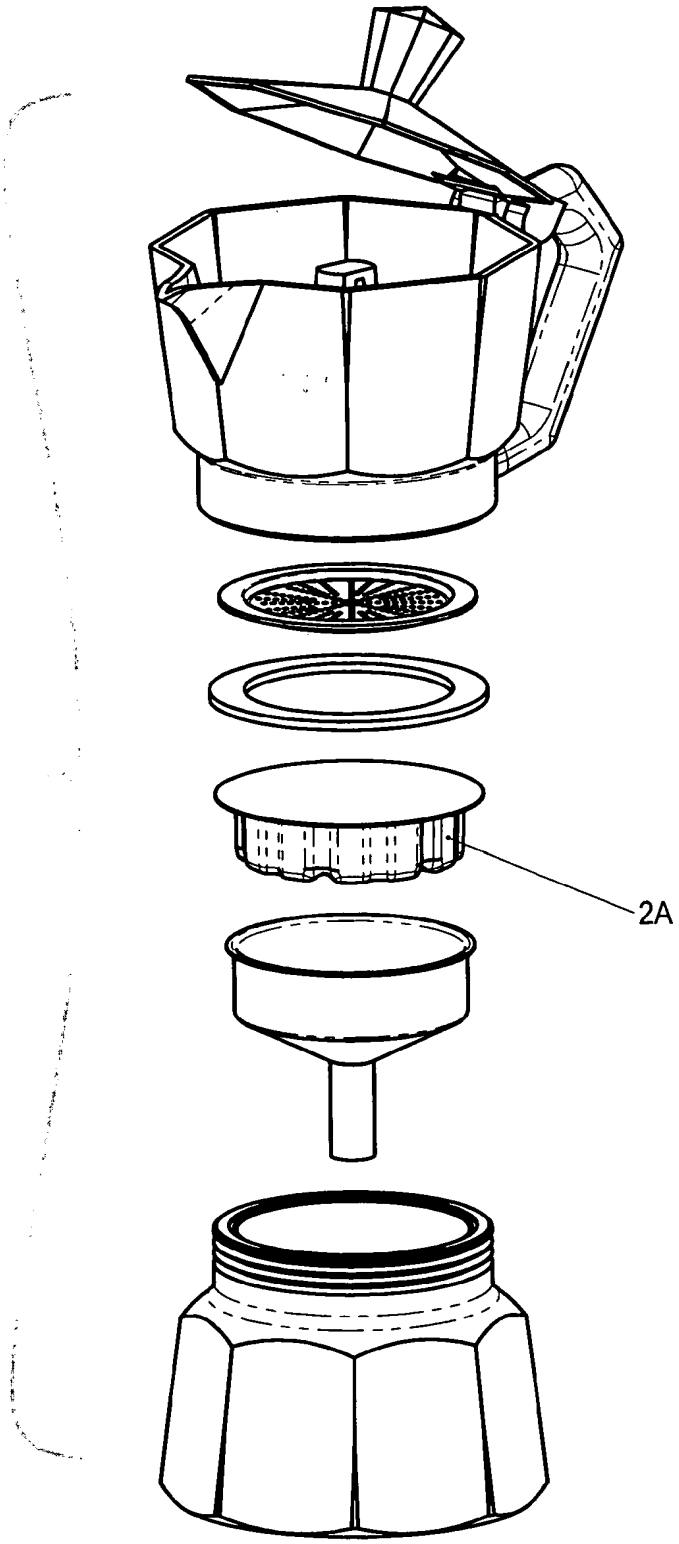


FIG. 11

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FIG. 12



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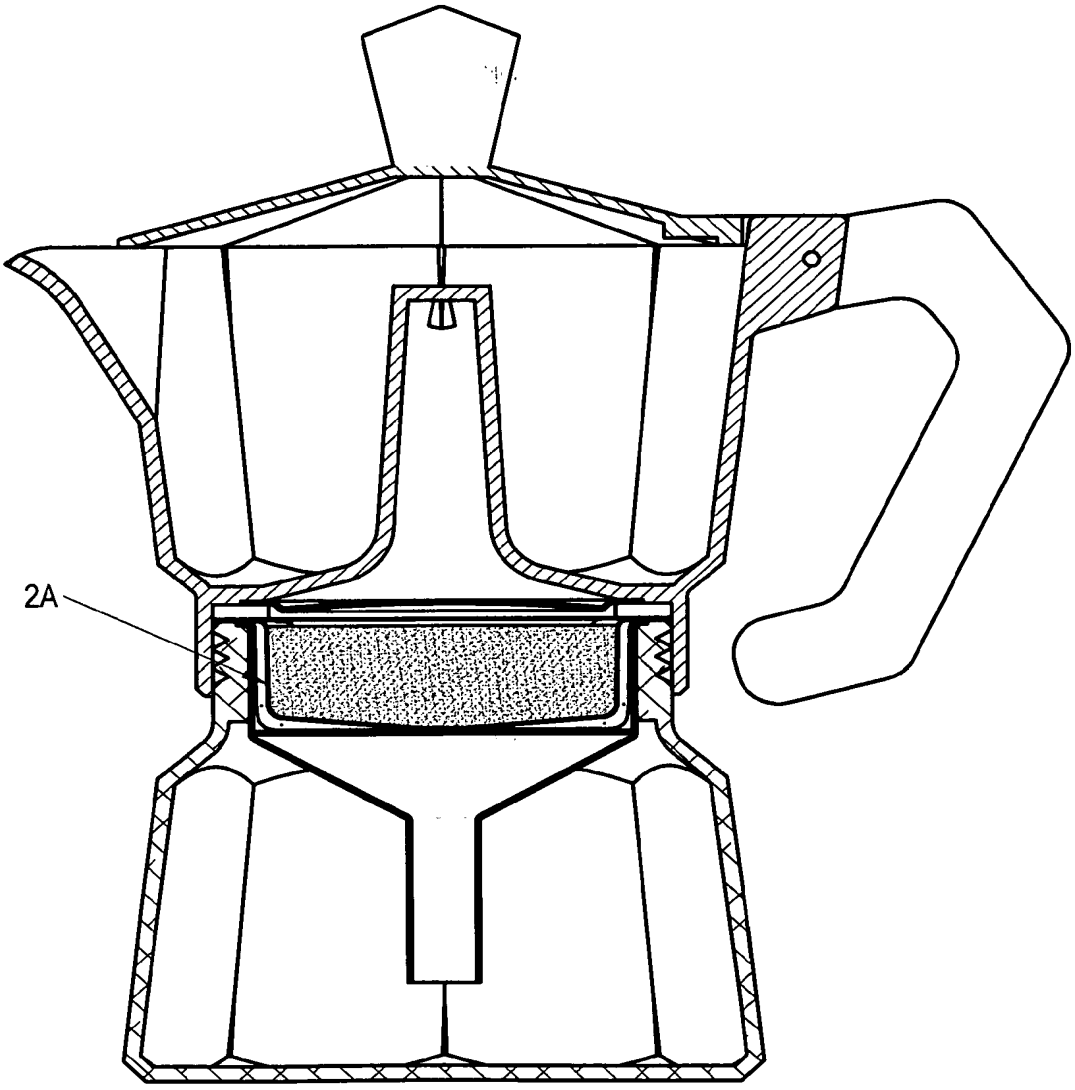


FIG. 13

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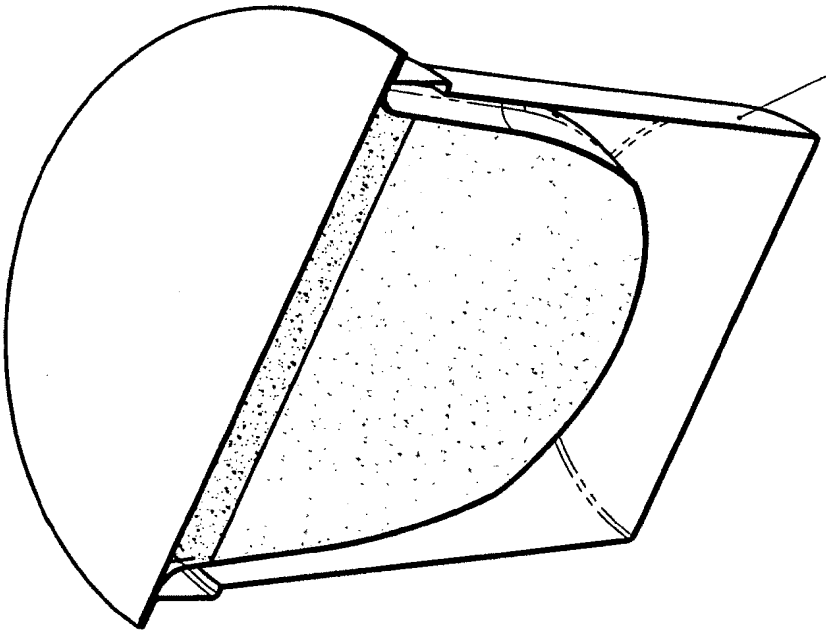


FIG. 15

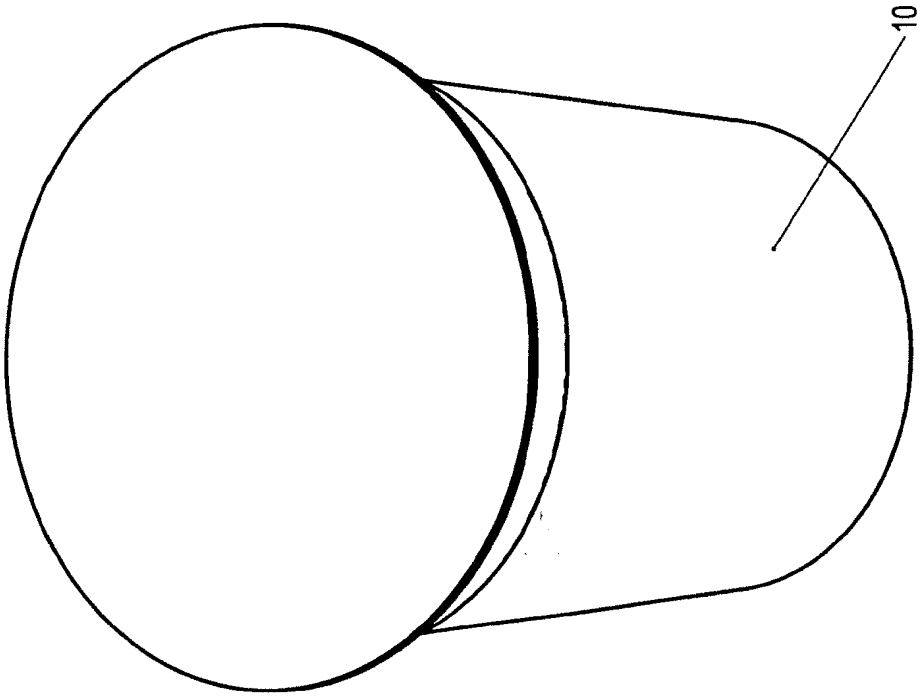


FIG. 14

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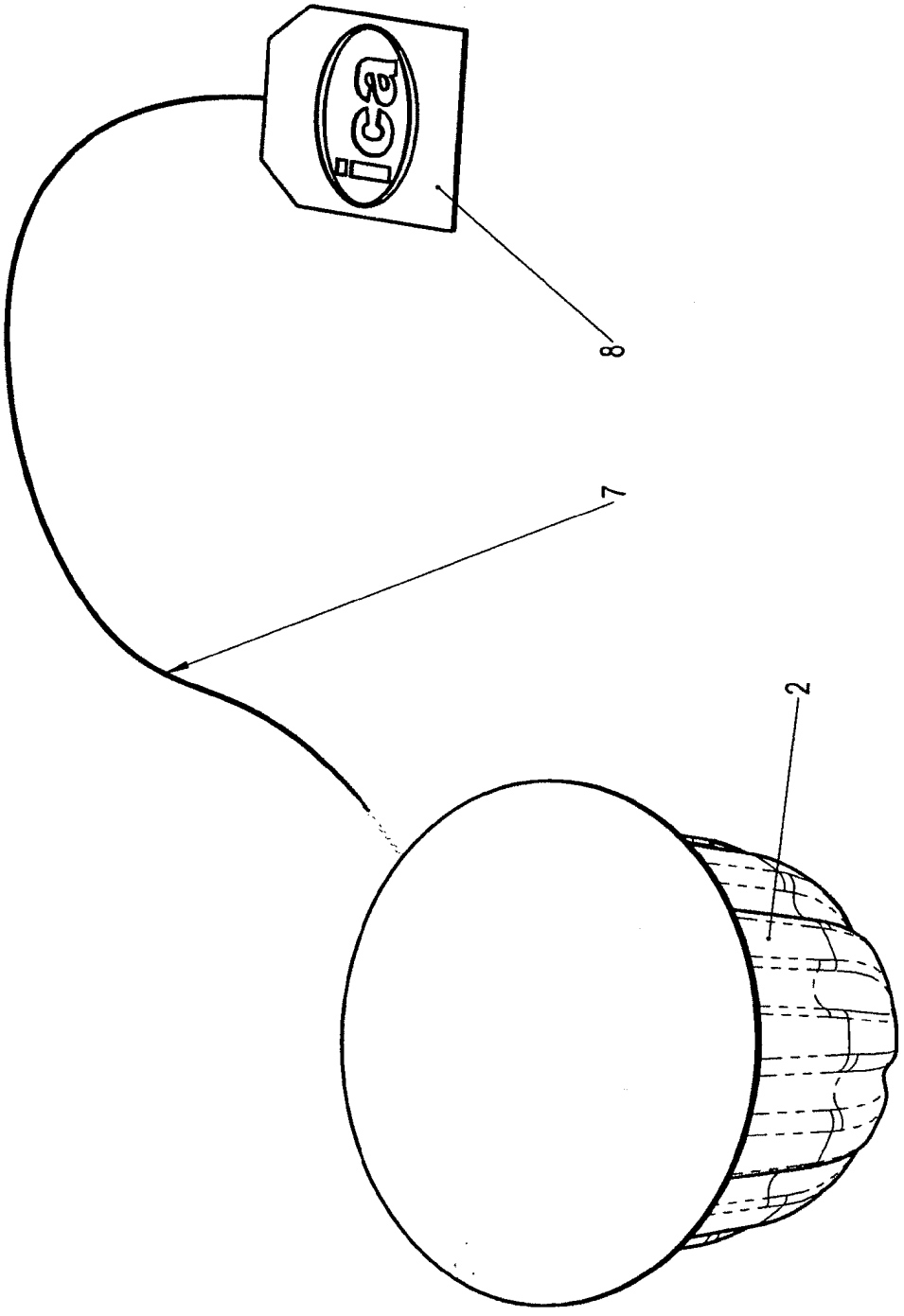


FIG. 16

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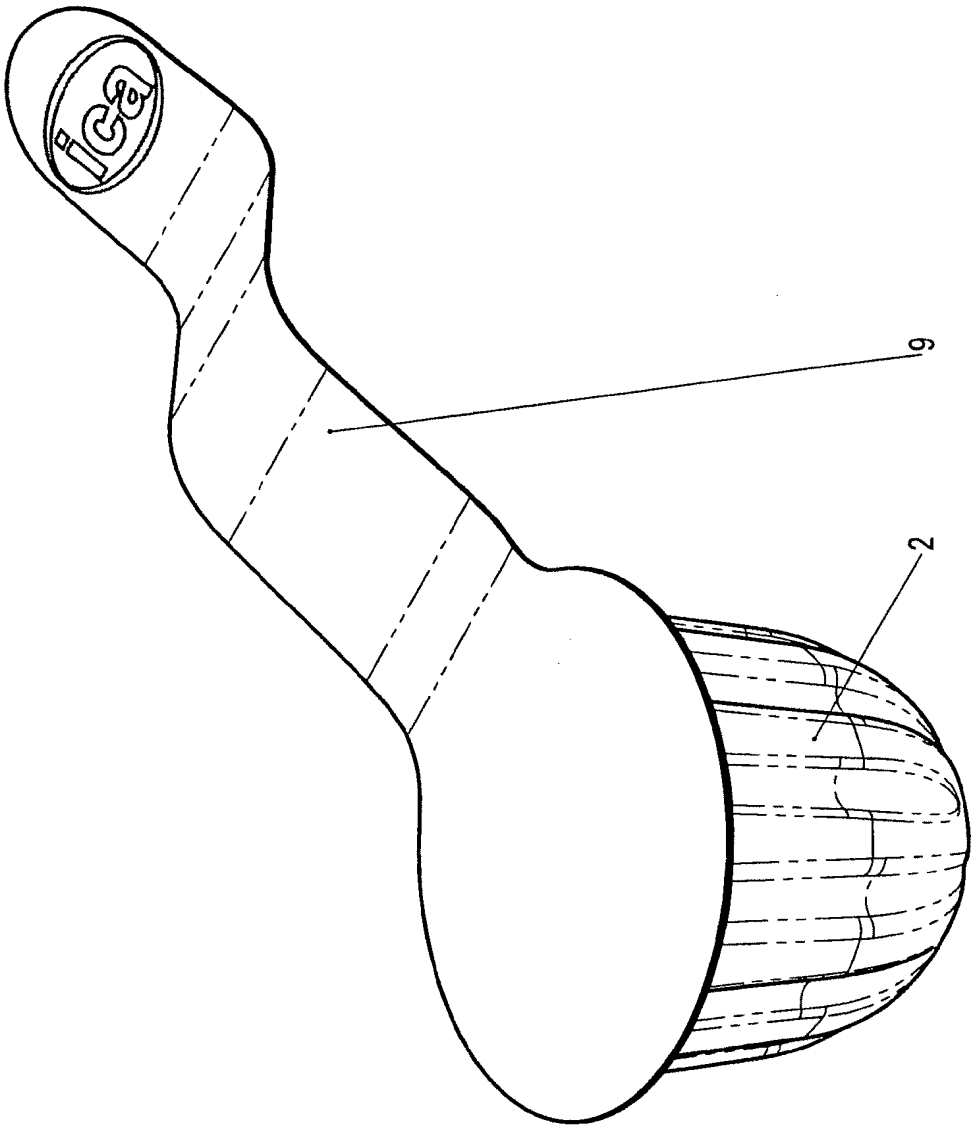


FIG. 17

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/006389

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D85/804 B65D85/808 B65D85/812
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

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.
A	EP 0 521 186 A1 (NESTLE SA [CH]) 7 January 1993 (1993-01-07) column 2, line 20 - line 31 column 3, line 7 - column 4, line 51 column 5, line 11 - line 18; claim 1; figures	1,8,10, 11,14,15
A	EP 0 631 948 A1 (JACOBS SUCHARD AG [CH]) 4 January 1995 (1995-01-04) column 5, line 16 - column 7, line 31; figures	15
A	US 2005/051478 A1 (KARANIKOS BASIL [US] ET AL) 10 March 2005 (2005-03-10) page 1, paragraph 17 - page 2, paragraph 22; figures 1-4	1,3-5, 10,14

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[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

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Date of the actual completion of the international search	Date of mailing of the international search report
15 December 2010	28/12/2010

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	Newell, Philip

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/006389

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 253 246 A2 (WOLTERMANN ERICH H) 20 January 1988 (1988-01-20) column 3, line 46 - column 4, line 8; figures	1,6,7,9, 10
A	GB 881 784 A (JOHN HENRIK GUY WELIN BERGER) 8 November 1961 (1961-11-08) page 1, line 67 - page 2, line 15; figures	12
A	EP 0 158 511 A2 (GEN FOODS LTD [GB]) 16 October 1985 (1985-10-16) page 2, line 13 - line 25 claims 1,3-9,16; figures	13

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2010/006389

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0521186 A1	07-01-1993	AT 114576 T	15-12-1994
		AU 658192 B2	06-04-1995
		BR 9202611 A	16-03-1993
		CA 2072317 A1	06-01-1993
		DE 69105494 D1	12-01-1995
		DK 0521186 T3	18-04-1995
		ES 2065583 T3	16-02-1995
		FI 922893 A	06-01-1993
		GR 3015003 T3	31-05-1995
		JP 3244777 B2	07-01-2002
		JP 5261023 A	12-10-1993
		NO 922613 A	06-01-1993
		NZ 243240 A	27-06-1994
		PH 31487 A	03-11-1998
		US 5637335 A	10-06-1997
		ZA 9204488 A	31-03-1993
EP 0631948 A1	04-01-1995	CA 2124600 A1	31-12-1994
US 2005051478 A1	10-03-2005	AU 2004272517 A1	24-03-2005
		CA 2538256 A1	24-03-2005
		CN 1849249 A	18-10-2006
		EP 1663813 A1	07-06-2006
		JP 2007504889 T	08-03-2007
		KR 20060121863 A	29-11-2006
		NZ 545752 A	31-01-2009
		WO 2005026018 A1	24-03-2005
EP 0253246 A2	20-01-1988	AU 7568887 A	21-01-1988
		DE 3623952 A1	28-01-1988
		US 4859337 A	22-08-1989
GB 881784 A	08-11-1961	NONE	
EP 0158511 A2	16-10-1985	GB 2156664 A	16-10-1985
		JP 5049552 B	26-07-1993
		JP 60251054 A	11-12-1985

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(19) Europäisches Patentamt
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(11) EP 1 849 718 A1

(12) EUROPEAN PATENT APPLICATION

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B65D 85/804 *(2006.01)*

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(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).

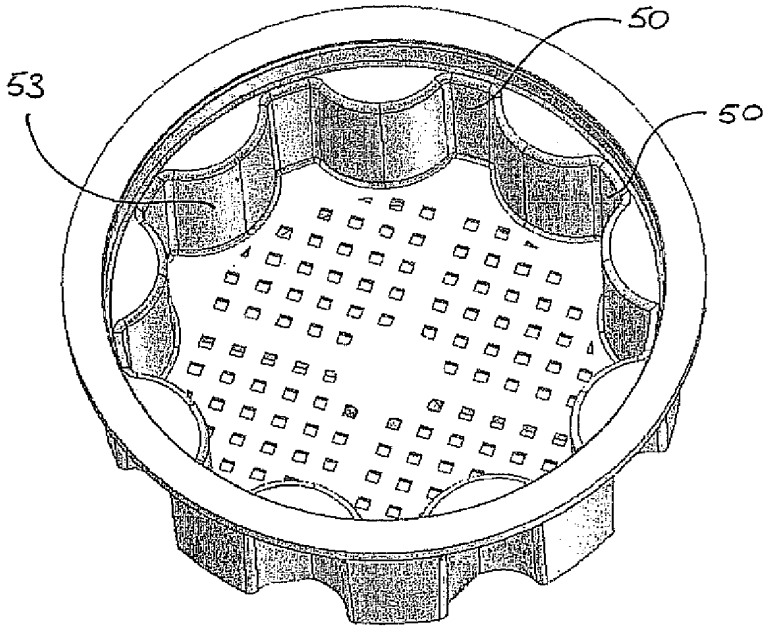


FIG. 8

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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-

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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,

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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.

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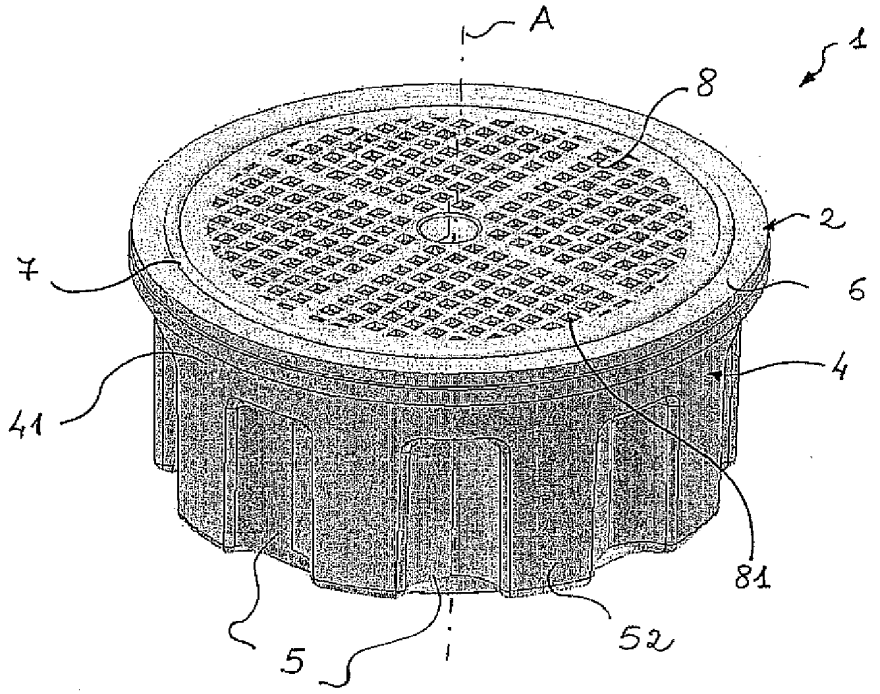


FIG. 1

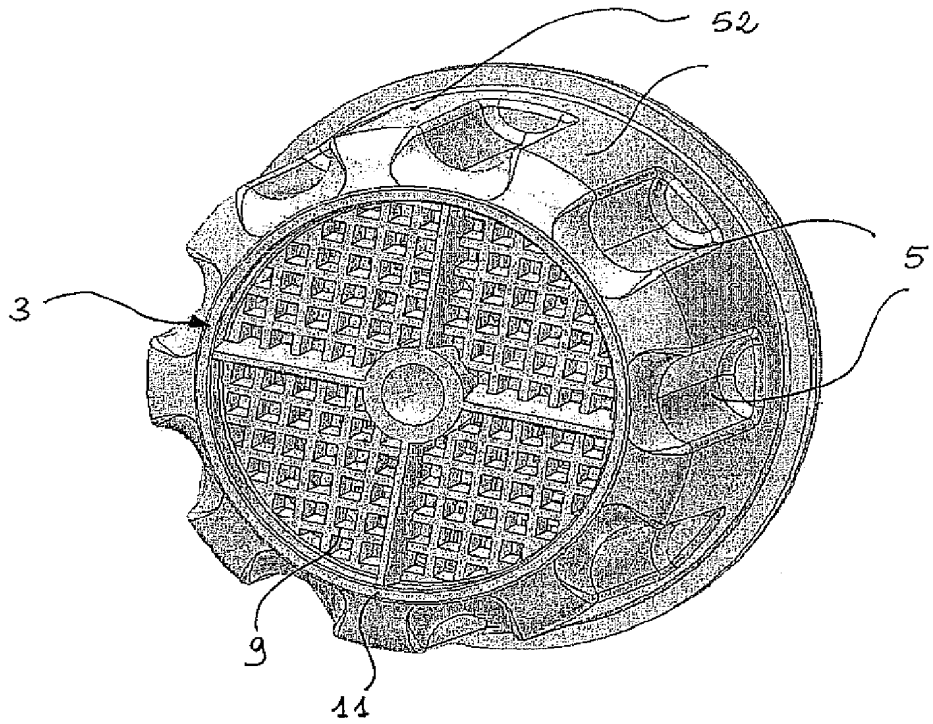


FIG. 2

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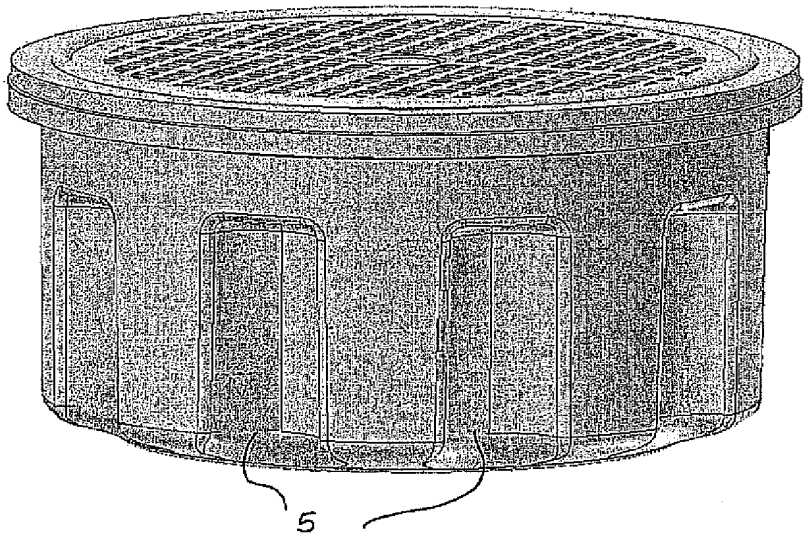


FIG. 3

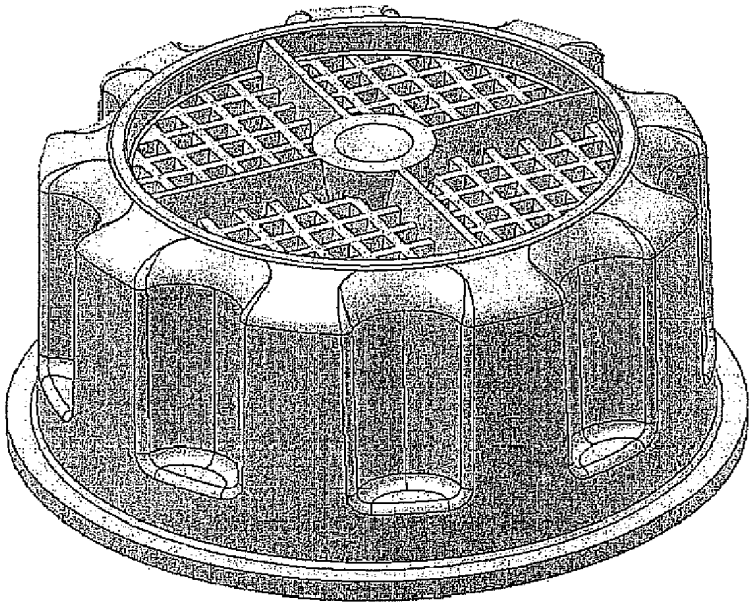


FIG. 4

K-FEE SYSTEM GMBH, EX2009, page 5389
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

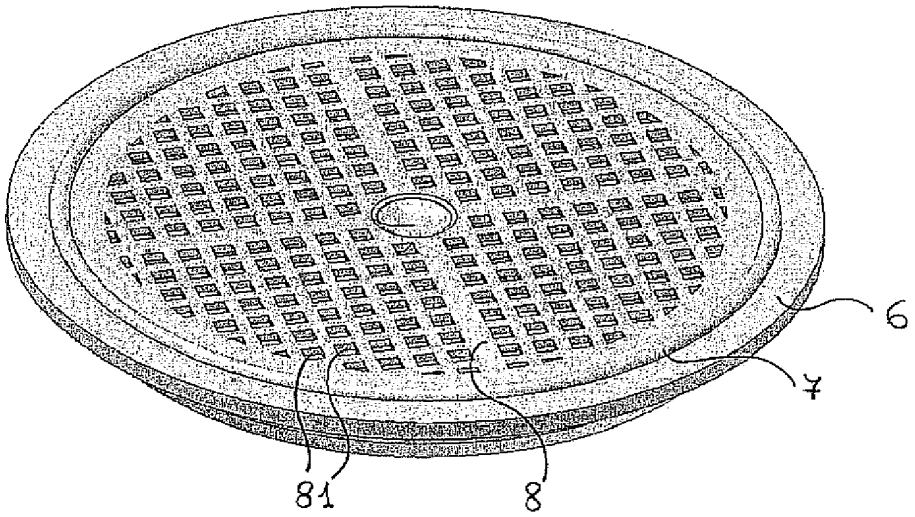


FIG. 5

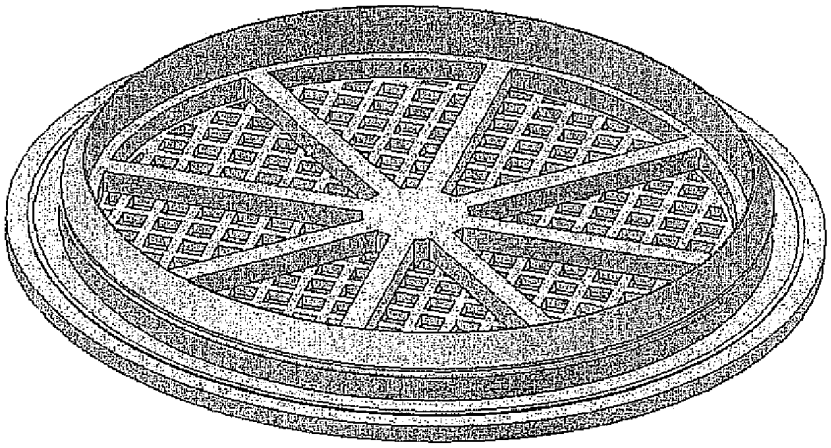


FIG. 6

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

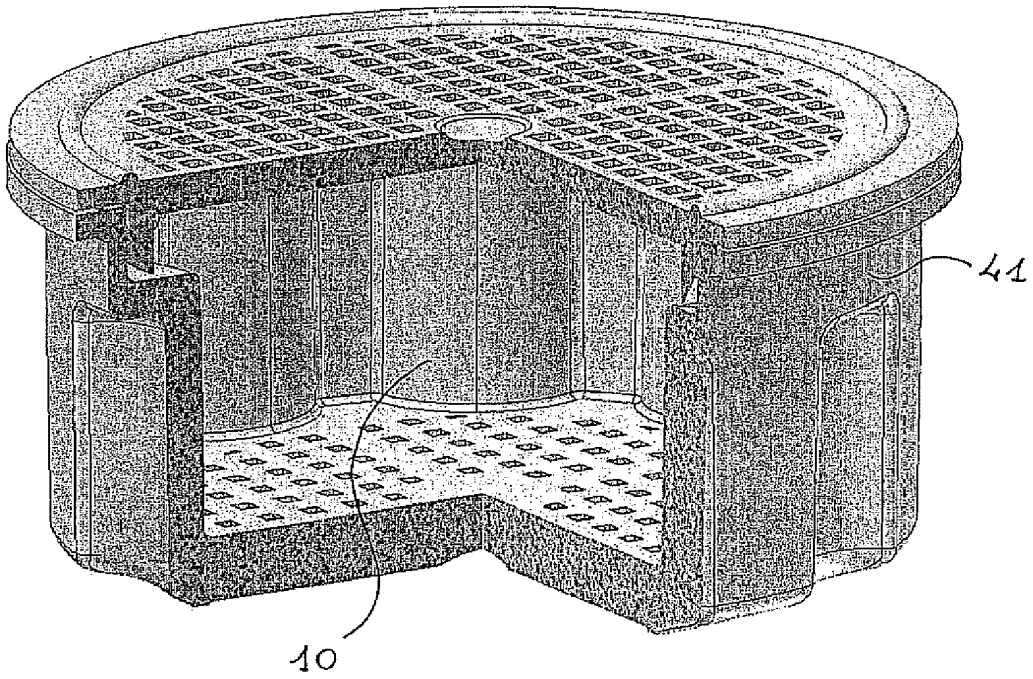


FIG. 7

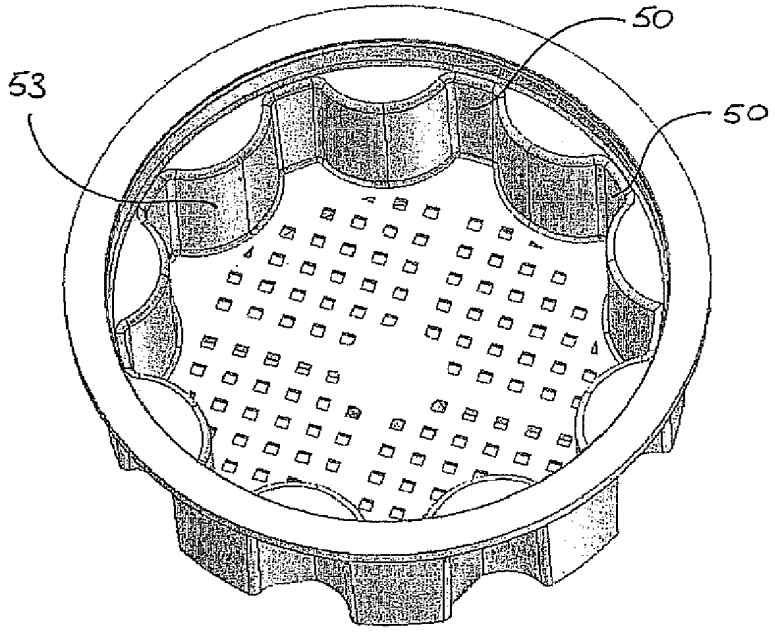


FIG. 8

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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
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EPO FORM 1503 03.82 (P04C01)

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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

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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	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
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PTO/SB/08a (02-18)
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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	3501896		1970-03-24	W. Von Stoeser et al.	
	2	5243164		1993-09-07	Erickson et al.	
	3	5285041		1994-02-08	Wright	

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	1	20020148356		2002-10-17	Lazaris et al.	
	2	20090324791		2009-12-31	Ohresser et al.	
	3	20100078480		2010-04-01	Aker	

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Application Number	13697297
Filing Date	2012-11-09
First Named Inventor	Jarisch et al.
Art Unit	1792
Examiner Name	Chaim A. Smith
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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] j	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	2011141532	WO		2011-11-17	NESTEC S.A.		☐
	2	1772398	EP		2007-04-11	CENSE D'ALMEZ S.A.		☐
	3	2005044067	WO		2005-05-19	GRIFFSS, CONSULTING, SA		☐
	4	0199047	WO		2001-12-27	MONEY CONTROLS PLC		☐
	5	0228241	WO		2002-04-11	BOYD COFFEE COMPANY		☐
	6	0638486	EP		1996-10-23	KRAFT JACONS SUCHARD LTD.		☐
	7	0455337	EP		1991-03-22	KRAFT GENERAL FOODS LIMITED		☐
	8	1849718	EP		2007-10-31	CAFE DO BRASIL S.P.A.		☐
	9	3432339	DE		1986-03-13	GESEN, WOLFGANG		☐
	10	2010041179	WO		2010-04-15	ETHICAL COFFEE COMPANY SA		☐

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
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	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

	11	2003235733	JP		2003-08-26	KASHIWAGI MOLD:KK		☐
	12	2011047836	WO		2011-04-28	RAPPARINI, GINO		☐
	13	0160712	WO		2001-08-23	KEURIG, INC.		☐
	14	2010026053	WO		2010-03-11	NESTEC S.A.		☐
	15	2004065258	WO		2004-08-05	KRAFT FOODS R & D, INC.		☐

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	1	Notice of Opposition to a European Patent Patent No. EP3521209 dated January 22, 2020	☐
	2	Wikipedia definition of "Barcode"	☐
	3	Regulation (EC) No 1935/2004 of the European Parliament and of the Counsel of 27 October 2004; Official Journal of The European Union	☐
	4	Wikipedia definition of "deep drawing" http://en.wikipedia.org/wiki/Deep_drawing	☐

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

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	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

	5	Wikipedia Defintion of "Stamping (metalworking)" https://en.wikipedia.org/wiki/Stamping_(metalworking)	☐
	6	Wikipedia definition of "Tiefziehen" https://de.wikipedia.org/wiki/Tiefziehen	☐
	7	Notice of Opposition: Opposition against European Patent No. 3 521 209 dated January 22, 2020	☐
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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

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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).

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☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

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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)	2020-06-25
Name/Print	Aaron J. Morrow	Registration Number	55819

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

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IPR2023-00502, U.S. PATENT 10,994,923

Electronic Acknowledgement Receipt

EFS ID:	39823480
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:	25-JUN-2020
Filing Date:	09-NOV-2012
Time Stamp:	13:06:36
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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7	Foreign Reference	FR6_EP0638486.pdf	863347 e6c171a96d416c2be468063bbf74a094c4982bac	no	16
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8	Foreign Reference	FR7_EP0455337.pdf	685810 19e4196f8d135300b117a4f397a8318628daa79d	no	13
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9	Foreign Reference	FR8_EP1849718.pdf	841913 21c3f36dc88dfe1bb199f675a1e8c61063302627	no	10
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10	Foreign Reference	FR9_DE.pdf	600613 70fccdbc2c67a7db58ec693c8039a01a4be72b59	no	14
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11	Foreign Reference	FR10_WO201004117.pdf	377110 75eded0225ffeeed6d5abe64aad7c087b008e834	no	14
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13	Foreign Reference	FR12_WO2011047836.pdf	951290 cec62cf954508b831c1422170b0c5de099298bd0	no	31
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17	Non Patent Literature	NPL`.pdf	12562543 7fdf76a76830339f53d836093ddd88227bd1190a	no	141
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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 August 2004 (05.08.2004)

PCT

(10) International Publication Number
WO 2004/065258 A2

(51) International Patent Classification[7]: B65D 81/00, B65B 43/42, A47J 31/40, B65B 59/00

(21) International Application Number: PCT/GB2004/000276

(22) International Filing Date: 23 January 2004 (23.01.2004)

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0301738.1	24 January 2003 (24.01.2003)	GB
0301745.6	24 January 2003 (24.01.2003)	GB
0301739.9	24 January 2003 (24.01.2003)	GB

(71) Applicant *(for all designated States except US)*: **KRAFT FOODS R & D, INC.** [DE/DE]; Zweigniederlassung Munchen, Unterbiberger Str. 15, 81737 MUNICH (DE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **GOMEZ, Maria** [GB/GB]; Ruscote Avenue, Banbury, Oxfordshire OX16 7QU (GB). **HALLIDAY, Andrew** [GB/GB]; Ruscote Avenue, Banbury, Oxfordshire OX16 7QU (GB). **BALLARD, Colin** [GB/GB]; Ruscote Avenue, Banbury, Oxfordshire OX16 7QU (GB). **PANESAR, Satwinder** [GB/GB]; Ruscote Avenue, Banbury, Oxfordshire OX16 7QU (GB).

(74) Agent: **BOULT WADE TENNANT**; Verulam Gardens, 70 Gray's Inn Road, London WX1X 8BT (GB).

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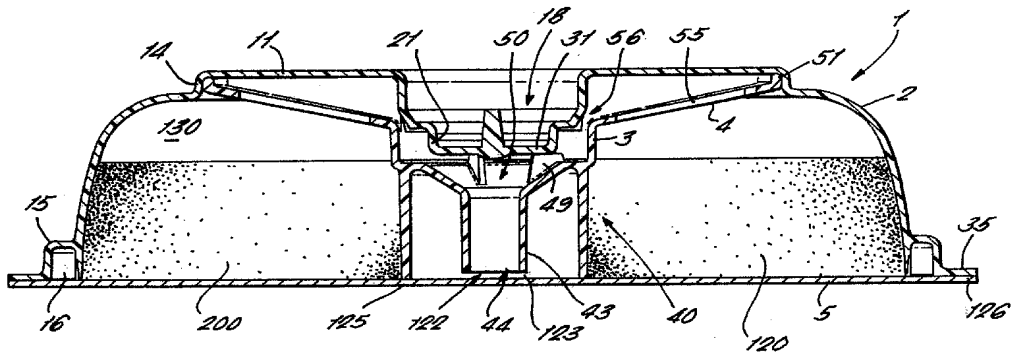
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(54) Title: CARTRIDGE AND METHOD FOR THE PREPARATION OF BEVERAGES



(57) Abstract: A cartridge (1) containing one or more liquid beverage ingredients (200) and being formed from substantially air- and water-impermeable materials, the cartridge comprising an inlet (121) for the introduction of an aqueous medium into the cartridge, a compartment (134) containing the one or more liquid beverage ingredients and an outlet (122) for a beverage produced by dilution of the one or more liquid beverage ingredients by the aqueous medium, characterised in that the compartment includes means for controlling dilution of at least a proportion of the one or more liquid beverage ingredients on introduction of the aqueous medium into the compartment.

WO 2004/065258 A2

K-FEE SYSTEM GMBH, EX2009, page 5405
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
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CARTRIDGE AND METHOD FOR THE PREPARATION OF BEVERAGES

The present invention relates to a cartridge and method for the preparation of beverages and, in particular, using sealed cartridges which are formed from substantially air- and water-impermeable materials and which contain one or more ingredients for the preparation of beverages.

It has previously been proposed to seal beverage preparation ingredients in individual air-impermeable packages. For example, cartridges or capsules containing compacted ground coffee are known for use in certain coffee preparation machines which are generally termed "espresso" machines. In the production of coffee using these preparation machines the coffee cartridge is placed in a brewing chamber and hot water is passed though the cartridge at relatively high pressures, thereby extracting the aromatic coffee constituents from the ground coffee to produce the coffee beverage. Typically, such machines operate at a pressure of greater than 6×10^5 Pa. The preparation machines of the type described have to date been relatively expensive since components of the machine, such as the water pumps and seals, must be able to withstand the high pressures.

In WO01/58786 there is described a cartridge for the preparation of beverages which operates at a pressure generally in the range 0.7 to 2.0×10^5 Pa. However, the cartridge is designed for use in a beverage preparation machine for the commercial or industrial market and is relatively expensive and limited in the types of beverage produced. Hence, there remains a requirement for a cartridge for the preparation of beverages wherein the

cartridges and beverage preparation machine are suitable, in particular, for the domestic market in terms of cost, performance and reliability. There is also a need for a beverage preparation machine for such a system which is simple to operate and reliable in operation and can produce a wide range of beverage types.

It is known to provide dairy-based beverage ingredients in cartridges in the form of a powder or other dehydrated form. However, consumers consistently indicate that the use of such powdered dairy-based products adversely affects the taste, colour and texture of the final beverage. It has proven difficult to provide liquid dairy-based products in a cartridge due to the requirement to sterilise the cartridge components. Further, it has been found to be difficult to control the dilution and dispensing of the liquid milk products to arrive at a consistent and acceptable final beverage.

In addition, powdered dairy products cannot be used to produce an authentic looking frothy milk-based foam as desired by consumers for cappuccino-style beverages. A number of beverage preparation machines provide a steam wand or similar for frothing of a quantity of milk. However, the addition of the steam wand increases the cost of the machine and requires a means for generating steam. Operation of the steam wand must be done manually and requires experience to be successful. In addition, since steam is being used there is the potential for the consumer to be burnt by either the steam or hot components of the machine. Further, the consumer must keep a supply of milk available separate from the machine and carry out a further process step of a different type in order to produce a cappuccino style

beverage. This increases the complexity and time required to produce such beverages.

Hence, there remains a requirement for a system for the preparation of beverages wherein the cartridges and beverage preparation machine of the system are suitable, in particular, for the domestic market in terms of cost, performance and reliability. There is also a need for a beverage preparation machine for such a system which is simple to operate and reliable in operation and can produce a wide range of beverage types.

Accordingly, the present invention provides a cartridge containing one or more liquid beverage ingredients and being formed from substantially air- and water-impermeable materials, the cartridge comprising an inlet for the introduction of an aqueous medium into the cartridge, a compartment containing the one or more liquid beverage ingredients and an outlet for a beverage produced by dilution of the one or more liquid beverage ingredients by the aqueous medium, characterised in that the compartment includes means for controlling dilution of at least a proportion of the one or more liquid beverage ingredients on introduction of the aqueous medium into the compartment.

Advantageously, the cartridge of the present invention provides superior dilution and dispensing of liquid beverage ingredients by ensuring that the liquid beverage ingredients are dispensed more evenly over the operating cycle rather that being dispensed all at the start of the operating cycle followed by substantially pure aqueous medium, which is, for example, water. This steady dispensation of the liquid beverage ingredients leads to improved homogeneity of the dispensed liquid beverage. In addition, where the diluted

liquid beverage is subsequently subjected to foaming, by for example, jetting through an orifice, the improved homogeneity of the liquid leads to a greater consistency of foaming and improved quality and quantity of foam produced per unit volume of liquid beverage.

Preferably, the means for controlling dilution delays dilution of at least a proportion of the one or more liquid beverage ingredients on introduction of the aqueous medium into the compartment.

Preferably, in use, an aqueous medium flow path is established from the inlet to the outlet, the means for delaying dilution comprising a partition which hinders entry of at least a proportion of the one or more liquid beverage ingredients into the aqueous medium flow path. In one embodiment the partition comprises one or more apertures for controllably releasing the at least a proportion of the one or more liquid beverage ingredients into the aqueous medium flow path. Four apertures may be provided.

The partition may comprise a cup-shaped member having an open mouth directed away from the aqueous medium flow path. The cup-shaped member is preferably annular. The one or more apertures are preferably provided at or near a base of the cup-shaped member. The at least a proportion of the liquid beverage ingredients in the cup-shaped member, for example, drain by gravity through the one or more apertures in use.

In one embodiment, the cup-shaped member is spaced from a bottom of the cartridge, such that the aqueous medium flow path passes between the cup-shaped member and the bottom of the cartridge. Consequently, the at least a proportion of the liquid beverage ingredients in the cup-shaped member

drains by gravity through the one or more apertures in use vertically downwards into the aqueous medium flow path.

Preferably, the cartridge comprises an inner member and an outer member, wherein the inner member comprises the cup-shaped member. The components of the inner member and the outer member may more easily be sterilised prior to assembly when they are separated. Once the components are conjoined a number of small-apertured, tortuous pathways are created which cannot effectively be sterilised using known methods. The ability to sterilise the components is a particularly advantageous feature where the cartridges are used for dispensing dairy-based beverages such as milk.

Preferably, the cartridge further comprises means for producing a jet of the beverage, wherein said means for producing the jet of the beverage comprises an aperture in the aqueous medium flow path. The aperture may be delimited by an interface between the inner member and the outer member.

Preferably, the cartridge further comprises at least one inlet for air and means for generating a pressure reduction of the jet of beverage, whereby, in use, air from the at least one air inlet is incorporated into the beverage as a plurality of small bubbles. At least one air inlet may be provided in the inner member downstream of the aperture.

In one embodiment the at least one air inlet and means for producing a pressure reduction in the jet of beverage produces a foaming of the one or more liquid beverage ingredients of greater than 40%. Preferably, greater than 70%. Preferably, the cartridge is disc-shaped. The outer member and/or inner member are formed, for example, from polypropylene.

In one example, the liquid beverage ingredient is a concentrated liquid milk composition. Preferably, the concentrated liquid milk contains between 25 and 40% total solids. More preferably, the concentrated liquid milk contains 30% total solids. Also preferably, the concentrated liquid milk contains between 0.1 and 12% fat. Alternatively, the one or more liquid beverage ingredients are selected from the group of cocoa solids, coffee, tea, sweeteners, cordials, flavourings, alcoholic beverages, flavoured milk, fruit juices, squashes, sauces and desserts.

The present invention also provides a method of dispensing a beverage from a cartridge containing one or more liquid beverage ingredients during an operating cycle, comprising the steps of passing an aqueous medium through the cartridge to form a beverage by dilution of said one or more beverage ingredients, and dispensing the beverage into a receptacle, wherein the one or more liquid ingredients as dispensed has a concentration at the start of the operating cycle of between 30 and 70% total solids and a concentration at the end of the operating cycle of between 1 and 15% total solids.

In one embodiment the concentration at the start of the operating cycle is between 30 and 35% total solids. The concentration at the end of the operating cycle is approximately 10% total solids. The liquid ingredient may be concentrated milk. In another embodiment, the concentration at the start of the operating cycle is between 60 and 70% total solids. The concentration at the end of the operating cycle is between 12 and 15% total solids. The liquid ingredient may contain cocoa solids. In another embodiment, the concentration at the start of the operating cycle is

between 40 and 70% total solids. The concentration at the end of the operating cycle is between 1 and 2% total solids. The liquid ingredient may contain coffee.

The present invention further provides a method of dispensing a beverage from a cartridge containing one or more liquid beverage ingredients during an operating cycle, comprising the steps of passing an aqueous medium through the cartridge to form a beverage by dilution of said one or more beverage ingredients, and dispensing the beverage into a receptacle, wherein the one or more liquid beverage ingredients is foamed on dispense to a ratio of between 20 and 150%.

Preferably the one or more liquid beverage ingredients are foamed to a ratio between 70 and 100%.

The one or more liquid beverage ingredients may include one or more of concentrated milk, coffee and cocoa solids.

The present invention further provides a beverage as produced by the above methods.

The present invention also provides a method of manufacturing a cartridge for dispensation of a beverage comprising the steps of:

a. manufacturing a plurality of outer members comprising at least a first type of outer member and a second type of outer member having differing shape or configurations;
b. manufacturing a plurality of inner members comprising at least a first type of inner member and a second type of inner member having differing shape or configurations;
c. storing said plurality of outer members and said inner members;

d. selecting one of the first type of outer member or the second type of outer member from the plurality of outer members;
e. selecting one of the first type of inner member or the second type of inner member from the plurality of inner members;
f. conjoining the selected inner member to the selected outer member such the inner member is within the outer member;
g. filling the outer member with one or more beverage ingredients selected from a plurality of beverage ingredients; and
h. sealing the outer member with a lid to form the cartridge.

The method of manufacture of the present invention provides an economical means for producing cartridges for the dispensation of one of a plurality of beverages. Advantageously, the cartridge is easily assembled from the main components of the inner member, the outer member, the beverage ingredient and the lid. Different types of outer member, inner member and lid are manufactured depending on the beverage ingredient to be dispensed. However, the differing types of inner member, outer member and lid are interchangeable so that individual cartridges may be assembled from specific combinations of the stock components. This results in a reduced number of total components that need to be manufactured without affecting the flexibility of the type of cartridges that can be produced. For example, the same type of outer member may be used for dispensing filter coffee and espresso-style coffee.

The cost of manufacturing the range of beverage cartridges is reduced by using interchangeable components. In addition, the types of outer member share substantially the same external shape and configuration so that all cartridges in the range can be dispensed using the same beverage preparation machine.

Optionally the method further comprises in step b. joining a filter member to the first type and/or second type of inner member.

The first type of outer member may be suitable for containing roast and ground beverage ingredients or the like. The second type of outer member may be suitable for containing soluble or liquid beverage ingredients or the like.

The first type of inner member may be suitable for filtering roast and ground beverage ingredients and the like. The second type of inner member may be suitable for filtering roast and ground beverage ingredients and the like and for entraining a plurality of air bubbles in the dispensed beverage.

The first and second type of inner member may comprise a frame having a filter disposed thereupon, and wherein a peripheral rim of the frame is conjoined to the selected type of outer member by welding.

By using separate components for the inner and outer members which are then conjoined on assembly by a welding process the manufacture of each component and the assembly of the cartridge can be optimised. This is particularly advantageous in the present cartridge where very small tolerances are desirable since the beverage flow path through the cartridge is defined by the interface between

the outer member and the inner member. In addition the components of the inner member and the outer member may more easily be sterilised prior to assembly when they are separated. Once the components are welded together a number of small-apertured, tortuous pathways are created which cannot effectively be sterilised using known methods. The ability to sterilise the components is a particularly advantageous feature where the cartridges are used for dispensing dairy-based beverages. A welded arrangement provides a quick to assemble but secure method of conjoining the inner member and outer member. Advantageously, the welding method avoids the need for glues or other such adhesives in the interior of the cartridge which will be exposed to the beverage ingredients.

Preferably, the second type of inner member comprises means for producing a jet of the beverage, which means comprises an aperture in a beverage flow path between an inlet and an outlet of the cartridge.

Preferably, the method further comprises manufacturing and storing a third type of inner member. The third type of inner member may be suitable for dispensing soluble beverage ingredients and the like.

Preferably, the method further comprises manufacturing and storing a fourth type of inner member. The fourth type of inner member may be suitable for dispensing a liquid beverage ingredients and the like.

The third or fourth type of inner member may comprise a skirt surrounding an outlet, the skirt comprising an upper extension having an upper rim which engages, on assembly of the cartridge, a co-operating formation of the selected type of outer member to form a snap-fit arrangement for

conjoining the third or fourth type of inner member to the selected type of outer member.

The present invention also provides a cartridge system for dispensing a plurality of beverages comprising:

a. a plurality of outer members comprising at least a first type of outer member and a second type of outer member having differing shape or configurations;
b. a plurality of inner members comprising at least a first type of inner member and a second type of inner member having differing shape or configurations;
c. a plurality of beverage ingredients; and
d. at least one lid to seal the cartridge;

wherein each cartridge comprises an outer member, an inner member, one or more beverage ingredients and a lid.

The present invention also provides a method of preparing a beverage comprising the steps of:

a. inserting a first beverage cartridge containing one or more beverage ingredients into a beverage preparation machine;
b. operating said beverage preparation machine to pass an aqueous medium through the first beverage cartridge to dispense a first portion of said beverage into a receptacle;
c. inserting a second beverage cartridge containing one or more beverage ingredients into the beverage preparation machine; and
d. operating the beverage preparation machine to pass an aqueous medium through the second beverage cartridge to dispense a second portion of said beverage into the receptacle;

characterised in that one of the first or second beverage cartridges contains a liquid dairy-based ingredient.

By using two or more cartridges to prepare a beverage a large variety of beverage can be produced by the same beverage preparation machine. In addition, each cartridge can be optimised for dispensing particular beverage ingredients. In particular, the ability to dispense liquid dairy-based ingredients allows for the formation of beverages having an authentic look, taste and mouth feel which have previously only been possible using non-cartridge based systems such as the use of a separate steam wand to froth bulk quantities of milk. The present method provides a reliable and easy to operate system for forming such beverages.

Preferably, one of the first or second beverage cartridges contains an ingredient for forming a brewed portion of a beverage.

Preferably, the method further comprises the step of removing the first beverage cartridge before inserting the second beverage cartridge.

In one embodiment, the beverage ingredient in the first or second beverage cartridge is roast and ground coffee. In another embodiment, the beverage ingredient in the first or second beverage cartridge is leaf-based tea. In another, the beverage ingredient in the first or second beverage cartridge is a liquid coffee ingredient.

Preferably, the liquid beverage ingredient is a concentrated dairy-based product. Advantageously, the concentrated dairy-based product is concentrated liquid milk. Preferably, the concentrated liquid milk contains

between 25 and 40% total solids. More preferably, the concentrated liquid milk contains 30% total solids. In addition, preferably, the concentrated liquid milk contains between 0.1 and 12% fat.

Preferably, the method further comprises the step of foaming the one or more liquid dairy-based ingredients during dispensation.

The present invention also provides a beverage preparation system comprising a beverage preparation machine having means for receiving a range of beverage cartridges and means for passing an aqueous medium through said beverage cartridges, a first beverage cartridge containing one or more beverage ingredients for preparing a first portion of said beverage, and a second beverage cartridge containing one or more beverage ingredients for preparing a second portion of said beverage, characterised in that one of the first or second beverage cartridges contains a liquid dairy-based ingredient.

It will be understood that by the term "cartridge" as used herein is meant any package, container, sachet or receptacle which contains one or more beverage ingredients in the manner described. The cartridge may be rigid, semi-rigid or flexible.

The cartridge of the present invention contains one or more liquid beverage ingredients suitable for the formation of a beverage product. The beverage product may be, for example, one of coffee, tea, chocolate or a dairy-based beverage including milk.

In the following description the terms "upper" and "lower" and equivalents will be used to describe the relational positioning of features of the invention. The

terms "upper" and "lower" and equivalents should be understood to refer to the cartridge (or other components) in its normal orientation for insertion into a beverage preparation machine and subsequent dispensing as shown, for example, in Figure 4. In particular, "upper" and "lower" refer, respectively, to relative positions nearer or further from a top surface 11 of the cartridge. In addition, the terms "inner" and "outer" and equivalents will be used to describe the relational positioning of features of the invention. The terms "inner" and "outer" and equivalents should be understood to refer to relative positions in the cartridge (or other components) being, respectively, nearer or further from a centre or major axis X of the cartridge 1 (or other component).

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is cross-sectional drawing of an outer member of first and second embodiments of cartridge;

Figure 2 is a cross-sectional drawing of a detail of the outer member of Figure 1 showing an inwardly directed cylindrical extension;

Figure 3 is a cross-sectional drawing of a detail of the outer member of Figure 1 showing a slot;

Figure 4 is a perspective view from above of the outer member of Figure 1;

Figure 5 is a perspective view from above of the outer member of Figure 1 in an inverted orientation;

Figure 6 is a plan view from above of the outer member of Figure 1;

Figure 7 is a cross-sectional drawing of an inner member of the first embodiment of cartridge;

Figure 8 is a perspective view from above of the inner member of Figure 7;

Figure 9 is a perspective view from above of the inner member of Figure 7 in an inverted orientation;

Figure 10 is a plan view from above of the inner member of Figure 7;

Figure 11 is a cross-sectional drawing of the first embodiment of cartridge in an assembled condition;

Figure 12 is a cross-sectional drawing of an inner member of the second embodiment of cartridge;

Figure 13 is a cross-sectional drawing of a detail of the inner member of Figure 12 showing an aperture;

Figure 14 is a perspective view from above of the inner member of Figure 12;

Figure 15 is a perspective view from above of the inner member of Figure 12 in an inverted orientation;

Figure 16 is another cross-sectional drawing of the inner member of Figure 12;

Figure 17 is a cross-sectional drawing of another detail of the inner member of Figure 12 showing an air inlet;

Figure 18 is a cross-sectional drawing of the second embodiment of cartridge in an assembled condition;

Figure 19 is cross-sectional drawing of an outer member of third and fourth embodiments of cartridge;

Figure 20 is a cross-sectional drawing of a detail of the outer member of Figure 19 showing an inwardly directed cylindrical extension;

Figure 21 is a plan view from above of the outer member of Figure 19;

Figure 22 is a perspective view from above of the outer member of Figure 19;

Figure 23 is a perspective view from above of the outer member of Figure 19 in an inverted orientation;

Figure 24 is a cross-sectional drawing of an inner member of the third embodiment of cartridge;

Figure 25 is a plan view from above of the inner member of Figure 24;

Figure 26 is a cross-sectional drawing of a detail of the inner member of Figure 24 showing an in-turned upper rim;

Figure 27 is a perspective view from above of the inner member of Figure 24;

Figure 28 is a perspective view from above of the inner member of Figure 24 in an inverted orientation;

Figure 29 is a cross-sectional drawing of the third embodiment of cartridge in an assembled condition;

Figure 30 is a cross-sectional drawing of an inner member of the fourth embodiment of cartridge according to the present invention;

Figure 31 is a plan view from above of the inner member of Figure 30;

Figure 32 is a perspective view from above of the inner member of Figure 30;

Figure 33 is a perspective view from above of the inner member of Figure 30 in an inverted orientation;

Figure 34 is a cross-sectional drawing of the fourth embodiment of cartridge in an assembled condition;

Figure 35 is a front perspective view of a beverage preparation machine for use with the present invention;

Figure 36 is a front perspective view of the machine of Figure 35 with a cartridge head in an open position;

Figure 37 is a rear perspective view of the machine of Figure 35 with some parts omitted for clarity;

Figure 38 is another rear perspective view of the machine of Figure 35 with some parts omitted for clarity;

Figure 39 is a perspective view of the cartridge head of the machine of Figure 35 with some parts omitted for clarity;

Figure 40 is another perspective view of the cartridge head of the machine of Figure 35 with some parts omitted for clarity;

Figure 41 is a cross-sectional view of the cartridge head in a closed position;

Figure 42 is a cross-sectional view of the cartridge head in an open position;

Figure 43 is a schematic layout of the machine of Figure 35;

Figure 44a and 44b are schematic layouts of first and second code recognition means for the machine of Figure 35;

Figure 45 is a plan view of a beverage of the present invention comprising a barcode;

Figure 46a is a graph of concentration vs. operating cycle time;

Figure 46b is a graph of foamability vs. operating cycle time; and

Figure 46c is a graph of temperature vs. operating cycle time.

As shown in Figure 11, the cartridge 1 generally comprises an outer member 2, an inner member 3 and a laminate 5. The outer member 2, inner member 3 and laminate 5 are assembled to form the cartridge 1 which has an interior 120 for containing one or more beverage ingredients, an inlet 121, an outlet 122 and a beverage flow path linking the inlet 121 to the outlet 122 and which passes through the interior 120. The inlet 121 and outlet 122 are initially sealed by the laminate 5 and are opened in use by piercing or cutting of the laminate 5. The beverage flow path is defined by spatial inter-relationships between the outer member 2, inner member 3 and laminate 5 as discussed below. Other components may optionally be included in the cartridge 1, such as a filter 4, as will be described further below.

A first version of cartridge 1 which will be described for background purposes is shown in Figures 1 to 11. The first version of the cartridge 1 is particularly designed for use in dispensing filtered products such as roast and ground coffee or leaf tea. However, this version of the cartridge 1 and the other versions described below may be used with other products such as chocolate, coffee, tea, sweeteners, cordials, flavourings, alcoholic beverages, flavoured milk, fruit juices, squashes, sauces and desserts.

As can be seen from Figure 5, the overall shape of the cartridge 1 is generally circular or disc-shaped with the diameter of the cartridge 1 being significantly greater than its height. A major axis X passes through the centre of the outer member as shown in Figure 1. Typically the overall diameter of the outer member 2 is 74.5 mm ±6mm and the

overall height is 16 mm ±3mm. Typically the volume of the cartridge 1 when assembled is 30.2 ml ±20%.

The outer member 2 generally comprises a bowl-shaped shell 10 having a curved annular wall 13, a closed top 11 and an open bottom 12. The diameter of the outer member 2 is smaller at the top 11 compared to the diameter at the bottom 12, resulting from a flaring of the annular wall 13 as one traverses from the closed top 11 to the open bottom 12. The annular wall 13 and closed bottom 11 together define a receptacle having an interior 34.

A hollow inwardly directed cylindrical extension 18 is provided in the closed top 11 centred on the major axis X. As more clearly shown in Figure 2, the cylindrical extension 18 comprises a stepped profile having first, second and third portions 19, 20 and 21. The first portion 19 is right circular cylindrical. The second portion 20 is frusto-conical in shape and is inwardly tapered. The third portion 21 is another right circular cylinder and is closed off by a lower face 31. The diameter of the first, second and third portion 19, 20 and 21 incrementally decreases such that the diameter of the cylindrical extension 18 decreases as one traverses from the top 11 to the closed lower face 31 of the cylindrical extension 18. A generally horizontal shoulder 32 is formed on the cylindrical extension 18 at the junction between the second and third portions 20 and 21.

An outwardly extending shoulder 33 is formed in the outer member 2 towards the bottom 12. The outwardly extending shoulder 33 forms a secondary wall 15 co-axial with the annular wall 13 so as to define an annular track forming a manifold 16 between the secondary wall 15 and the annular wall 13. The manifold 16 passes around the

circumference of the outer member 2. A series of slots 17 are provided in the annular wall 13 level with the manifold 16 to provide gas and liquid communication between the manifold 16 and the interior 34 of the outer member 2. As shown in Figure 3, the slots 17 comprise vertical slits in the annular wall 13. Between 20 and 40 slots are provided. In the embodiment shown thirty-seven slots 17 are provided generally equi-spaced around the circumference of the manifold 16. The slots 17 are preferably between 1.4 and 1.8 mm in length. Typically the length of each slot is 1.6 mm representing 10% of the overall height of the outer member 2. The width of each slot is between 0.25 and 0.35 mm. Typically, the width of each slot is 0.3 mm. The width of the slots 17 is sufficiently narrow to prevent the beverage ingredients passing therethrough into the manifold 16 either during storage or in use.

An inlet chamber 26 is formed in the outer member 2 at the periphery of the outer member 2. A cylindrical wall 27 is provided, as most clearly shown in Figure 5, which defines the inlet chamber 26 within, and partitions the inlet chamber 26 from, the interior 34 of the outer member 2. The cylindrical wall 27 has a closed upper face 28 which is formed on a plane perpendicular to the major axis X and an open lower end 29 co-planar with the bottom 12 of the outer member 2. The inlet chamber 26 communicates with the manifold 16 via two slots 30 as shown in Figure 1. Alternatively, between one and four slots may be used to communicate between the manifold 16 and the inlet chamber 26.

A lower end of the outwardly extending shoulder 33 is provided with an outwardly extending flange 35 which extends

perpendicularly to the major axis X. Typically the flange 35 has a width of between 2 and 4 mm. A portion of the flange 35 is enlarged to form a handle 24 by which the outer member 2 may be held. The handle 24 is provided with an upturned rim 25 to improve grip.

The outer member 2 is formed as a single integral piece from high density polyethylene, polypropylene, polystyrene, polyester, or a laminate of two or more of these materials. A suitable polypropylene is the range of polymers available from DSM UK Limited (Redditch, United Kingdom). The outer member may be opaque, transparent or translucent. The manufacturing process may be injection moulding.

The inner member 3 as shown in Figures 7 to 10, comprises an annular frame 41 and a downwardly extending cylindrical funnel 40. A major axis X passes through the centre of the inner member 3 as shown in Figure 7.

As best shown in Figure 8, the annular frame 41 comprises an outer rim 51 and an inner hub 52 joined by ten equi-spaced radial spokes 53. The inner hub 52 is integral with and extends from the cylindrical funnel 40. Filtration apertures 55 are formed in the annular frame 41 between the radial spokes 53. A filter 4 is disposed on the annular frame 41 so as to cover the filtration apertures 55. The filter is preferably made from a material with a high wet strength, for example a non-woven fibre material of polyester. Other materials which may be used include a water-impermeable cellulosic material, such as a cellulosic material comprising woven paper fibres. The woven paper fibres may be admixed with fibres of polypropylene, polyvinyl chloride and/or polyethylene. The incorporation of these plastic materials into the cellulosic material

renders the cellulosic material heat-sealable. The filter 4 may also be treated or coated with a material which is activated by heat and/or pressure so that it can be sealed to the annular frame 41 in this way.

As shown in the cross-sectional profile of Figure 7, the inner hub 52 is located at a lower position than the outer rim 51, resulting in the annular frame 41 having a sloping lower profile.

The upper surface of each spoke 53 is provided with an upstanding web 54 which divides a void space above the annular frame 41 into a plurality of passages 57. Each passage 57 is bounded on either side by a web 54 and on a lower face by the filter 4. The passages 57 extend from the outer rim 51 downwardly towards, and open into, the cylindrical funnel 40 at openings 56 defined by the inner extremities of the webs 54.

The cylindrical funnel 40 comprises an outer tube 42 surrounding an inner discharge spout 43. The outer tube 42 forms the exterior of the cylindrical funnel 40. The discharge spout 43 is joined to the outer tube 42 at an upper end of the discharge spout 43 by means of an annular flange 47. The discharge spout 43 comprises an inlet 45 at an upper end which communicates with the openings 56 of the passages 57 and an outlet 44 at a lower end through which the prepared beverage is discharged into a cup or other receptacle. The discharge spout 43 comprises a frusto-conical portion 48 at an upper end and a cylindrical portion 58 at a lower end. The cylindrical portion 58 may have a slight taper such that it narrows towards the outlet 44. The frusto-conical portion 48 helps to channel beverage from the passages 57 down towards the outlet 44 without inducing

turbulence to the beverage. An upper surface of the frusto-conical portion 48 is provided with four support webs 49 equi-spaced around the circumference of the cylindrical funnel 40. The support webs 49 define channels 50 therebetween. The upper edges of the support webs 49 are level with one another and perpendicular to the major axis X.

The inner member 3 may be formed as a single integral piece from polypropylene or a similar material as described above and by injection moulding in the same manner as the outer member 2.

Alternatively, the inner member 3 and/or the outer member 2 may be made from a biodegradable polymer. Examples of suitable materials include degradable polyethylene (for example, SPITEK supplied by Symphony Environmental, Borehamwood, United Kingdom), biodegradable polyester amide (for example, BAK 1095 supplied by Symphony Environmental), poly lactic acids (PLA supplied by Cargil, Minnesota, USA), starch-based polymers, cellulose derivatives and polypeptides.

The laminate 5 is formed from two layers, a first layer of aluminium and a second layer of cast polypropylene. The aluminium layer is between 0.02 and 0.07 mm in thickness. The cast polypropylene layer is between 0.025 and 0.065 mm in thickness. In one embodiment the aluminium layer is 0.06 mm and the polypropylene layer is 0.025 mm thick. This laminate is particularly advantageous as it has a high resistance to curling during assembly. As a result the laminate 5 may be pre-cut to the correct size and shape and subsequently transferred to the assembly station on the production line without undergoing distortion. Consequently,

the laminate 5 is particularly well suited to welding. Other laminate materials may be used including PET/Aluminium/PP, PE/EVOH/PP, PET/metallised/PP and Aluminium/PP laminates. Roll laminate stock may be used instead of die cut stock.

The cartridge 1 may be closed by a rigid or semi-rigid lid instead of a flexible laminate.

Assembly of the cartridge 1 involves the following steps:

a) the inner member 3 is inserted into the outer member 2;

b) the filter 4 is cut to shape and placed onto the inner member 3 so to be received over the cylindrical funnel 40 and come to rest against the annular frame 41;

c) the inner member 3, outer member 2 and filter 4 are joined by ultrasonic welding;

d) the cartridge 1 is filled with one or more beverage ingredients;

e) the laminate 5 is affixed to the outer member 2.

These steps will be discussed in greater detail below.

The outer member 2 is orientated with the open bottom 12 directed upwards. The inner member 3 is then inserted into the outer member 2 with the outer rim 51 being received as a loose fit in an axial extension 14 at top 11 of the cartridge 1. The cylindrical extension 18 of the outer member 2 is at the same time received in the upper portion of the cylindrical funnel 40 of the inner member 3. The third portion 21 of the cylindrical extension 18 is seated inside the cylindrical funnel 40 with the closed lower face 31 of the cylindrical extension 18 bearing against the support webs 49 of the inner member 3. The filter 4 is then

placed over the inner member 3 such that the filter material contacts the annular rim 51. An ultrasonic welding process is then used to join the filter 4 to the inner member 3 and at the same time, and in the same process step, the inner member 3 to the outer member 2. The inner member 3 and filter 4 are welded around the outer rim 51. The inner member 3 and outer member 2 are joined by means of weld lines around the outer rim 51 and also the upper edges of the webs 54.

As shown most clearly in Figure 11, the outer member 2 and inner member 3 when joined together define a void space 130 in the interior 120 below the annular flange 41 and exterior the cylindrical funnel 40 which forms a filtration chamber. The filtration chamber 130 and passages 57 above the annular frame 41 are separated by the filter paper 4.

The filtration chamber 130 contains the one or more beverage ingredients 200. The one or more beverage ingredients are packed into the filtration chamber 130. For a filtered style beverage the ingredient is typically roast and ground coffee or leaf tea. The density of packing of the beverage ingredients in the filtration chamber 130 can be varied as desired. Typically, for a filtered coffee product the filtration chamber contains between 5.0 and 10.2 grams of roast and ground coffee in a filtration bed of thickness of typically 5 to 14 mm. Optionally, the interior 120 may contain one or more bodies, such as spheres, which are freely movable within the interior 120 to aid mixing by inducing turbulence and breaking down deposits of beverage ingredients during discharge of the beverage.

The laminate 5 is then affixed to the outer member 2 by forming a weld 126 around the periphery of the laminate 5 to

join the laminate 5 to the lower surface of the outwardly extending flange 35. The weld 126 is extended to seal the laminate 5 against the lower edge of the cylindrical wall 27 of the inlet chamber 26. Further, a weld 125 is formed between the laminate 5 and the lower edge of the outer tube 42 of the cylindrical funnel 40. The laminate 5 forms the lower wall of the filtration chamber 130 and also seals the inlet chamber 26 and cylindrical funnel 40. However, a small gap 123 exists prior to dispensation between the laminate 5 and the lower edge of the discharge spout 43. A variety of welding methods may be used, such as heat and ultrasonic welding, depending on the material characteristics of the laminate 5.

Advantageously, the inner member 3 spans between the outer member 2 and the laminate 5. The inner member 3 is formed from a material of relative rigidity, such as polypropylene. As such, the inner member 3 forms a load-bearing member that acts to keep the laminate 5 and outer member 2 spaced apart when the cartridge 1 is compressed. It is preferred that the cartridge 1 is subjected to a compressive load of between 130 and 280N in use. The compressive force acts to prevent the cartridge failing under internal pressurisation and also serves to squeeze the inner member 3 and outer member 2 together. This ensures that the internal dimensions of passageways and apertures in the cartridge 1 are fixed and unable to change during pressurisation of the cartridge 1.

To use the cartridge 1 it is first inserted into a beverage preparation machine and the inlet 121 and outlet 122 are opened by piercing members of the beverage preparation machine which perforate and fold back the

laminate 5. An aqueous medium, typically water, under pressure enters the cartridge 1 through the inlet 121 into the inlet chamber 26 at a pressure of between 0.1-2.0 bar. From there the water is directed to flow through the slots 30 and round the manifold 16 and into the filtration chamber 130 of the cartridge 1 through the plurality of slots 17. The water is forced radially inwardly through the filtration chamber 130 and mixes with the beverage ingredients 200 contained therein. The water is at the same time forced upwardly through the beverage ingredients. The beverage formed by passage of the water through the beverage ingredients passes through the filter 4 and filtration apertures 55 into the passages 57 lying above the annular frame 41. The sealing of the filter 4 onto the spokes 53 and the welding of the rim 51 with the outer member 2 ensures that there are no short-circuits and all the beverage has to pass through the filter 4.

The beverage then flows downwardly along the radial passages 57 formed between the webs 54 and through the openings 56 and into the cylindrical funnel 40. The beverage passes along the channels 50 between the support webs 47 and down the discharge spout 43 to the outlet 44 where the beverage is discharged into a receptacle such as a cup.

Preferably, the beverage preparation machine comprises an air purge facility, wherein compressed air is forced through the cartridge 1 at the end of the operating cycle to flush out the remaining beverage into the receptacle.

A second version of cartridge 1 will now be described for background purposes with reference to Figures 12 to 18. The second version of the cartridge 1 is particularly designed for use in dispensing espresso-style products such

as roast and ground coffee where it is desirable to produce a beverage having a froth of tiny bubbles known as a crema. Many of the features of the second version of the cartridge 1 are the same as in the first version and like numerals have been used to reference like features. In the following description the differences between the first and second versions will be discussed. Common features which function in the same manner will not be discussed in detail.

The outer member 2 is of the same construction as in the first version of cartridge 1 and as shown in Figures 1 to 6.

The annular frame 41 of the inner member 3 is the same as in the first version. Also, a filter 4 is disposed on the annular frame 41 so as to cover the filtration apertures 55. The outer tube 42 of the cylindrical funnel 40 is also as before. However, there are a number of differences in the construction of the inner member 2 of the second version compared to the first version. As shown in Figure 16, the discharge spout 43 is provided with a partition 65 which extends part way up the discharge spout 43 from the outlet 44. The partition 65 helps to prevent the beverage spraying and/or splashing as it exits the discharge spout 43. The profile of the discharge spout 43 is also different and comprises a stepped profile with a distinct dog-leg 66 near an upper end of the tube 43.

A rim 67 is provided upstanding from the annular flange 47 joining the outer tube 42 to the discharge spout 43. The rim 67 surrounds the inlet 45 to the discharge spout 43 and defines an annular channel 69 between the rim 67 and the upper portion of the outer tube 42. The rim 67 is provided with an inwardly directed shoulder 68. At one point around

the circumference of the rim 67 an aperture 70 is provided in the form of a slot which extends from an upper edge of rim 67 to a point marginally below the level of the shoulder 68 as most clearly shown in Figures 12 and 13. The slot has a width of 0.64 mm.

An air inlet 71 is provided in annular flange 47 circumferentially aligned with the aperture 70 as shown in Figures 16 and 17. The air inlet 71 comprises an aperture passing through the flange 47 so as to provide communication between a point above the flange 47 and the void space below the flange 47 between the outer tube 42 and discharge spout 43. Preferably, and as shown, the air inlet 71 comprises an upper frusto-conical portion 73 and a lower cylindrical portion 72. The air inlet 71 is typically formed by a mould tool such as a pin. The tapered profile of the air inlet 71 allows the mould tool to be more easily removed from the moulded component. The wall of the outer tube 42 in the vicinity of the air inlet 71 is shaped to form a chute 75 leading from the air inlet 71 to the inlet 45 of the discharge spout 43. As shown in Figure 17, a canted shoulder 74 is formed between the air inlet 71 and the chute 75 to ensure that the jet of beverage issuing from the slot 70 does not immediately foul on the upper surface of the flange 47 in the immediate vicinity of the air inlet 71.

The assembly procedure for the second version of cartridge 1 is similar to the assembly of the first version. However, there are certain differences. As shown in Figure 18, the third portion 21 of the cylindrical extension 18 is seated inside the support rim 67 rather than against support webs. The shoulder 32 of the cylindrical extension 18 between the second portion 20 and third portion 21 bears

against the upper edge of the support rim 67 of the inner member 3. An interface zone 124 is thus formed between the inner member 3 and the outer member 2 comprising a face seal between the cylindrical extension 18 and the support rim 67 which extends around nearly the whole circumference of the cartridge 1. The seal between the cylindrical extension 18 and the support rim 67 is not fluid-tight though since the slot 70 in the support rim 67 extends through the support rim 67 and downwardly to a point marginally below the shoulder 68. Consequently the interface fit between the cylindrical extension 18 and the support rim 67 transforms the slot 70 into an aperture 128, as most clearly shown in Figure 18, providing gas and liquid communication between the annular channel 69 and the discharge spout 43. The aperture is typically 0.64 mm wide by 0.69 mm long.

Operation of the second version of cartridge 1 to dispense a beverage is similar to the operation of the first version but with certain differences. Beverage in the radial passages 57 flows downwardly along the passages 57 formed between the webs 54 and through the openings 56 and into the annular channel 69 of the cylindrical funnel 40. From the annular channel 69 the beverage is forced under pressure through the aperture 128 by the back pressure of beverage collecting in the filtration chamber 130 and passages 57. The beverage is thus forced through aperture 128 as a jet and into an expansion chamber formed by the upper end of the discharge spout 43. As shown in Figure 18, the jet of beverage passes directly over the air inlet 71. As the beverage enters the discharge spout 43 the pressure of the beverage jet drops. As a result air is entrained into the beverage stream in the form of a multitude of small air

bubbles as the air is drawn up through the air inlet 71. The jet of beverage issuing from the aperture 128 is funnelled downwards to the outlet 44 where the beverage is discharged into a receptacle such as a cup where the air bubbles form the desired crema. Thus, the aperture 128 and the air inlet 71 together form an eductor which acts to entrain air into the beverage. Flow of beverage into the eductor should be kept as smooth as possible to reduce pressure losses. Advantageously, the walls of the eductor should be made concave to reduce losses due to 'wall effect' friction. The dimensional tolerance of the aperture 128 is small. Preferably the aperture size is fixed plus or minus 0.02 mm^2. Hairs, fibrils or other surface irregularities can be provided within or at the exit of the eductor to increase the effective cross-sectional area which has been found to increase the degree of air entrainment.

A third version of cartridge 1 will now be described for background purposes and is shown in Figures 19 to 29. The third version of the cartridge 1 is particularly designed for use in dispensing soluble products which may be in powdered, liquid, syrup, gel or similar form. The soluble product is dissolved by or forms a suspension in, an aqueous medium such as water when the aqueous medium is passed, in use, through the cartridge 1. Examples of beverages include chocolate, coffee, milk, tea, soup or other rehydratable or aqueous-soluble products. Many of the features of the third version of the cartridge 1 are the same as in the previous versions and like numerals have been used to reference like features. In the following description the differences between the third and previous versions will be discussed.

Common features which function in the same manner will not be discussed in detail.

Compared to the outer member 2 of the previous versions, the hollow inwardly directed cylindrical extension 18 of the outer member 2 of the third version has a larger overall diameter as shown in Figure 20. In particular the diameter of the first portion 19 is typically between 16 and 18 mm compared to 13.2 mm for the outer member 2 of the previous versions. In addition, the first portion 19 is provided with a convex outer surface 19a, or bulge, as most clearly shown in Figure 20, the function of which will be described below. The diameter of the third portions 21 of the cartridges 1 are however the same resulting in the area of the shoulder 32 being greater in this, the third version of the cartridge 1. Typically the volume of the cartridge 1 when assembled is 32.5 ml ±20%.

The number and positioning of the slots in the lower end of the annular wall 13 is also different. Between 3 and 5 slots are provided. In the embodiment as shown in Figure 23, four slots 36 are provided equi-spaced around the circumference of the manifold 16. The slots 36 are slightly wider than in the previous versions of the cartridge 1 being between 0.35 and 0.45 mm, preferably 0.4 mm wide.

In other respects the outer members 2 of the cartridges 1 are the same.

The construction of the cylindrical funnel 40 of the inner member 3 is the same as in the first version of cartridge 1 with an outer tube 42, discharge spout 45, annular flange 47 and support webs 49 being provided. The only difference is that the discharge spout 45 is shaped

with an upper frusto-conical section 92 and a lower cylindrical section 93.

In contrast to the previous versions and as shown in Figures 24 to 28, the annular frame 41 is replaced by a skirt portion 80 which surrounds the cylindrical funnel 40 and is joined thereto by means of eight radial struts 87 which adjoin the cylindrical funnel 40 at or near the annular flange 47. A cylindrical extension 81 of the skirt portion 80 extends upwardly from the struts 87 to define a chamber 90 with an open upper face. An upper rim 91 of the cylindrical extension 81 has an in-turned profile as shown in Figure 26. An annular wall 82 of the skirt portion 80 extends downwardly from the struts 87 to define an annular channel 86 between the skirt portion 80 and the outer tube 42.

The annular wall 82 comprises at a lower end an exterior flange 83 which lies perpendicular to the major axis X. A rim 84 depends downwardly from a lower surface of the flange 83 and contains five apertures 85 which are circumferentially equi-spaced around the rim 84. Thus, the rim 84 is provided with a castellated lower profile.

Apertures 89 are provided between the struts 87 allowing communication between the chamber 90 and the annular channel 86.

The assembly procedure for the third version of cartridge 1 is similar to the assembly of the first version but with certain differences. The outer member 2 and inner member 3 are push-fitted together as shown in Figure 29 and retained by means of a snap-fit arrangement rather than welded together. On joining the two members the inwardly directed cylindrical extension 18 is received inside the

upper cylindrical extension 81 of the skirt portion 80. The inner member 3 is retained in the outer member 2 by frictional interengagement of the convex outer surface 19a of the first portion 19 of the cylindrical extension 18 with the in-turned rim 91 of the upper cylindrical extension 81. With the inner member 3 located in the outer member 2 a mixing chamber 134 is defined located exterior to the skirt portion 80. The mixing chamber 134 contains the beverage ingredients 200 prior to dispensation. It should be noted that the four inlets 36 and the five apertures 85 are staggered circumferentially with respect to one another. The radial location of the two parts relative to each other need not be determined or fixed during assembly since the use of four inlets 36 and five apertures 85 ensures that misalignment occurs between the inlets and apertures whatever the relative rotational positioning of the components.

The one or more beverage ingredients are packed into the mixing chamber 134 of the cartridge. The density of packing of the beverage ingredients in the mixing chamber 134 can be varied as desired.

The laminate 5 is then affixed to the outer member 2 and inner member 3 in the same manner as described above in the previous versions.

In use, water enters the mixing chamber 134 through the four slots 36 in the same manner as previous versions of the cartridge. The water is forced radially inwardly through the mixing chamber and mixes with the beverage ingredients contained therein. The product is dissolved or mixed in the water and forms the beverage in the mixing chamber 134 and is then driven though the apertures 85 into the annular

channel 86 by back pressure of beverage and water in the mixing chamber 134. The circumferential staggering of the four inlet slots 36 and the five apertures 85 ensures that jets of water are not able to pass radially directly from the inlet slots 36 to the apertures 85 without first circulating within the mixing chamber 134. In this way the degree and consistency of dissolution or mixing of the product is significantly increased. The beverage is forced upwardly in the annular channel 86, through the apertures 89 between the struts 87 and into the chamber 90. The beverage passes from chamber 90 through the inlets 45 between the support webs 49 into the discharge spout 43 and towards the outlet 44 where the beverage is discharged into a receptacle such as a cup. The cartridge finds particular application with beverage ingredients in the form of viscous liquids or gels. In one application a liquid chocolate ingredient is contained in the cartridge 1 with a viscosity of between 1700 and 3900mPa at ambient temperature and between 5000 and 10000mPa at 0°C and a refractive solids of 67 Brix ±3. In another application liquid coffee is contained in the cartridge 1 with a viscosity of between 70 and 2000mPa at ambient and between 80 and 5000mPa at 0°C where the coffee has a total solids level of between 40 and 70%. The liquid coffee ingredient may contain between 0.1 and 2.0% by weight sodium bicarbonate, preferably between 0.5 and 1.0% by weight. The sodium bicarbonate acts to maintain the pH level of the coffee at or below 4.8 enabling a shelf-life for coffee-filled cartridges of up to 12 months.

A fourth version of cartridge 1 embodying the present invention is shown in Figures 30 to 34. The fourth version of the cartridge 1 is particularly designed for use in

dispensing liquid products such as concentrated liquid milk. Many of the features of the fourth version of the cartridge 1 are the same as in the previous versions and like numerals have been used to reference like features. In the following description the differences between the fourth and previous versions will be discussed. Common features which function in the same manner will not be discussed in detail.

The outer member 2 is the same as in the third version of cartridge 1 and as shown in Figures 19 to 23.

The cylindrical funnel 40 of the inner member 3 is similar to that shown in the second version of cartridge 1 but with certain differences. As shown in Figure 30 the discharge spout 43 is shaped with an upper frusto-conical section 106 and a lower cylindrical section 107. Three axial ribs 105 are provided on the inner surface of the discharge spout 43 to direct the dispensed beverage downwards towards the outlet 44 and prevent the discharged beverage from spinning within the spout. Consequently, the ribs 105 act as baffles. As in the second version of cartridge 1, an air inlet 71 is provided through the annular flange 47. However, the chute 75 beneath the air inlet 71 is more elongated than in the second version.

A skirt portion 80 is provided similar to that shown in the third version of the cartridge 1 described above. Between 5 and 12 apertures 85 are provided in the rim 84. Typically ten apertures are provided rather than the five provided in the third version of cartridge 1.

An annular bowl 100 is provided extending from and integral with the flange 83 of the skirt portion 80. The annular bowl 100 comprises a flared body 101 with an open upper mouth 104 which is directed upwards. Four feed

apertures 103 shown in Figures 30 and 31 are located in the body 101 at or near the lower end of the bowl 100 where it joins the skirt portion 80. Preferably, the feed apertures are equi-spaced around the circumference of the bowl 100. The bowl 100 joins the skirt portion 80 part-way up its length such that a discrete gap is provided between the bowl 100 and the laminate 5 when the cartridge is assembled. Thus, the apertures 85 are located below the level of the bowl 100. As can be seen from Figure 34, when the cartridge 1 is assembled and filled the bowl 100 contains a proportion of the liquid beverage ingredients therein, effectively partitioning that proportion of the beverage ingredients from the apertures 85.

The laminate 5 is of the type described above in the previous embodiments.

The assembly procedure for the fourth version of cartridge 1 is the same as that for the third version.

Operation of the fourth version of cartridge is similar to that of the third version. The water enters the cartridge 1 and the mixing chamber 134 in the same manner as before. There the water mixes with and dilutes the liquid product which is then forced out below the bowl 100 and through the apertures 85 towards the outlet 44 as described above. The proportion of the liquid product initially contained within the annular bowl 100 as shown in Figure 34 is not subject to immediate dilution by the water entering the mixing chamber 134. Rather, the diluted liquid product in the lower part of the mixing chamber 134 will tend to exit through apertures 85 rather than be forced up and into the annular bowl 100 through upper mouth 104. Consequently, the liquid product in the annular bowl 100 will remain

relatively concentrated during the initial stages of the operating cycle compared to the product in the lower part of the mixing chamber 134. The liquid product in the annular bowl 100 drips through the feed apertures 103 under gravity into the stream of product exiting the mixing chamber 134 through the apertures 85 and below the bowl 100. The annular bowl 100 acts to even out the concentration of the diluted liquid product entering the cylindrical funnel 40 by holding back a proportion of the concentrated liquid product and releasing it into the exiting liquid stream flow path steadily throughout the operating cycle as illustrated in Figure 46a where the concentration of the milk measured as a percentage of the total solids present is shown during an operating cycle of approximately 15 seconds. Line a illustrates the concentration profile with the bowl 100 whilst line b illustrates a cartridge without the bowl 100. As can be seen the concentration profile with the cup 100 is more even during the operating cycle and there is no immediate large drop in concentration as occurs without the bowl 100. The initial concentration of the milk is typically 30-35% SS and at the end of the cycle 10% SS. This results in a dilution ratio of around 3 to 1, although dilution ratios of between 1 to 1 and 6 to 1 are possible with the present invention. For other liquid beverage ingredients the concentrations may vary. For example for liquid chocolate the initial concentration is approximately 67% SS and at the end of the cycle 12-15% SS. This results in a dilution ratio (ratio of aqueous medium to beverage ingredient in dispensed beverage) of around 5 to 1, although dilution ratios of between 2 to 1 and 10 to 1 are possible with the present invention. For liquid coffee the initial concentration is

between 40-67% and the concentration at the end of dispense 1-2% SS. This results in a dilution ratio of between 20 to 1 and 70 to 1, although dilution ratios of between 10 to 1 and 100 to 1 are possible with the present invention.

From the annular channel 86 the beverage is forced under pressure through the aperture 128 by the back pressure of beverage collecting in the filtration chamber 134 and chamber 90. The beverage is thus forced through aperture 128 as a jet and into an expansion chamber formed by the upper end of the discharge spout 43. As shown in Figure 34, the jet of beverage passes directly over the air inlet 71. As the beverage enters the discharge spout 43 the pressure of the beverage jet drops. As a result air is entrained into the beverage stream in the form of a multitude of small air bubbles as the air is drawn up through the air inlet 71. The jet of beverage issuing from the aperture 128 is funnelled downwards to the outlet 44 where the beverage is discharged into a receptacle such as a cup where the air bubbles form the desired frothy appearance.

Advantageously, the inner member 3, outer member 2, laminate 5 and filter 4 can all be readily sterilised due to the components being separable and not individually comprising tortuous passageways or narrow crevices. Rather, it is only after conjoining the components, after sterilisation, that the necessary passageways are formed. This is particularly important where the beverage ingredient is a dairy-based product such as liquid milk concentrate.

The fourth embodiment of beverage cartridge is particularly advantageous for dispensing a concentrated dairy-based liquid product such as liquid milk. Previously, powdered milk products have been provided in the form of

sachets for adding to a pre-prepared beverage. However, for a cappuccino-style beverage it is necessary to foam the milk. This has been achieved previously by passing steam through a liquid milk product. However this necessitates the provision of a steam supply which increases the cost and complexity of the machine used to dispense the beverage. The use of steam also increases the risk of injury during operation of the cartridge. Accordingly the present invention provides for a beverage cartridge having a concentrated dairy-based liquid product therein. It has been found that by concentrating the milk product a greater amount of foam can be produced for a particular volume of milk when compared to fresh or UHT milk. This reduces the size required for the milk cartridge. Fresh semi-skimmed milk contains approximately 1.6% fat and 10% total solids. The concentrated liquid milk preparations of the present invention contain between 0.1 and 12% fat and 25 to 40% total solids. In a typical example, the preparation contains 4% fat and 30% total solids. The concentrated milk preparations are suitable for foaming using a low pressure preparation machine as will be described below. In particular, foaming of the milk is achieved at pressures below 2 bar, preferably approximately 1.5 bar using the cartridge of the fourth embodiment described above.

The foaming of the concentrated milk is particularly advantageous for beverages such as cappuccinos and milk shakes. Preferably the passing of the milk through the aperture 128 and over the air inlet 71 and the optional use of the bowl 100 enables foaming levels of greater than 40%, preferably greater than 70% for milk. For liquid chocolate foaming levels of greater than 70% are possible. For liquid

coffee foaming levels of greater than 70% are possible. The foamability level is measured as the ratio of the volume of the foam produced to the volume of liquid beverage ingredient dispensed. For example, where 138.3ml of beverage is dispensed, of which 58.3ml is foam the foamability is measured as [58.3/(138.3-58.3)]*100 = 72.9%. The foamability of the milk (and other liquid ingredients) is enhanced by the provision of the bowl 100 as can be seen in Figure 46b. The foamability of the milk dispensed with the bowl 100 present (line a) is greater than that of milk dispensed without the bowl present (line b). This is because the foamability of the milk is positively correlated to the concentration of the milk and as shown in Figure 35a the bowl 100 maintains a higher concentration of the milk a larger part of the operating cycle. It is also known that foamability of the milk is positively correlated to temperature of the aqueous medium as shown in Figure 46c. Thus the bowl 100 is advantageous since more of the milk remains in the cartridge until near the end of the operating cycle when the aqueous medium is at its hottest. This again improves foamability.

The cartridge of the fourth embodiment is also advantageous in dispensing liquid coffee products.

It has been found that the embodiments of beverage cartridge of the present invention advantageously provide an improved consistency of the brewed beverage when compared to prior art cartridges. Reference is made to Table 1 below which shows the results of brew yields for twenty samples each of cartridges A and B containing roast and ground coffee. Cartridge A is a beverage cartridge according to the first embodiment of the present invention. Cartridge B is a

prior art beverage cartridge as described in the applicant's document WO01/58786. The refractive index of the brewed beverage is measured in Brix units and converted to a percentage of soluble solids (%SS) using standard tables and formulae. In the examples below:

%SS = 0.7774 * (Brix value) + 0.0569.

% Yield = (%SS * Brew Volume (g))/
(100 * Coffee Weight (g))

Table 1

CARTRIDGE A

Sample	Brew Volume (g)	Coffee Weight (g)	Brix	% SS (*)	% Yield
1	105.6	6.5	1.58	1.29	20.88
2	104.24	6.5	1.64	1.33	21.36
3	100.95	6.5	1.67	1.36	21.05
4	102.23	6.5	1.71	1.39	21.80
5	100.49	6.5	1.73	1.40	21.67
6	107.54	6.5	1.59	1.29	21.39
7	102.70	6.5	1.67	1.36	21.41
8	97.77	6.5	1.86	1.50	22.61
9	97.82	6.5	1.7	1.38	20.75
10	97.83	6.5	1.67	1.36	20.40
11	97.6	6.5	1.78	1.44	21.63
12	106.64	6.5	1.61	1.31	21.47
13	99.26	6.5	1.54	1.25	19.15
14	97.29	6.5	1.59	1.29	19.35
15	101.54	6.5	1.51	1.23	19.23
16	104.23	6.5	1.61	1.31	20.98
17	97.5	6.5	1.73	1.40	21.03
18	100.83	6.5	1.68	1.36	21.14
19	101.67	6.5	1.67	1.36	21.20
20	101.32	6.5	1.68	1.36	21.24
				AVERAGE	20.99

CARTRIDGE B

Sample	Brew Volume (g)	Coffee Weight (g)	Brix	% SS (*)	% Yield
1	100.65	6.5	1.87	1.511	23.39
2	95.85	6.5	1.86	1.503	22.16
3	98.4	6.5	1.8	1.456	22.04
4	92.43	6.5	2.3	1.845	26.23
5	100.26	6.5	1.72	1.394	21.50
6	98.05	6.5	2.05	1.651	24.90
7	99.49	6.5	1.96	1.581	24.19
8	95.62	6.5	2.3	1.845	27.14
9	94.28	6.5	2.17	1.744	25.29
10	96.13	6.5	1.72	1.394	20.62
11	96.86	6.5	1.81	1.464	21.82
12	94.03	6.5	2.2	1.767	25.56
13	96.28	6.5	1.78	1.441	21.34
14	95.85	6.5	1.95	1.573	23.19
15	95.36	6.5	1.88	1.518	22.28
16	92.73	6.5	1.89	1.526	21.77
17	88	6.5	1.59	1.293	17.50
18	93.5	6.5	2.08	1.674	24.08
19	100.88	6.5	1.75	1.417	22.00
20	84.77	6.5	2.37	1.899	24.77
				AVERAGE	23.09

Performing a t-test statistical analysis on the above data gives the following results:

Table 2

t-Test: Two-Sample Assuming Equal Variances

	% Yield (Cartridge A)	*% Yield (Cartridge B)*
Mean	20.99	23.09
Variance	0.77	5.04
Observations	20	20
Pooled Variance	2.90	
Hypothesized Mean Difference	0	
df	38	
t Stat	-3.90	
P(T<=t) one-tail	0.000188	

t Critical one-tail	1.686	
P(T<=t) two-tail	0.000376	
t Critical two-tail	2.0244	
Standard Deviation	0.876	2.245

The analysis shows that the consistency of % yield, which equates to brew strength, for the cartridges of the present invention is significantly better (at a 95% confidence level) than the prior art cartridges, with a standard deviation of 0.88% compared to 2.24%. This means that beverages brewed with the cartridges of the present invention have a more repeatable and uniform strength. This is preferred by consumers who like their drinks to taste the same time after time and do not want arbitrary changes in brew strength.

The materials of the cartridges described above may be provided with a barrier coating to improve their resistance to oxygen and/or moisture and/or other contaminant ingress. The barrier coating may also improve the resistance to leakage of the beverage ingredients from within the cartridges and/or reduce the degree of leaching of extractibles from the cartridge materials which might adversely affect the beverage ingredients. The barrier coating may be of a material selected from the group of PET, Polyamide, EVOH, PVDC or a metallised material. The barrier coating may be applied by a number of mechanisms including but not limited to vapour deposition, vacuum deposition, plasma coating, co-extrusion, in-mould labelling and two/multi-stage moulding.

A beverage preparation machine 201 for use with the present invention for use with the above described beverage cartridges is shown in Figures 35 to 45. The beverage

preparation machine 201 generally comprises a housing 210 containing a water tank 220, a water heater 225, a water pump 230, an air compressor 235, a control processor, a user interface 240 and a cartridge head 250. The cartridge head 250 in turn generally comprises a cartridge holder 251 for holding, in use, the beverage cartridge 1, cartridge recognition means 252 and inlet and outlet piercers 253, 254 for forming, in use, the inlet 121 and the outlet 122 in the beverage cartridge 1.

The housing 210 contains and holds in position the other components of the machine 201. The housing 210 preferably made in whole or in part from a robust plastics material such as ABS. Alternatively, the housing 210 can be made in whole or in part from a metallic material such as stainless steel or aluminium. The housing 210 is preferably comprises a clam-shell design having a front half 211 and a rear half 212 which allow access during assembly for fitting of the machine 201 components and can afterwards be joined together to define an interior 213 of the housing 210. The rear half 212 provides a recess 214 for the attachment of the water tank 220. The housing 210 is formed with means, such as detents, abutments, bosses and threaded portions, for retaining the components of the machine 201 in position without the need for a separate chassis. This reduces the overall cost and weight of the machine 201. A base 215 of the housing 210 is preferably provided with feet for standing the machine thereon in a stable manner. Alternatively, the base 215 itself may have a shape forming a stable support.

The front half 211 of the housing 210 comprises a dispense station 270 where dispensation of the beverage

takes place. The dispense station 270 comprises a receptacle stand 271 having a hollow interior forming a drip tray 272. An upper surface 273 of the receptacle stand is provided with a grill 274 on which the receptacle is positioned. The drip tray 272 is removable from the housing 210 to ease emptying of the collected water. A recess 275 is formed in the front half of the housing 210 above the receptacle stand 271 to accommodate the dimensions of the receptacle.

The cartridge head 250 is located towards the top of the housing 210 above the receptacle stand as shown in Figures 35 and 36. Preferably, the height of the grill 274 relative to the cartridge head 250 can be adjusted to accommodate different sizes of receptacle. It is preferred that the receptacle is as close to the cartridge head 250 as possible, whilst still allowing the receptacle to be inserted and withdrawn from the dispense station 270, so as to minimise the height that the dispensed beverage has to descend before contacting the receptacle. This acts to minimise spraying and splashing of the beverage and minimise loss of entrained air bubbles where these are present. Preferably receptacles of between 70mm and 110 mm in height can be inserted between the grill 274 and cartridge head 250.

The machine user interface 240 is located on the front of the housing 210 and comprises a start/stop button 241, and a plurality of status indicators 243-246.

The status indicators 243-246 preferably include a light emitting diode (LED) 243 to indicate readiness of the machine 201, a LED 244 to indicate if an error has occurred in the machine 201 operation, and one or more LEDs 245-256

to indicate whether the machine 201 is operating in manual or automatic modes. The LEDs 243-246 may be controlled to illuminate at a constant intensity, to flash intermittently, or both depending on the status of the machine 201. The LEDs 243-246 may have a variety of colours including green, red and yellow.

The start/stop button 241 controls commencement of the operating cycle and is a manually operated push-button, switch or similar.

A volume adjustment control may be provided to allow a user of the machine 201 to manually adjust the volume of the delivered beverage without altering the other operating characteristics. Preferably the volume adjustment control allows an adjustment in volume of plus or minus 20%. The volume adjustment control may be a rotary knob, a linear slider, a digital readout with increment and decrement buttons, or similar. More typically, volume is controlled by a user operating the start/stop button 241.

A manual power switch (not shown) may be provided on the machine 201. Alternatively, power supply can be controlled simply by insertion or removal or the power supply plug from the mains power supply.

The water tank 220 is located to the rear of the housing 210 and is connected to the rear half 212 of the housing 210. The water tank 220 comprises a generally cylindrical body 221 which may be right circular or a frustum as desired for aesthetic reasons. The tank comprises an inlet for filling the tank with water which is closed off in use by a manually removable lid 222. An outlet is provided towards a lower end of the tank which communicates with the water pump 230. The water tank 220 may

be made from a transparent or translucent material to allow a consumer to view the quantity of water remaining in the tank. Alternatively, the water tank 220 may be made from an opaque material but have provided a viewing window therein. In addition, or in place of the above, the water tank 220 may be provided with a low level sensor which prevents operation of the water pump 230 and optionally triggers a warning indicator, such as an LED, when the water level in the tank descends to a preselected level. The water tank 220 preferably has an internal capacity of approximately 1.5 litres.

The water pump 230 is operatively connected between the water tank 220 and the water heater 225 as shown schematically in Figure 43 and is controlled by the control processor. The pump provides a maximum flow rate of 900 ml/min of water at a maximum pressure of 2.5 bar. Preferably, in normal use, the pressure will be limited to 2 bar. The flow rate of water through the machine 201 can be controlled by the control processor to be a percentage of the maximum flow rate of the pump by cycle chopping the electrical supply to the pump. Preferably the pump can be driven at any of 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% or 100% of the maximum rated flow rate. The accuracy of the volume of water pumped is preferably + or - 5% leading to a + or - 5% accuracy in the final volume of the dispensed beverage. A suitable pump is the Evolution EP8 pump produced by Ulka S.r.l. (Pavia, Italy). A volumetric flow sensor (not shown) is preferably provided in the flow line either upstream or downstream of the water pump 230. Preferably, the volumetric flow sensor is a rotary sensor.

The water heater 225 is located in the interior of the housing 210. The heater 225 has a power rating of 1550 W and is able to heat water received from the water pump 230 from a starting temperature of approximately 20 °C to an operating temperature of around 85 °C in under 1 minute. Preferably the dwell time between the end of one operating cycle and the heater 225 being able to commence a subsequent operating cycle is less than 10 seconds. The heater maintains the selected temperature to within + or - 2 °C during the operating cycle. As discussed below, the water for the operating cycle may be delivered to the cartridge head 250 at 83 °C or 93 °C. The heater 225 is able to quickly adjust the delivery temperature to either 83 °C or 93 °C from a nominal water temperature of 85 °C. The heater 225 comprises an over-temperature cut-off which shuts off the heater if the temperature exceeds 98 °C. Water output from the heater 225 is fed to the cartridge head 250 and cartridge 1 by means of a three-way valve. If the pressure of the water flow is acceptable the water is passed to the cartridge 1. If the pressure is below or above predetermined limits then the water is diverted by means of the three-way valve into the drip tray recovery receptacle 270.

The air compressor 235 is operatively connected to the cartridge head 250 by means of a one-way valve and controlled by the control processor. The air compressor 235 provides a maximum flow rate of air of 500 ml/min at 1.0 bar. In use a working volume of 35 ml is pressurised to 2.0 bar. Preferably, the air compressor 235 can produce two flow rates: a fast (or maximum) flow rate and a slow flow rate.

The control processor of the beverage preparation machine 201 comprises a processing module and a memory. The

control processor is operatively connected to, and controls operation of, the water heater 225, water pump 230, air compressor 235 and user interface 240.

The memory of the control processor includes one or more variables for one or more operational parameters for the beverage preparation machine 201. In the illustrated embodiment the operational parameters are the temperature of the water passed through the beverage cartridge 1 during the operating stage, the speed of charging the beverage cartridge 1, the presence or otherwise of a soak step, the total dispensed volume of the beverage, the flow rate of the water during the discharge stage, and the flow rate and period of the purge stage.

The variables for the operational parameters are stored in the memory. The cartridge 1 comprises a code provided on or in the cartridge 1 representing the operational parameters required for optimal dispensation of the beverage in that cartridge 1. The code is in binary format and comprises a plurality of data bits corresponding to the variables stored in the control processor memory. Table 3 illustrates how 13 bits of data can be used to represent the necessary variables for the operational parameters described above.

Table 3

Bit	Parameter	Description
0 & 1	Water temperature	00 = cold 01 = warm 10 = 83 °C 11 = 93 °C
2 & 3	Cartridge charge	00 = fast charge with soak 01 = fast charge without soak

		10 = slow charge with soak 11 = slow charge without soak
4, 5, 6 & 7	Beverage volume	0000 = 50 ml 0001 = 60 ml 0010 = 70 ml 0011 = 80 ml 0100 = 90 ml 0101 = 100 ml 0110 = 110 ml 0111 = 130 ml 1000 = 150 ml 1001 = 170 ml 1010 = 190 ml 1011 = 210 ml 1100 = 230 ml 1101 = 250 ml 1110 = 275 ml 1111 = 300 ml
8, 9 & 10	Flow rate	000 = 30% 001 = 40% 010 = 50% 011 = 60% 100 = 70% 101 = 80% 110 = 90% 111 = 100%
11 &12	Purge	00 = slow flow/short period 01 = slow flow/long period 10 = fast flow/short period 11 = fast flow/long period

The code on or in the cartridge 1 will normally comprises one or more extra data bits for error checking. In one example a 16 bit code is provided. For example, using the variables listed in Table 3, a cartridge 1 bearing the

code "1000100011110" would have the following operational parameters:

10	Water temperature of 83 °C
00	Fast charge with soak
1000	Dispensed drink volume of 150ml
111	Flow rate equals 100%
10	Fast air flow purge/short period.

Thus, unlike in previous beverage preparation machines, the memory of the control processor does not store operational instructions for beverage cartridges based on the cartridge type, i.e. instructions for a coffee cartridge, instructions for a chocolate cartridge, instructions for a tea cartridge etc. Instead the memory of the control processor stores variables for adjusting the individual operational parameters of the operating cycle. This has a number of advantages. Firstly, a greater degree of control of the dispensation cycle can be exercised. For example, slightly different operational parameters can be used for different grades or blends of coffee rather than using the same parameters for all types of coffee. Prior coding solutions relying on storing instructions by cartridge type rather than by individual parameters are unsuited to such subtle differences in operating cycles for similar beverage types because they quickly consume the available storage space in the coding medium and control processor. Secondly, the coding method of the present invention allows for new beverage cartridge types to be used in pre-existing beverage preparation machines even where the operational parameters for the operating cycle for the new beverage cartridge 1 are only decided upon after sale of the beverage preparation machine 201. This is because the

control processor of the beverage preparation machine 201 does not need to recognise that the beverage is of a new type. Rather the operational parameters of the operating cycle are set without direct reference to the beverage type. Hence the coding method of the present invention provides excellent backward compatibility of the beverage preparation machines for new beverage types. In contrast, with prior machines, the manufacturer is restricted to dispensing a new beverage type using one of the pre-existing dispensation cycles as determined by the in-market machines.

The cartridge head 250 is shown in Figures 39 to 42. The cartridge holder 251 of the cartridge head 250 comprises a fixed lower part 255, a rotatable upper part 256 and a pivotable cartridge mount 257 positioned inbetween the fixed lower part 255 and the rotatable upper part 256. The upper part 256, lower part 255 and cartridge mount 257 are rotated about a common hinge axis 258. Figures 39 to 42 show the cartridge holder 251 with some components of the machine 201 omitted for clarity.

The rotatable upper part 256 and pivotable cartridge mount 257 are moved relative to the fixed lower part 255 by means of a clamping mechanism 280. The clamping mechanism 280 comprises a clamping lever having first and second members or parts 281 and 282. The first part 281 of the clamping lever comprises a U-shaped arm which is pivotably mounted to the upper part 256 at two first pivot points 283, one on each side of the cartridge holder 251.

The second part of the clamping lever comprises two over-centre arms 282, one on each side of the cartridge holder 251 which are each pivotably mounted to the upper part 256 at a second pivot point 285 located on the hinge

axis 258 coupling the upper part 256 to the fixed lower part 255. Each over-centre arm 282 is a reciprocal member comprising a cylinder 282a, a stem 282b and a resilient sleeve 282c. The cylinder 282a has an internal bore and is rotatably mounted at one end at the hinge axis 258. A first end of the stem 282b is slidingly received in the bore of the cylinder 282a. The opposite end of the stem 282b is rotatably mounted to the U-shaped arm 281 at a third pivot point 286. The third pivot points 286 are unconnected to, and freely moveable relative to, the upper part 256 and lower part 255. The resilient sleeve 282c is mounted externally on the stem 282b and extends, in use, between abutment surfaces on the cylinder 282a and stem 282b. The resilient sleeve 282c accommodates shortening of the over-centre arm 282 but biases the over-centre arm 282 into an extended configuration. Movement of the third pivot points 286 towards and away from the hinge axis 258 is thus possible by relative movement of the stems 282b in the cylinders 282a. The resilient sleeves 282c are preferably formed from silicone.

The U-shaped arm 281 extends around the front of the cartridge holder 251 and comprises two downwardly dependant hook members 287, one on each side of the cartridge holder 251, each comprising a cam surface 288 facing the hinge axis 258. The fixed lower part 255 of the cartridge holder 251 is provided with two bosses 259, or detents, located one on each side of the lower part 255 at or near a front edge 260 thereof aligned generally with the hook members 287.

As shown in Figure 39, the U-shaped arm 281 may be formed from a one piece plastics moulding comprising an

ergonomic hand grip and the hook members 287 integral to the arm.

The cartridge mount 257 is rotatably mounted between the upper and lower parts 255, 256 of the cartridge holder 251. The mount 257 is provided with a substantially circular recess 290 which receives in use the beverage cartridge 1. The recess 290 includes an irregularity 291 for accommodating the handle portion 24 of the beverage cartridge 1 which also acts to prevent rotation of the beverage cartridge 1 in the cartridge holder 251. The cartridge mount 257 is sprung relative to the fixed lower part 255 such that in the open position, as shown in Figure 41, the cartridge mount 257 is biased out of contact with the fixed lower part 255 so that the cartridge mount 257 is moved out of contact with the outlet and inlet piercer members 254, 253. The cartridge mount 257 is provided with an aperture 292 for receiving therethrough the inlet and outlet piercers 253, 254 and a head 300 of the cartridge recognition means 252 when the cartridge mount 257 is moved into the closed position.

The upper part 255 comprises a generally circular body 310 housing a circular viewing window 312 through which a consumer can view the beverage cartridge 1 during an operating cycle and also visually confirm whether a cartridge 1 is loaded in the machine 201. The viewing window 312 is cup-shaped having a downwardly directed rim 311 which engages and grips the flange 35 of the beverage cartridge 1 against the lower part 256 when the cartridge holder 251 is closed. At the same time the window 312 contacts the closed top 11 of the cartridge 1. A wave spring (not shown) is positioned between the viewing window 312 and the circular

body 310 to enable the viewing window 312 to move axially relative to the circular body 310 by a small degree. The pressure exerted by the rim 311 on the flange 35 and by the window 312 on the closed top 11 ensures a fluid tight seal between the cartridge 1 and the cartridge holder 251.

The lower part 255 comprises the inlet and outlet piercers 253, 254 and the head 300 of the cartridge recognition means 252. The inlet piercer 253 comprises a hollow needle-like tube 260 having a sharpened end 261 for perforating the laminate 5 of the beverage cartridge 1 in use. The inlet piercer 253 is in fluid communication with a water conduit 262 as shown in Figure 42 which passes through the lower part 255 and is connected to an outlet conduit 263 of the water heater 225. The outlet piercer 254 is similar in type to the outlet piercer described in the applicant's European patents EP 0 389 141 and EP 0 334 572 and comprises an open ended cylinder 264 of circular or D-shaped cross-section having dimensions larger than the discharge spout 43. An arcuate portion 265 of the upper end of the outlet piercer 254 is serrated to pierce and eventually cut the laminate of the beverage cartridge 1. The remainder of the upper end is cut back longitudinally of the cylinder at least to the base of the teeth 266 of the serrated portion to fold or pull the cut laminate 5 away from the outlet aperture before the beverage is dispensed therethrough. The outlet piercer 254 pierces the laminate 5 externally of the discharge spout 43 and when the cartridge mount 257 is in the closed position, rests in the annulus between the discharge spout 43 and the outer wall 42 of the discharge funnel 40. The outlet piercer 254 folds back the cut laminate 105 into the annulus. Thereby both the outlet

piercer 254 and the cut laminate 105 are held out of the way of the discharged beverage.

The outlet piercer 254 is surrounded by a ledge 254a which is raised relative to its surroundings by 0.5mm.

Advantageously, the outlet piercer 254 is removable from the lower part 255 to enable it to be thoroughly cleaned, for example, in a dishwasher. The removable outlet piercer 254 is received in a recess 267 in the lower part 255 where it is seated. The inlet piercer 253 and/or the outlet piercer 254 may be made of a metal, such as stainless steel, or from a plastics material. Advantageously, the use of plastic cutting elements is enabled by use of a laminate 5 which is able to be punctured and cut by a non-metallic material. Consequently, the piercers 253, 254 can be made less sharp which lowers the risk of injury to the consumer. In addition, plastic piercing elements are not prone to rust. Preferably, the inlet piercer 253 and the outlet piercer 24 are formed as a single, integral unit which is removable from the lower part 255.

In use, the upper part 256 of the cartridge holder 251 is movable from an open position in which it is orientated vertically or towards the vertical as shown in Figure 36, to a closed position in which it is orientated substantially horizontally and in interengagement with the fixed lower part 255 and cartridge mount 257. The upper part 256 is moved from the open to the closed positions by operation of the clamping lever. To close the upper part 256 a user takes hold of the clamping lever by the U-shaped arm 281 and pulls downwards. Consequently, the upper part 256 rotates which first brings the rim 311 of the viewing window 312 into contact with the flange 35 of the beverage cartridge 1 in

the cartridge mount 257 and the window 312 itself into contact with the closed top 11 of the cartridge 1. Continued rotation of the upper part 256 rotates the upper part 256 and cartridge mount 257 down into contact with the lower part 255. Further rotation of the U-shaped arm 281 causes the U-shaped arm 281 to rotate relative to the upper part 256 and the lower part 255 resulting in the hook members 287 of the upper part 256 engaging the bosses 259 of the lower part 255 with the cam surface 288 riding over the bosses 259. During this last stage of rotation the cartridge 1 is compressed between the cartridge mount 257 and the viewing window 312. As a result, the viewing window 312 is moved axially relative to the circular body 310 of the upper part 256 against the bias of the wave spring. This movement allows for a take up of tolerances in the beverage cartridge 1 and beverage preparation machine and ensures that the amount of compressive force applied to the cartridge is kept within an acceptable range. The clamping force of the mechanism as moderated by the action of the wave spring ensures a clamping pressure on the cartridge of between 130 and 280N. Preferably the force is approximately 200N. A force less than about 130N does not provide an adequate seal, whilst a force greater than about 280N leads to plastic failure of the components of the cartridge 1. During closure of the cartridge head the laminate 5 of the cartridge 1 is tensioned as it is brought into contact with the ledge 254a surrounding the outlet piercer 254 which causes the laminate 5 to flex out of plane as the distal end of the outer tube 42 of the cylindrical funnel is moved upwardly by 0.5mm relative to the flange 35. This movement also ensures that the great majority of the compressive

force applied to the cartridge acts through the central region of the cartridge 1 through the load-bearing inner member 3. In the closed position the cartridge 1 is thus clamped around the flange 35 by means of the rim 311 of the viewing window 312 and firmly clamped between the closed top 11 of the cartridge and the outer tube 42 of the inner member 3 by contact with the viewing window 312 and the ledge 254a. These clamping forces help prevent failure of the cartridge 1 during pressurisation and also ensure that the inner member 3 and outer member 2 are fully seated relative to one another and thus that all internal passageways and apertures remain at their intended dimensions even during internal pressurisation.

An imaginary datum line can be drawn between the first and second pivot points 283, 285 of the cartridge holder 251. As can be seen in Figure 41, in the open position the third pivot points 286 are located on the side of the datum line nearest the fixed lower part 255. As the upper part 256 reaches the closed position, the third pivot points 286 of the clamping lever pass through the datum line joining the first and second pivot points 283, 285 to the opposite side of the line, furthest from the fixed lower part 255. Consequently, the U-shaped arm 281 'snaps through' from a first stable position to a second stable position. The snap through action is accommodated by shortening of the over-centre arms 282 and consequential compression of the resilient sleeves 282c. Once the third pivot points 286 are past the imaginary datum line then recovery of the resilient sleeves 282c acts to continue the motion of the third pivot points 286 away from the imaginary datum line. The clamping lever thus has a bi-stable operation in that the lever is

stable in the open or closed positions but unstable at the point when the third pivot points 286 lie on the imaginary datum line joining the first and second pivot points 283, 285. Thus, the snap-through action of the clamping lever provides a positive closure mechanism which leads to a definite closure action wherein in the final stages of the clamping lever's rotation, the snap-through action of the U-shaped arm 281 and second arms 284 forces the hook members 287 firmly into engagement with the bosses 259. In addition, the resilient sleeves 282c provide a resistance to re-opening of the upper part 256 since a minimum force is required to compress the sleeves 282c sufficiently to move the third pivot points 286 back into line with the datum line joining the first and second pivot points 283, 285. Advantageously, the interengagement of the hook members 287 and the bosses 259 prevents separation of the upper and lower parts other than by rotation of the clamping lever. This is useful in preventing opening of the cartridge head 250 during operation when the cartridge head 250 is subject to internal pressurisation.

The purpose of the cartridge recognition means 252 is to allow the machine 201 to recognise the type of beverage cartridge 1 that has been inserted and to adjust one or more operational parameters accordingly. In a typical embodiment, the cartridge recognition means 252 comprises an optical barcode reader which reads a printed barcode 320 provided on the laminate 5 of the beverage cartridge 1 as shown in Figure 45. The barcode 320 is formed from a plurality of bars of contrasting colour. Preferably the bars are black on a white background to maximise the contrast. The barcode 320 is not required to conform to a published standard but a

standard format for barcodes, such as EAN-13, UPC-A, or Interleaf 2 of 5 may be used. The optical barcode reader comprises one or more LEDs 321 to illuminate the barcode 320, a focusing lens 322 to acquire an image of the barcode, a charge coupled device (CCD) 323 for producing an electrical signal representative of the acquired image and support circuitry for the LEDs and CCD. The space in the lower part for accommodating the barcode reader is limited. A mirror or mirrors 324 may be used to reflect the light from the LEDs 321 to a focussing lens which is not located in the lower part 255. Schematic arrangements are shown in Figures 44a and 44b. The lower part 255 comprises an aperture 326 which is the same size as the barcode 320 on the beverage cartridge 1. In use the electrical signals produced are decoded by signal processing software and the results forwarded to the control processor. The software can recognise whether the read of the barcode contained errors. The barcode 320 may be rescanned a number of times before an error message is presented to the consumer. If the machine 201 is unable to read the barcode the consumer is able to use the beverage cartridge 1 to dispense a beverage using a manual mode of operation.

The cartridge head 250 also includes a cartridge sensor for detecting whether a cartridge is present in the cartridge holder 251.

The cartridge head 250 also includes a lock sensor which detects whether the cartridge holder 251 is properly closed. Preferably the lock sensor comprises a micro-switch which is triggered when the cartridge holder 251 is closed and locked. Preferably the cartridge sensor and lock sensor are connected in series such that the output of both sensors

must be satisfactory, i.e. cartridge present and mechanism locked, before the operating cycle can be commenced.

Operation of the machine 201 comprises insertion of a beverage cartridge 1 into the cartridge head 250, carrying out an operating cycle in which the beverage is dispensed and removal of the cartridge 1 from the machine.

The operational behaviour of the machine 201 is determined by software embedded in the control processor. Operation of the machine can be described in terms of 'States', wherein the machine 201 will normally exist in a particular State until an event occurs to change the State, a step called a State transition.

Table 4 shows a State Transition Table which illustrates the States and State transitions for one embodiment of the beverage preparation machine 201.

Table 4

State	State Description	Temperature	Lock Sensor	Cartridge Sensor variable (OK, NOK, CLR)	Water level indicator	Water flow rate	StartStop
1	WATER HEATING	> or = 85 goto 2	Closed: [Cartridge Sensor= readpod()] Open: [Cartridge Sensor =CLR]	N/A	Low goto 10	N/A	No Action
2	WATER READY If timeout 10mins goto 9	< 85 goto 2	Closed: [Cartridge Sensor = readpod()] Open: [Cartridge Sensor =CLR]	Cartridge Sensor =OK goto 4 Cartridge Sensor =NOK goto 3	Low goto 10	N/A	No Action
3	READY TO BREW AUTO	N/A [temperature controlled in background]	Open: [Cartridge Sensor =CLR] goto 2	N/A	Low goto 10	N/A	Goto 5
4	BREW IN PROGRESS AUTO [Run Brew State] goto 7	N/A [temperature controlled in background]	Open: [Cartridge Sensor =CLR] goto 10	N/A	Low goto 10	No flow goto 10	Water off goto 6
5	BREW SUSPENDED	N/A [temperature controlled in background]	Open: [Cartridge Sensor =CLR] goto 10	N/A	Low goto 10	N/A	Goto 5
6	READY TO BREW MANUAL	N/A [temperature controlled in background]	Open: [Cartridge Sensor =CLR] goto 2	N/A	Low goto 10	N/A	[Water On] Goto 8

7	BREW IN PROGRESS MANUAL	N/A [temperature controlled in background]	Open: [Cartridge Sensor =CLR] goto 10	N/A	Low goto 10	No flow goto 10	Release d goto 7
8	PURGE [Water off; air on, timeout n sec then goto 9]	N/A [temperature controlled in background]	Open: [Cartridge Sensor =CLR] goto 10	N/A	No action	N/A	No Action
9	BREW DONE [air purge] [Cartridge Sensor =CLR] if timeout 10s goto 2	N/A [temperature controlled in background]	Open goto 2	N/A	Low goto 10	N/A	Goto 9
10	STANDBY	N/A [heater off]	Open: [Cartridge Sensor =CLR] goto 1 Closed: [Cartridge Sensor = readpod()]	N/A	Low goto 10	N/A	Goto 1
11	ERROR Power off/on required to clear	N/A	N/A	N/A	N/A	N/A	N/A
12	WATER LOW				Low goto 10		

The following example illustrates an operating cycle to exemplify the use of the State Transitions by the control processor.

It is assumed that the machine 201 is initially switched off and with no cartridge 1 inserted in the cartridge head 250. When the machine 201 is switched on the control processor is in State 1. The water heater 225 is switched on. Once the temperature reaches 85 °C the control

processor transits to State 2. If at any time during State 1 or 2 the cartridge holder 251 is closed the lock sensor will be triggered to send a signal to the control processor indicating that the cartridge holder 251 is properly closed. The control processor then interrogates the cartridge sensor by sending a 'readpod' instruction. The cartridge sensor returns a signal to the control processor indicating whether a cartridge is in place in the cartridge holder 251. If no cartridge is present the control processor transits to State 3 where it remains in a readiness state until the cartridge holder 251 is reopened at which point the control processor transits back to State 2. If a cartridge is present in State 2 then the control processor transits to State 4 and operation is commenced automatically. During States 4 to 9 the water temperature is controlled in the background to remain within the required tolerance range of the desired temperature as set by the operational parameters set by the barcode on the beverage cartridge 1. Once the discharge stage of dispense is completed an air purge is commenced in State 8. Once the air purge is completed the operating cycle is completed and the machine enters to standby mode in State 10. If, during operation, an error occurs then the processor transits to State 11. If a low water level is detected then the processor transits to State 12.

To insert the cartridge 1 the cartridge holder 251 is opened as described above to expose the cartridge mount 257. The cartridge 1 is then placed on the cartridge mount 257 received within the recess 290 such that the handle 24 of the cartridge is located in the irregularity 291. The optical or magnetic barcode 320 of the cartridge 1 is orientated directly above the aperture 326 in the cartridge

mount 257. The cartridge holder 251 is then closed by operation of the clamping lever as described above. During closure the inlet and outlet piercers 253, 254 pierce the laminate 5 of the cartridge 1 to form the cartridge inlet 121 and outlet 122. As described above the laminate 5 cut by the outlet piercer 254 is folded up into the annulus surrounding the discharge spout 43. When closed the cartridge holder 251 grips the cartridge 1 around the rim 35 between the cartridge mount 257 and the upper part 256 and between the window 311 and the top 11 of the cartridge 1 to form a fluid tight seal of sufficient integrity to withstand the pressures developed during the operating cycle.

To commence the operating cycle the consumer operates the start/stop button 241.

The operating cycle comprises the steps of cartridge recognition and the discharge cycle.

Cartridge recognition is performed by the optical cartridge recognition means 252 as described above assuming that the outputs from the cartridge sensor and lock sensor are satisfactory. Once the barcode 320 has been decoded the operational parameters of the machine 201 are adjusted by the control processor. The discharge cycle is then automatically commenced.

The discharge cycle has four main stages, not all of which are used for all beverage types:

(i) Pre-wet

(ii) Pause

(iii) Brew/Mixing

(iv) Purge

In the pre-wet stage the cartridge 1 is charged with water from the water storage tank 220 by means of the water

pump 230. The charging with water causes the beverage ingredients 200 in the filtration chamber 130 to be wetted. The charging may take place at a "fast" flow rate of 600 ml/min or a "slow" flow rate of 325 ml/min. The slow charging rate is particularly useful for cartridges containing viscous liquid beverage ingredients where the ingredients require some dilution before they are able to be pumped at a higher volume flow rate. The volume of water injected into the cartridge 1 is selected to ensure that water or beverage does not drip out of the cartridge outlet 122 during this stage.

The pause stage allows the beverage ingredients 200 to soak in the water injected during the pre-wet stage for a predetermined period of time. Both the pre-wetting and soaking stages are known to increase the yield of the extractibles from the beverage ingredients 200 and to improve the end flavour of the beverage. Pre-wetting and soaking are particularly used where the beverage ingredients are roast and ground coffee.

In the brew/mixing stage water is passed through the cartridge 1 in order to produce the beverage from the beverage ingredients 200. The temperature of the water is determined by the control processor which sends instructions to the water heater 225 to heat the water passing from the water tank 220 to the cartridge head 250. Water enters the lower part 255 of the cartridge holder 251 through the conduit 262 via the inlet valve and the inlet piercer 253 into the inlet chamber 126 of the beverage cartridge 1. Brewing and/or mixing and subsequent dispensing of the beverage from the beverage cartridge 1 is as described above with reference to the versions of the beverage cartridge 1.

The air purge comprises the blowing of pressurised air through the beverage preparation machine and the beverage cartridge 1 to ensure that all beverage is dispensed and that the flow path is cleared ready for dispensing another beverage. The air purge does not commence immediately on cessation of the brew/mixing stage to allow for the majority of the fluid to clear the flow path. This prevents an unacceptable spike in internal pressure on commencement of the air purge.

In normal operation a user manually stops the machine 201 by operating the start/stop button 241.

Once the operating cycle has been completed the consumer removes the cartridge 1 by opening the cartridge holder 251 and manually removing and disposing of the cartridge. Alternatively, the machine 201 may be provided with an automatic ejection mechanism for removing the cartridge automatically on opening the cartridge holder 251.

As described above, two or more of the beverage cartridges are used in combination according to the present invention to produce a wide variety of beverages including incorporating the advantage of dispensing a liquid dairy-based beverage portion from a cartridge of the same overall size as the cartridges used to prepare the remainder of the beverage. Thus a single beverage preparation machine may be used with all types of cartridges since the interface between the cartridges and the machine are the same irrespective of the beverage ingredients contained in the cartridges.

The delivery times for beverages using the machine 201 and cartridges 1 are typically between 10 and 120 seconds, preferably 30 to 40 seconds for roast and ground coffee,

between 5 and 120 seconds, preferably 10 to 20 seconds for chocolate and between 5 and 120 seconds, preferably 10 to 20 seconds for milk.

The machine 201 may also advantageously comprise a memory in operative communication with the control processor that stores information on the type of beverage dispensed by a user. The operating cycle of the machine 201 may then be adjusted for the next cartridge 1. This is especially advantageous where two or more beverage cartridges 1 are used sequentially to form a beverage. For example a coffee cartridge may be dispensed followed by a milk cartridge to form a cappuccino beverage. Alternatively a chocolate cartridge could be used followed by a milk cartridge to produce a creamy hot chocolate beverage. By using a memory that stores information on the first beverage dispensed, the manner of dispensing the second cartridge, say a milk cartridge, may be altered to achieve an optimum beverage. In the above example the milk dispensed for hot chocolate may, typically, be diluted less than the milk added to the coffee. In addition, the milk dispensed for chocolate may be dispensed at a slower flow rate to lessen the degree of foaming of the beverage. Many combinations of cartridges are possible and operating parameters as will be obvious to the skilled person. In addition, the memory may be used to allow the machine 201 to 'predict' the type of beverage that a user will next want to dispense. For example, if a user predominantly drinks one beverage type then the machine can instruct the water heater to remain at the optimum temperature for that beverage type.

Claims:

1. A cartridge (1) containing one or more liquid beverage ingredients (200) and being formed from substantially air- and water-impermeable materials, the cartridge comprising an inlet (121) for the introduction of an aqueous medium into the cartridge, a compartment (134) containing the one or more liquid beverage ingredients and an outlet (122) for a beverage produced by dilution of the one or more liquid beverage ingredients by the aqueous medium, characterised in that the compartment includes means for controlling dilution of at least a proportion of the one or more liquid beverage ingredients on introduction of the aqueous medium into the compartment.

2. A cartridge (1) as claimed in claim 1 wherein the means for controlling dilution delays dilution of at least a proportion of the one or more liquid beverage ingredients on introduction of the aqueous medium into the compartment.

3. A cartridge (1) as claimed in claim 1 or claim 2 wherein, in use, an aqueous medium flow path is established from the inlet to the outlet, the means for delaying dilution comprising a partition (100) which hinders entry of at least a proportion of the one or more liquid beverage ingredients into the aqueous medium flow path.

4. A cartridge (1) as claimed in claim 3 wherein the partition (100) comprises one or more apertures (103) for controllably releasing the at least a proportion of the one or more liquid beverage ingredients into the aqueous medium flow path.

5. A cartridge (1) as claimed in claim 4 wherein four apertures (103) are provided.

6. A cartridge (1) as claimed in any of claims 3 to 5 wherein the partition comprises a cup-shaped member having an open mouth (104) directed away from the aqueous medium flow path.

7. A cartridge (1) as claimed in claim 6 wherein the cup-shaped member is annular.

8. A cartridge (1) as claimed in claim 6 or claim 7 wherein one or more apertures (103) are provided at or near a base of the cup-shaped member.

9. A cartridge (1) as claimed in claim 8 wherein the at least a proportion of the liquid beverage ingredients in the cup-shaped member (100) drain by gravity through the one or more apertures (103) in use.

10. A cartridge (1) as claimed in claim 9 wherein the cup-shaped member is spaced from a bottom of the cartridge, such that the aqueous medium flow path passes between the cup-shaped member and the bottom of the cartridge.

11. A cartridge (1) as claimed in claim 10 wherein the at least a proportion of the liquid beverage ingredients in the cup-shaped member (100) drain by gravity through the one or more apertures (103) in use vertically downwards into the aqueous medium flow path.

12. A cartridge (1) as claimed in any of claims 6 to 11 comprising an inner member (3) and an outer member (2), wherein the inner member comprises the cup-shaped member.

13. A cartridge as claimed in any of claims 3 to 12 further comprising means for producing a jet of the beverage, wherein said means for producing the jet of the beverage comprises an aperture (128) in the aqueous medium flow path.

14. A cartridge as claimed in claim 13 as dependent on claim 11 wherein the aperture (128) is delimited by an interface between the inner member and the outer member.

15. A cartridge as claimed in claim 13 or claim 14 further comprising at least one inlet (71) for air and means for generating a pressure reduction of the jet of beverage, whereby, in use, air from the at least one air inlet is incorporated into the beverage as a plurality of small bubbles.

16. A cartridge (1) as claimed in claim 15 wherein the at least one air inlet (71) is provided in the inner member downstream of the aperture (128).

17. A cartridge (1) as claimed in claim 16 wherein the at least one air inlet (71) and means for producing a pressure reduction in the jet of beverage produces a foaming of the one or more liquid beverage ingredients of greater than 40%.

18. A cartridge (1) as claimed in claim 17 wherein the foaming is greater than 70%.

19. A cartridge (1) as claimed in any preceding claim wherein the cartridge is disc-shaped.

20. A cartridge (1) as claimed in any preceding claim wherein the outer member and/or inner member are formed from polypropylene.

21. A cartridge (1) as claimed in any preceding claim wherein the outer member and/or inner member is formed by injection moulding.

22. A cartridge (1) as claimed in any preceding claim wherein the liquid beverage ingredient is a concentrated liquid milk composition.

23. A cartridge (1) as claimed in claim 22 wherein the concentrated liquid milk contains between 25 and 40% total solids.

24. A cartridge (1) as claimed in claim 23 wherein the concentrated liquid milk contains 30% total solids.

25. A cartridge (1) as claimed in any of claims 22 to 24 wherein the concentrated liquid milk contains between 0.1 and 12% fat.

26. A cartridge (1) as claimed in any of claims 1 to 21 wherein the one or more liquid beverage ingredients are selected from the group of cocoa solids, coffee, tea, sweeteners, cordials, flavourings, alcoholic beverages, flavoured milk, fruit juices, squashes, sauces and desserts.

27. A method of dispensing a beverage from a cartridge (1) containing one or more liquid beverage ingredients (200) during an operating cycle, comprising the steps of passing an aqueous medium through the cartridge to form a beverage by dilution of said one or more beverage ingredients, and dispensing the beverage into a receptacle, wherein the one or more liquid ingredients as dispensed has a concentration at the start of the operating cycle of between 30 and 70% total solids and a concentration at the end of the operating cycle of between 1 and 15% total solids.

28. A method as claimed in claim 27 wherein the concentration at the start of the operating cycle is between 30 and 35% total solids.

29. A method as claimed in claim 28 wherein the concentration at the end of the operating cycle is approximately 10% total solids.

30. A method as claimed in claim 28 or claim 29 wherein the liquid ingredient is concentrated milk.

31. A method as claimed in claim 27 wherein the concentration at the start of the operating cycle is between 60 and 70% total solids.

32. A method as claimed in claim 31 wherein the concentration at the end of the operating cycle is between 12 and 15% total solids.

33. A method as claimed in claim 31 or claim 32 wherein the liquid ingredient contains cocoa solids.

34. A method as claimed in claim 27 wherein the concentration at the start of the operating cycle is between 40 and 70% total solids.

35. A method as claimed in claim 34 wherein the concentration at the end of the operating cycle is between 1 and 2% total solids.

36. A method as claimed in claim 34 or claim 35 wherein the liquid ingredient is contains coffee.

37. A method of dispensing a beverage from a cartridge (1) containing one or more liquid beverage ingredients

(200) during an operating cycle, comprising the steps of passing an aqueous medium through the cartridge to form a beverage by dilution of said one or more beverage ingredients, and dispensing the beverage into a receptacle, wherein the one or more liquid beverage ingredients is foamed on dispense to a ratio of between 20 and 150%.

38. A method as claimed in claim 37 wherein the one or more liquid beverage ingredients are foamed to a ratio between 70 and 100%.

39. A method as claimed in claim 37 or claim 38 wherein the one or more liquid beverage ingredients includes one or more of concentrated milk, coffee and cocoa solids.

40. A beverage as produced by the method of any of claims 27 to 39.

41. A method of manufacturing a cartridge (1) for dispensation of a beverage comprising the steps of:

a. manufacturing a plurality of outer members (2) comprising at least a first type of outer member and a second type of outer member having differing shape or configurations;

b. manufacturing a plurality of inner members (3) comprising at least a first type of inner member and a second type of inner member having differing shape or configurations;

c. storing said plurality of outer members and said inner members;

d. selecting one of the first type of outer member or the second type of outer member from the plurality of outer members;

e. selecting one of the first type of inner member or the second type of inner member from the plurality of inner members;

f. conjoining the selected inner member to the selected outer member such the inner member is within the outer member;

g. filling the outer member with one or more beverage ingredients (200) selected from a plurality of beverage ingredients; and

h. sealing the outer member with a lid (5) to form the cartridge.

42. A method as claimed in claim 41 further comprising in step b. of joining a filter member (4) to the first type and/or second type of inner member (3).

43. A method as claimed in claim 41 or claim 42 wherein the first type of outer member (2) is suitable for containing roast and ground beverage ingredients or the like.

44. A method as claimed in any of claims 41 to 43 wherein the second type of outer member (2) is suitable for containing soluble or liquid beverage ingredients or the like.

45. A method as claimed in any of claims 41 to 44 wherein the first type of inner member (3) is suitable for

filtering roast and ground beverage ingredients and the like.

46. A method as claimed in any of claims 41 to 45 wherein the second type of inner member (3) is suitable for filtering roast and ground beverage ingredients and the like and for entraining a plurality of air bubbles in the dispensed beverage.

47. A method as claimed in claim 45 or claim 46 wherein the first and second type of inner member (3) comprise a frame (41) having a filter (4) disposed thereupon, and wherein a peripheral rim (51) of the frame is conjoined to the selected type of outer member by welding.

48. A method as claimed in claim 47 wherein the second type of inner member (3) comprises means (70) for producing a jet of the beverage, which means comprises an aperture in a beverage flow path between an inlet and an outlet of the cartridge.

49. A method as claimed in any of claims 41 to 48 further comprising manufacturing and storing a third type of inner member (3).

50. A method as claimed in claim 49 wherein the third type of inner member is suitable for dispensing soluble beverage ingredients and the like.

51. A method as claimed in any of claims 41 to 50 further comprising manufacturing and storing a fourth type of inner member (3).

52. A method as claimed in claim 51 wherein the fourth type of inner member (3) is suitable for dispensing a liquid beverage ingredients and the like.

53. A method as claimed in any of claims 49 to 52 wherein the third or fourth type of inner member (3) comprises a skirt (80) surrounding an outlet, the skirt comprising an upper extension (81) having an upper rim (91) which engages, on assembly of the cartridge, a co-operating formation (19) of the selected type of outer member (2) to form a snap-fit arrangement for conjoining the third or fourth type of inner member to the selected type of outer member.

54. A cartridge system for dispensing a plurality of beverages comprising:

a. a plurality of outer members (3) comprising at least a first type of outer member and a second type of outer member having differing shape or configurations;
b. a plurality of inner members (2) comprising at least a first type of inner member and a second type of inner member having differing shape or configurations;
c. a plurality of beverage ingredients (200); and
d. at least one lid (5) to seal the cartridge;

wherein each cartridge comprises an outer member, an inner member, one or more beverage ingredients and a lid.

55. A cartridge system as claimed in claim 54 wherein each cartridge further comprises a filter (4).

56. A cartridge system as claimed in claim 54 or claim 55 wherein the first type of outer member (3) is suitable for containing roast and ground beverage ingredients or the like.

57. A cartridge system as claimed in any of claims 54 to 56 wherein the second type of outer member (3) is suitable for containing soluble or liquid beverage ingredients or the like.

58. A cartridge system as claimed in any of claims 54 to 57 wherein the first type of inner member (3) is suitable for filtering roast and ground beverage ingredients and the like.

59. A cartridge system as claimed in any of claims 54 to 58 wherein the second type of inner member (3) is suitable for filtering roast and ground beverage ingredients and the like and comprises means entraining a plurality of air bubbles in the dispensed beverage.

60. A cartridge system as claimed in any of claims 54 to 59 wherein the first and second type of inner member (3) comprise a frame (41) having a filter (4) disposed

thereupon, and wherein a peripheral rim (51) of the frame is conjoined to the selected type of outer member by welding.

61. A cartridge system as claimed in claim 59 or claim 60 wherein the second type of inner member (3) comprises means (70) for producing a jet of the beverage, which means comprises an aperture in a beverage flow path between an inlet and an outlet of the cartridge.

62. A cartridge system as claimed in any of claims 54 to 61 further comprising a third type of inner member (3).

63. A cartridge system as claimed in claim 62 wherein the third type of inner member (3) is suitable for dispensing soluble beverage ingredients and the like.

64. A cartridge system as claimed in any of claims 54 to 63 further comprising a fourth type of inner member (3).

65. A cartridge system as claimed in claim 64 wherein the fourth type of inner member (3) is suitable for dispensing a liquid beverage ingredients and the like.

66. A cartridge system as claimed in any of claims 62 to 65 wherein the third or fourth type of inner member (3) comprises a skirt (80) surrounding an outlet, the skirt comprising an upper extension (81) having an upper rim (91) which engages, on assembly of the cartridge, a co-operating formation (19) of the selected type of outer member to form a snap-fit arrangement for conjoining

the third or fourth type of inner member to the selected type of outer member.

67. A method of preparing a beverage comprising the steps of:

a) inserting a first beverage cartridge (1) containing one or more beverage ingredients (200) into a beverage preparation machine (201);

b) operating said beverage preparation machine to pass an aqueous medium through the first beverage cartridge to dispense a first portion of said beverage into a receptacle;

c) inserting a second beverage cartridge (1) containing one or more beverage ingredients (200) into the beverage preparation machine; and

d) operating the beverage preparation machine to pass an aqueous medium through the second beverage cartridge to dispense a second portion of said beverage into the receptacle;

characterised in that one of the first or second beverage cartridges contains a liquid dairy-based ingredient.

68. A method as claimed in claim 67 wherein one of the first or second beverage cartridges (1) contains an ingredient for forming a brewed portion of a beverage.

69. A method as claimed in claim 67 or claim 68 further comprising the step of removing the first beverage

cartridge (1) before inserting the second beverage cartridge (1).

70. A method as claimed in any of claims 67 to 69 wherein the beverage ingredient in the first or second beverage cartridge is roast and ground coffee.

71. A method as claimed in any of claims 67 to 69 wherein the beverage ingredient in the first or second beverage cartridge is leaf-based tea.

72. A method as claimed in any of claims 67 to 69 wherein the beverage ingredient in the first or second beverage cartridge is a liquid coffee ingredient.

73. A method as claimed in any of claims 67 to 69 wherein the liquid dairy-based ingredient is a concentrated dairy-based product.

74. A method as claimed in claim 73 wherein the concentrated dairy-based product is concentrated liquid milk.

75. A method as claimed in claim 74 wherein the concentrated liquid milk contains between 25 and 40% total solids.

76. A method as claimed in claim 75 wherein the concentrated liquid milk contains 30% total solids.

77. A method as claimed in any of claims 73 to 76 wherein the concentrated liquid milk contains between 0.1 and 12% fat.

78. A method as claimed in any of claims 73 to 77 further comprising the step of foaming the one or more liquid dairy-based ingredients during dispensation.

79. A beverage preparation system comprising a beverage preparation machine (201) having means for receiving a range of beverage cartridges (1) and means for passing an aqueous medium through said beverage cartridges, a first beverage cartridge (1) containing one or more beverage ingredients (200) for preparing a first portion of said beverage, and a second beverage cartridge (1) containing one or more beverage ingredients (200) for preparing a second portion of said beverage, characterised in that one of the first or second beverage cartridges contains a liquid dairy-based ingredient.

FIG. 1.

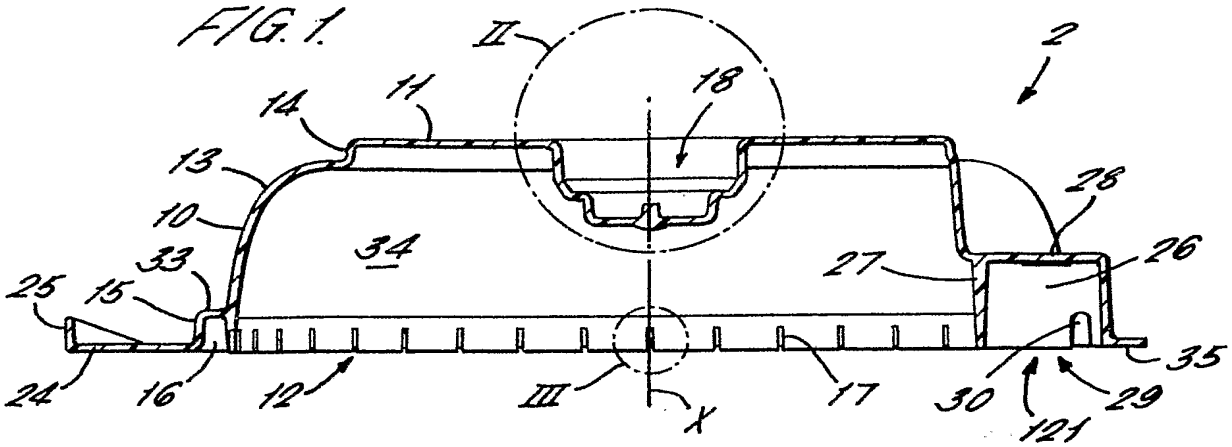


FIG. 2.

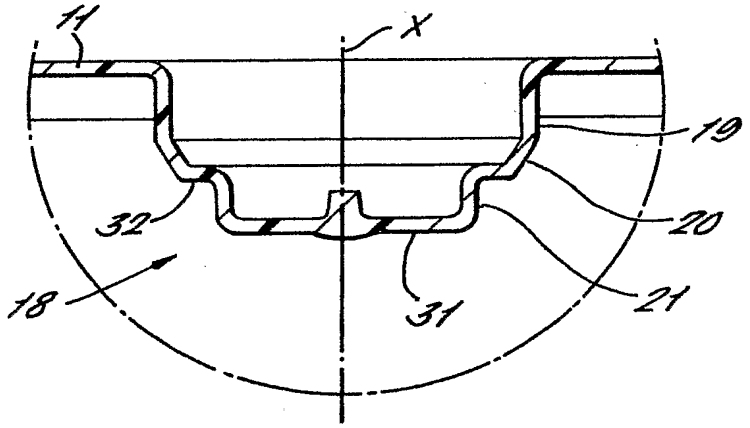


FIG. 3.

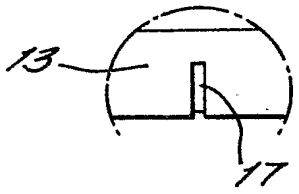


FIG. 4.

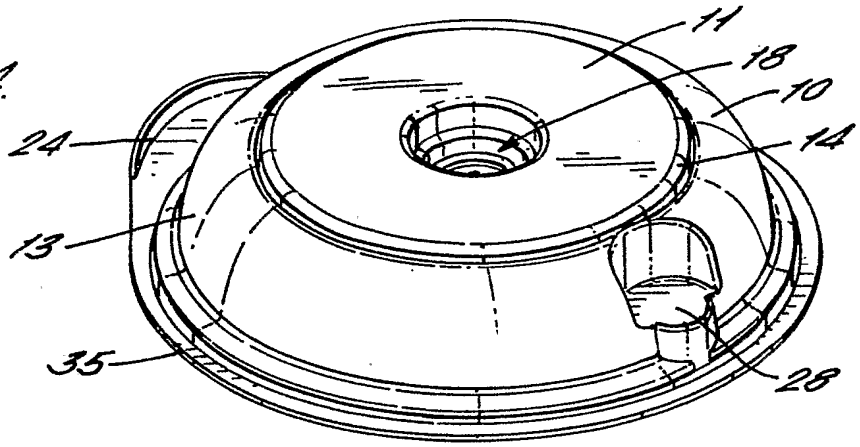


FIG. 5.

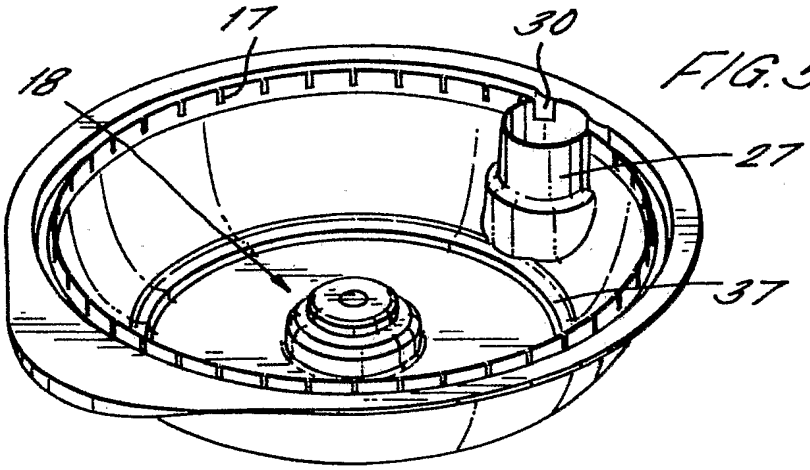


FIG. 6.

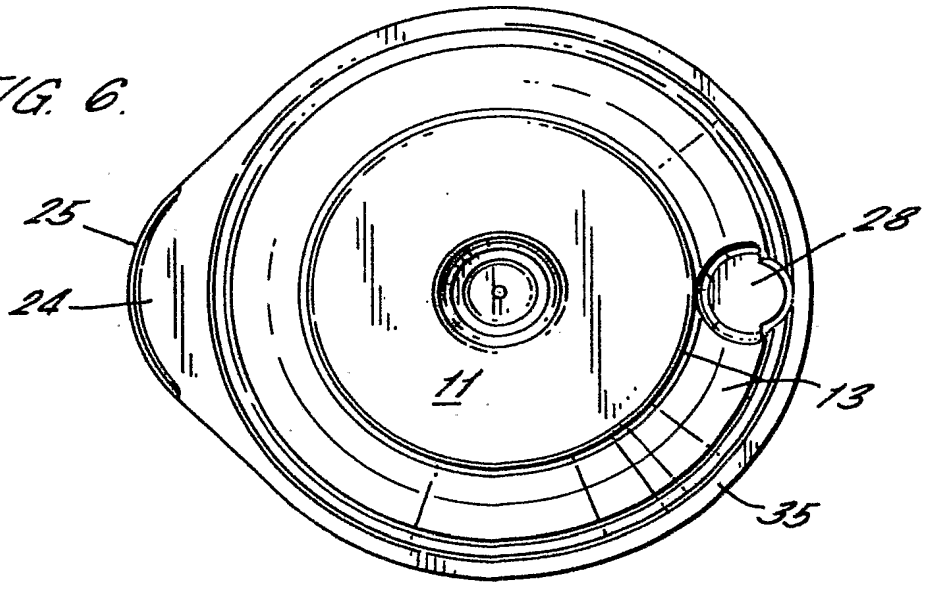


FIG. 7.

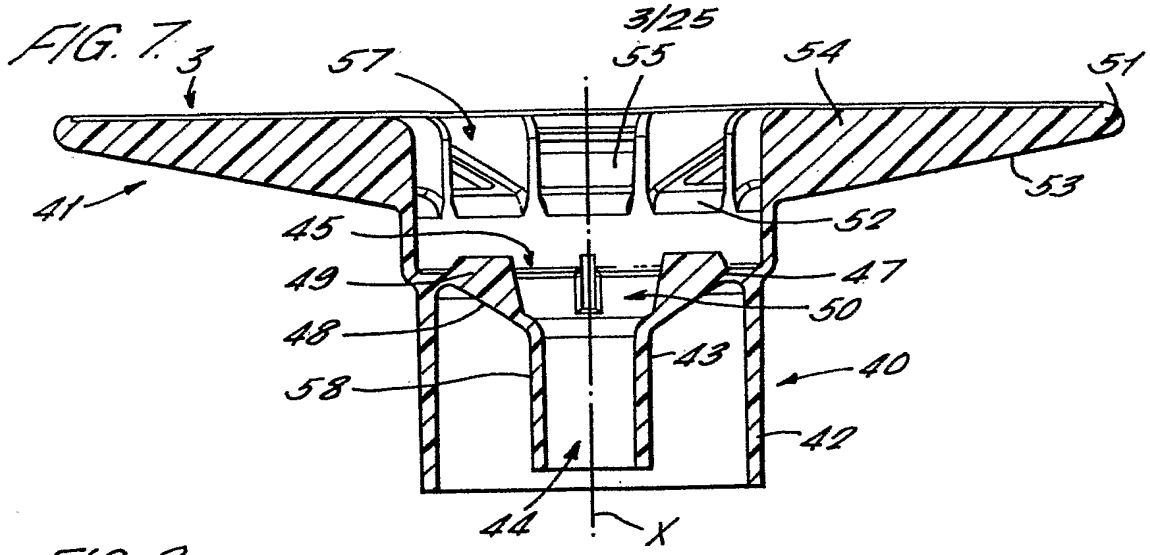


FIG. 8.

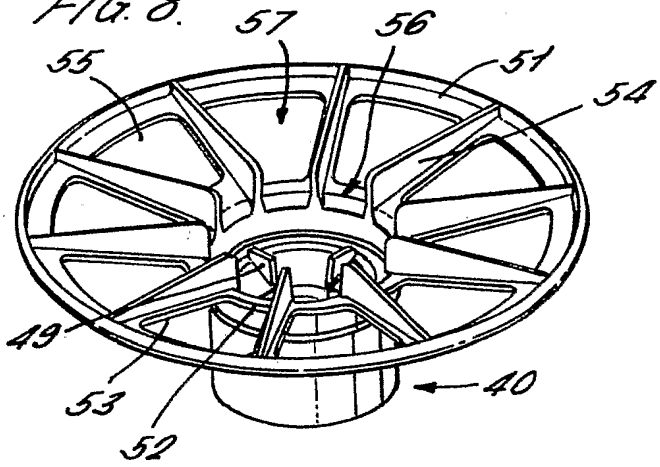


FIG. 9.

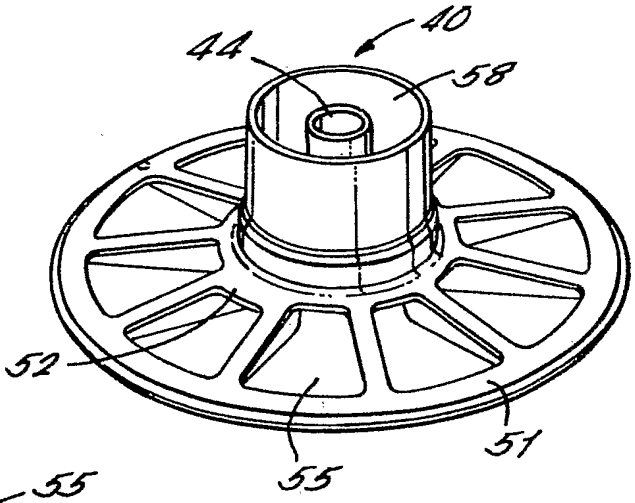
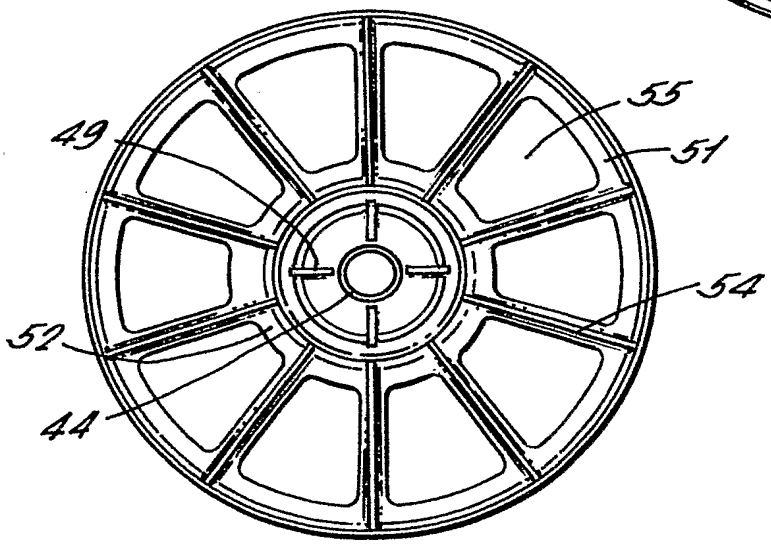


FIG. 10.



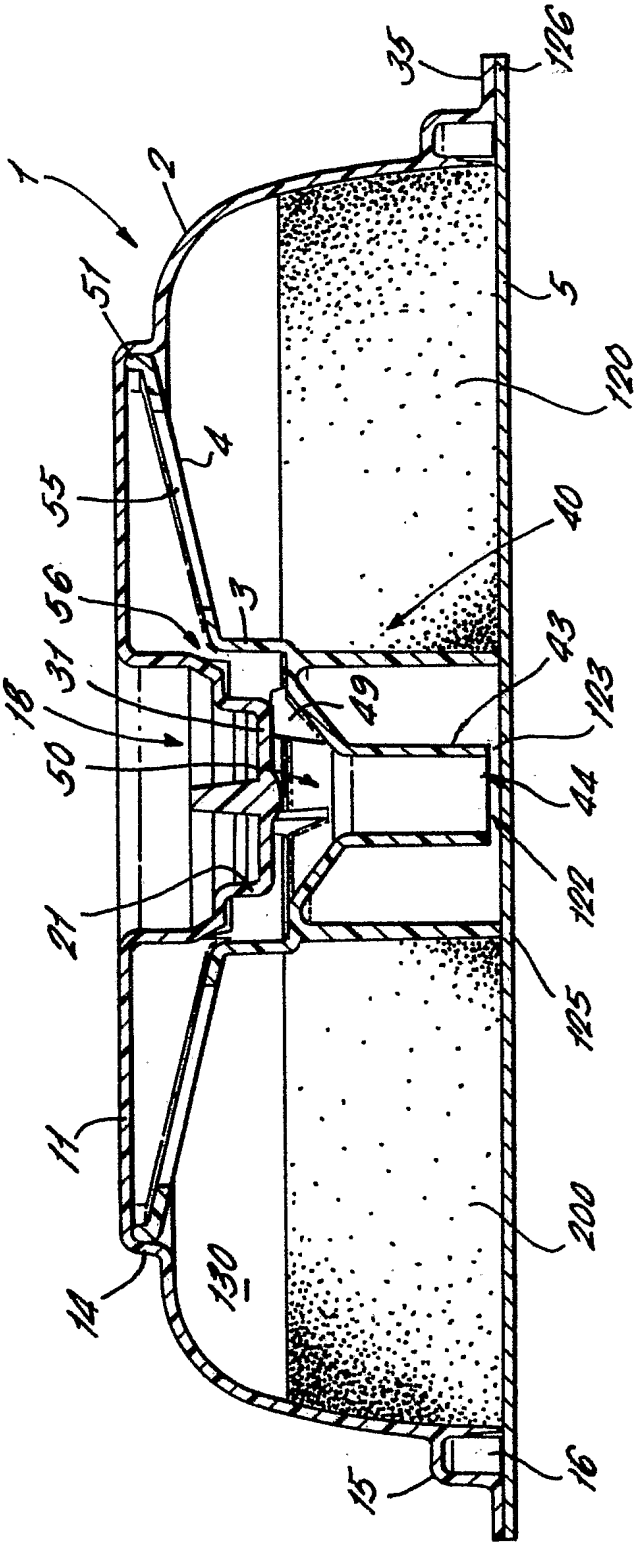

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FIG. 11.

FIG. 12.

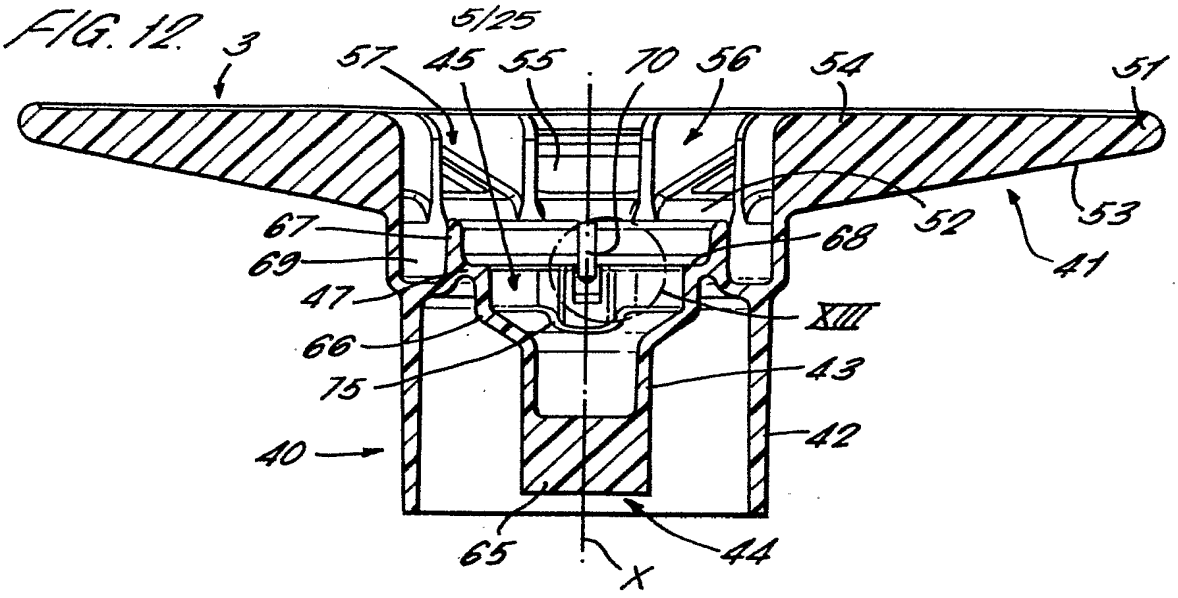


FIG. 13.

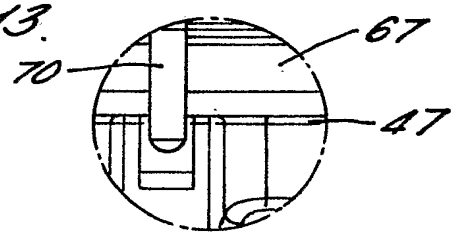


FIG. 14.

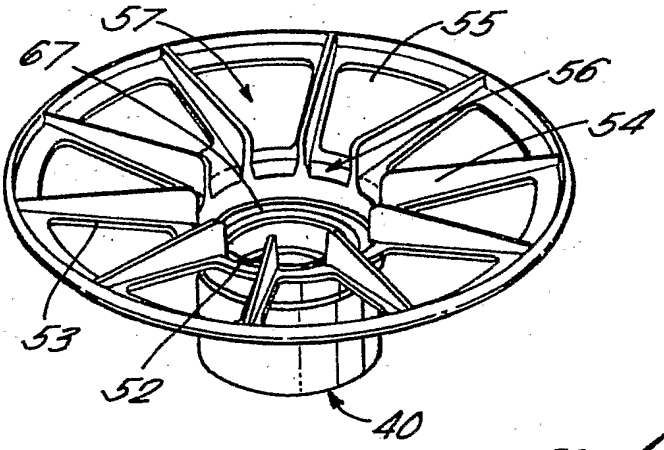


FIG. 15.

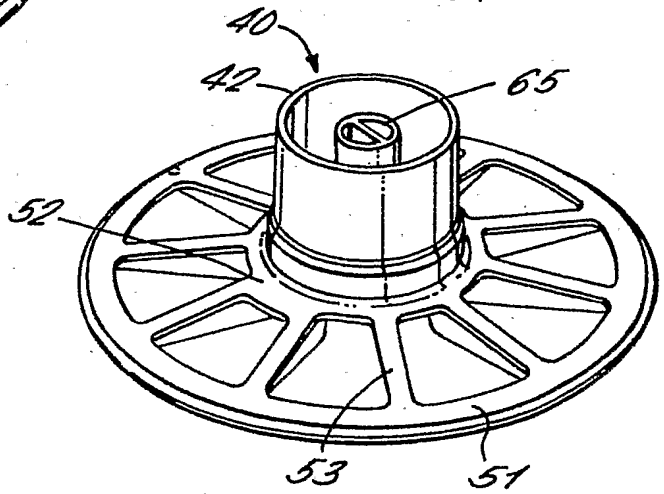


FIG. 16.

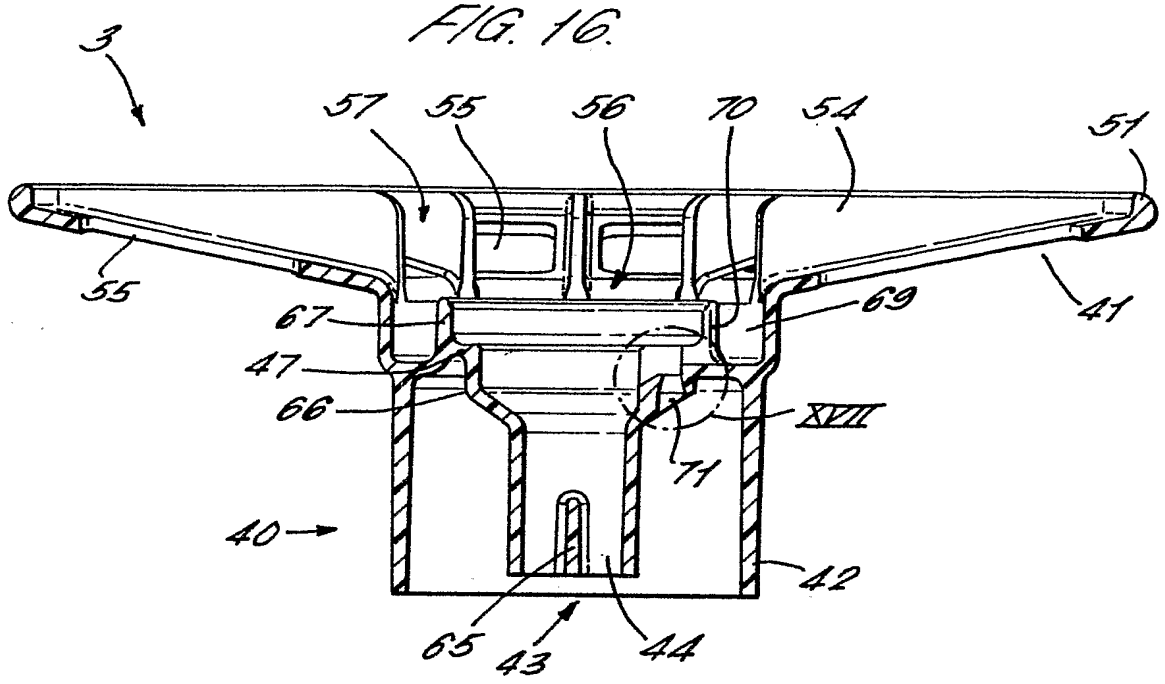
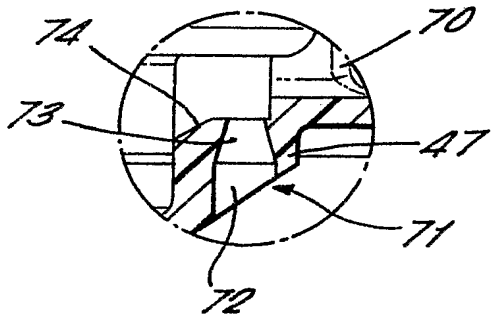

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FIG. 17.


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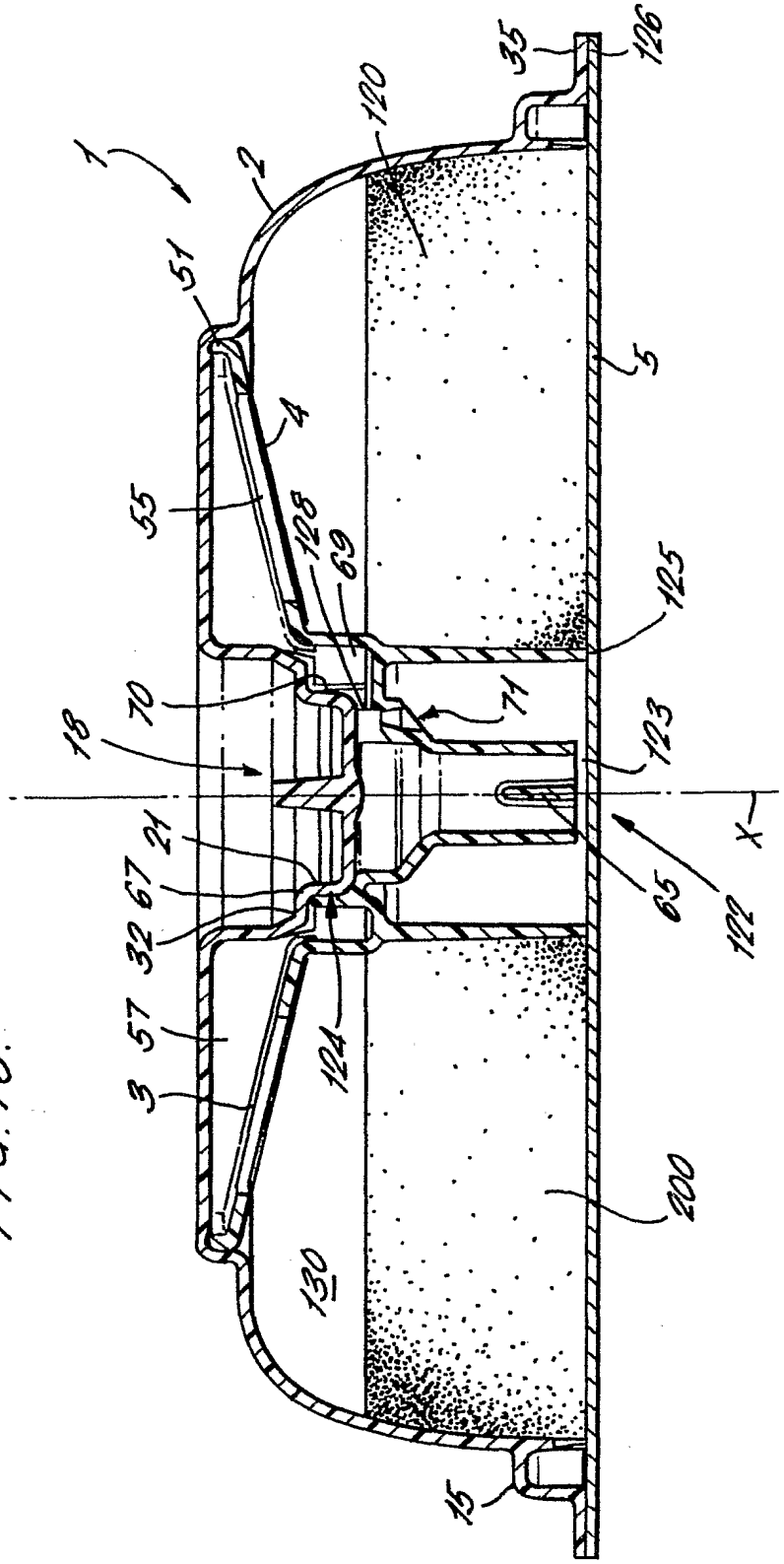

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FIG. 18.

FIG. 19.

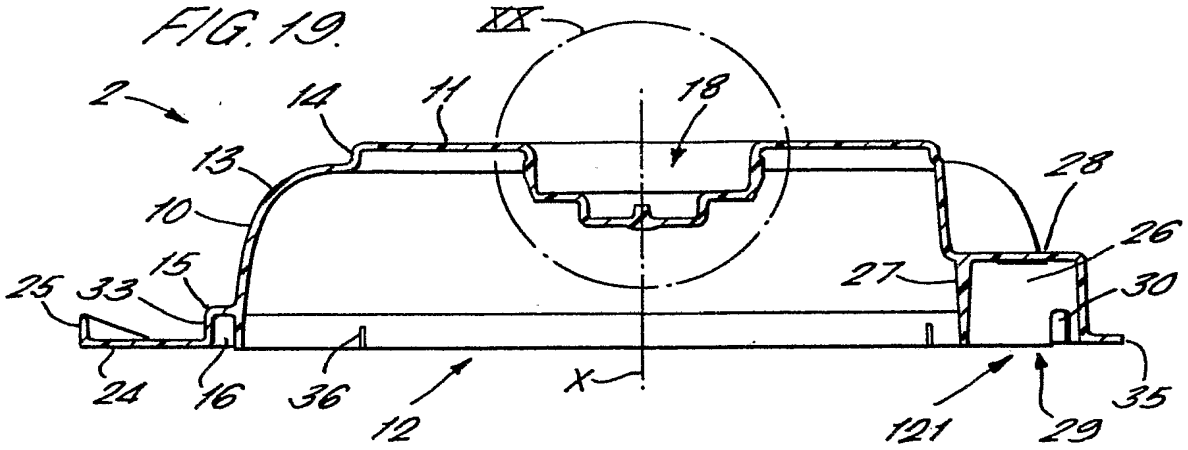

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FIG. 20.

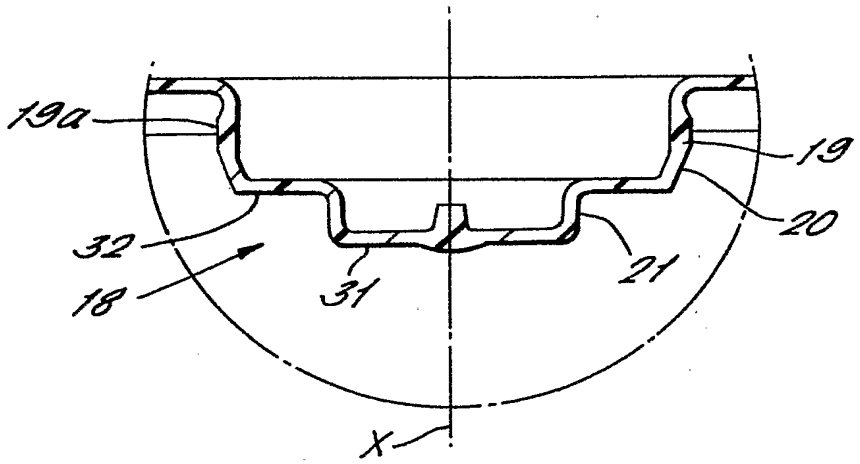

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FIG. 21.

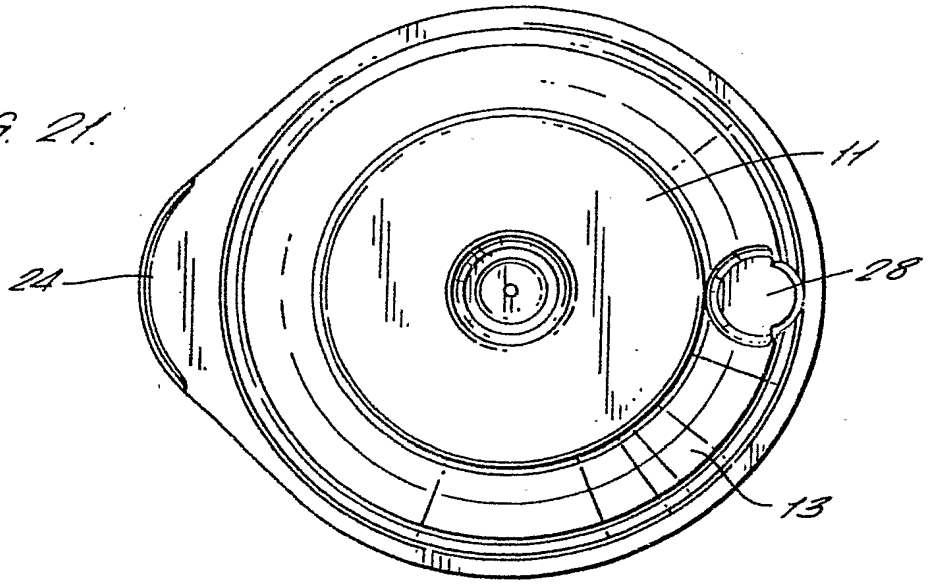


FIG. 22.

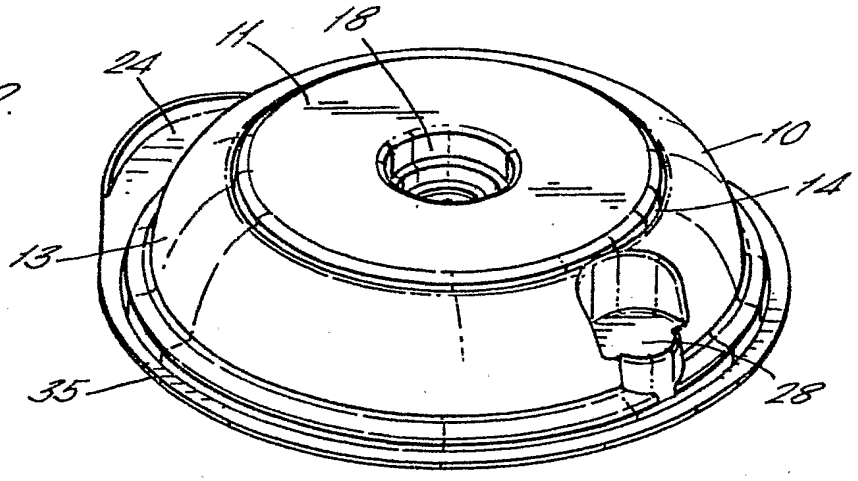


FIG. 23.

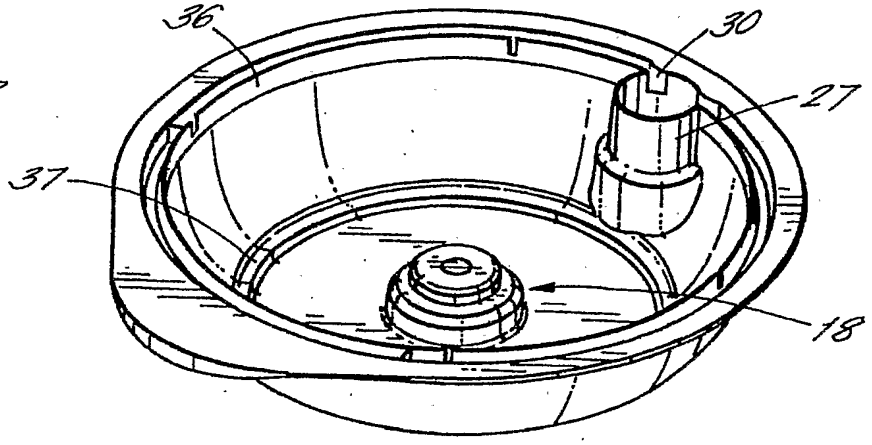


FIG. 24.

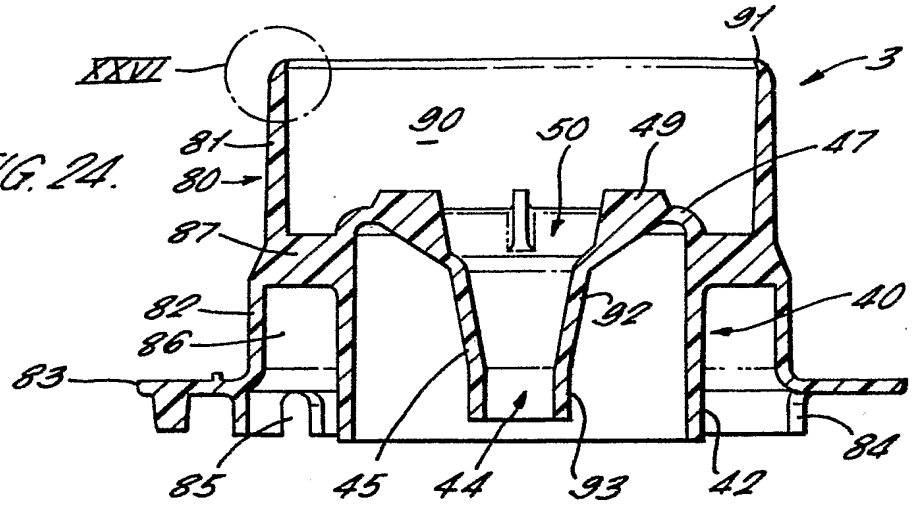


FIG. 25.

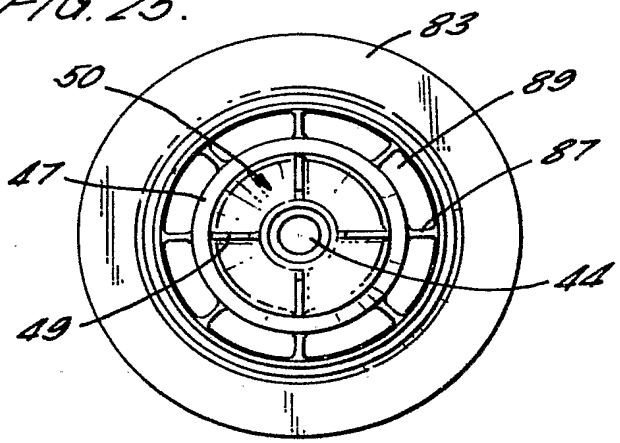


FIG. 26.

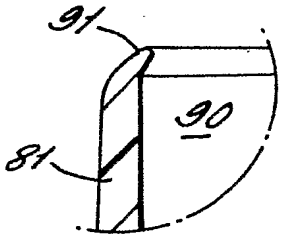


FIG. 27.

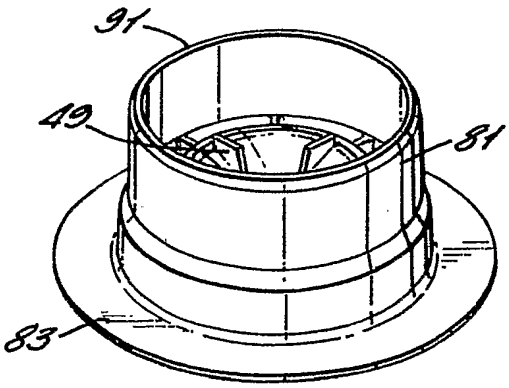
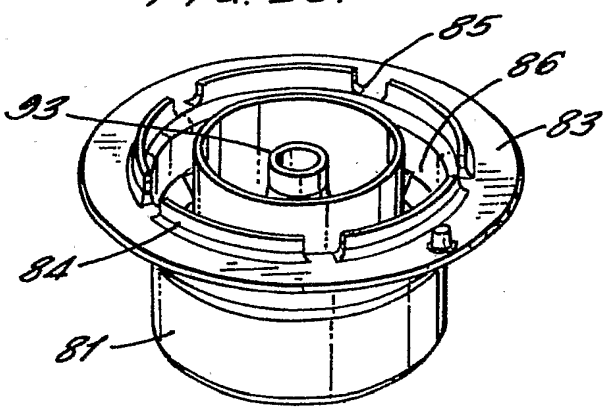


FIG. 28.



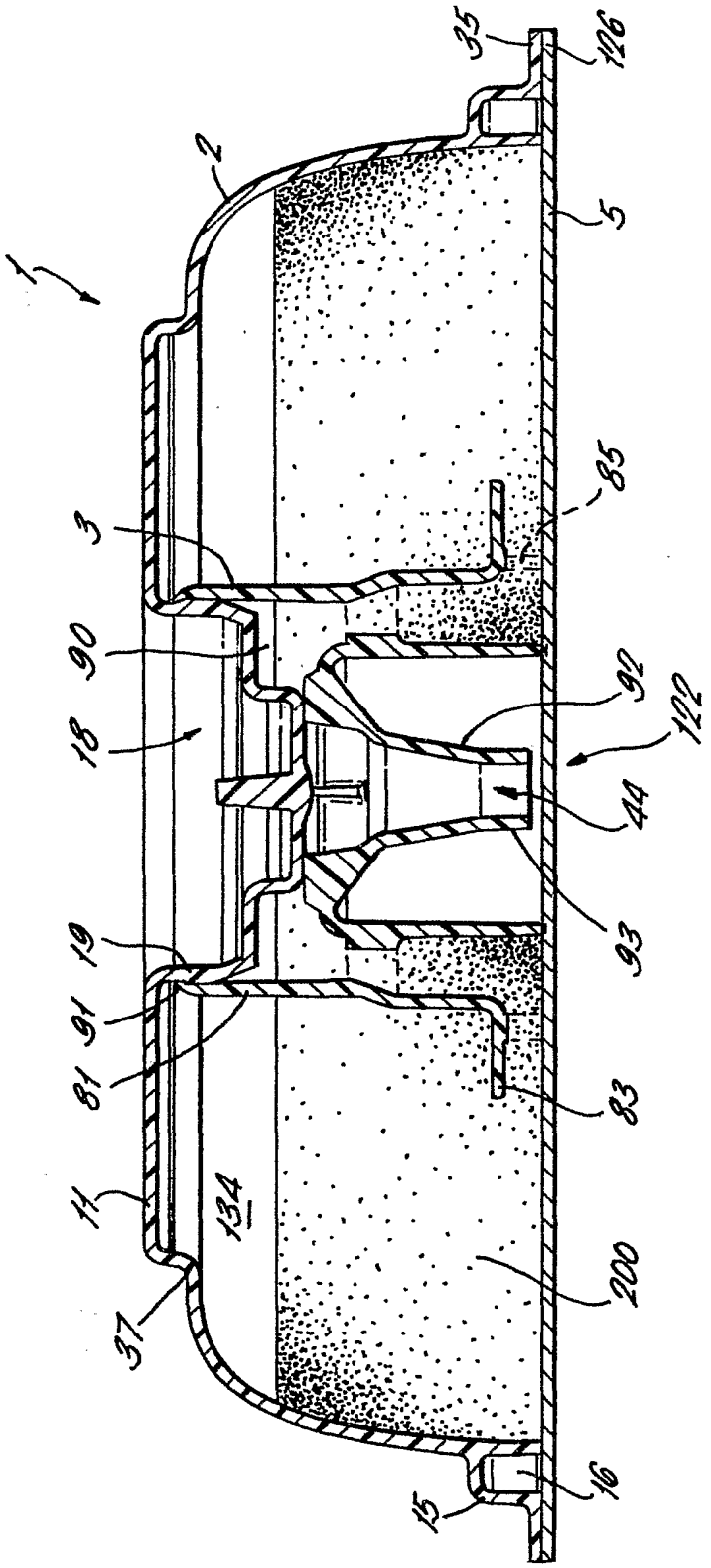


FIG. 29.

FIG. 30.

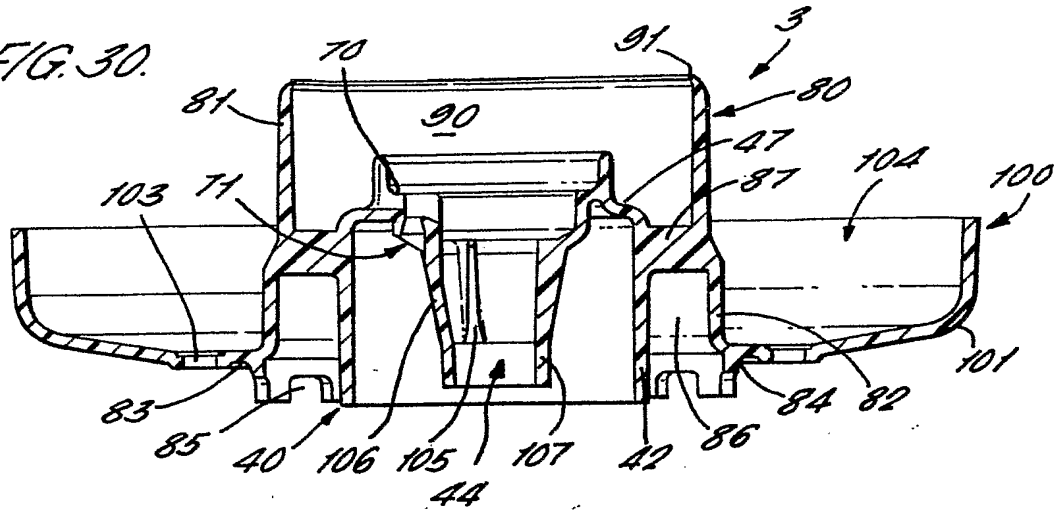


FIG. 32.

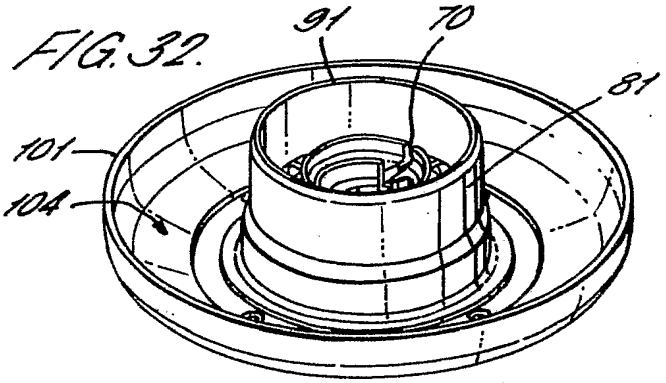


FIG. 31.

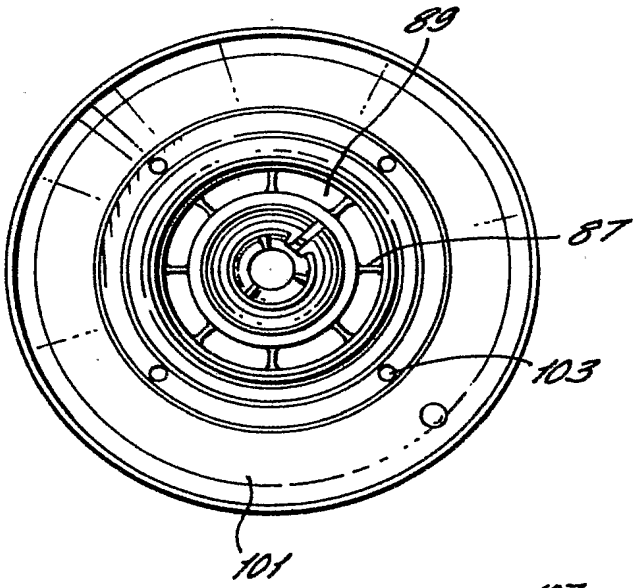
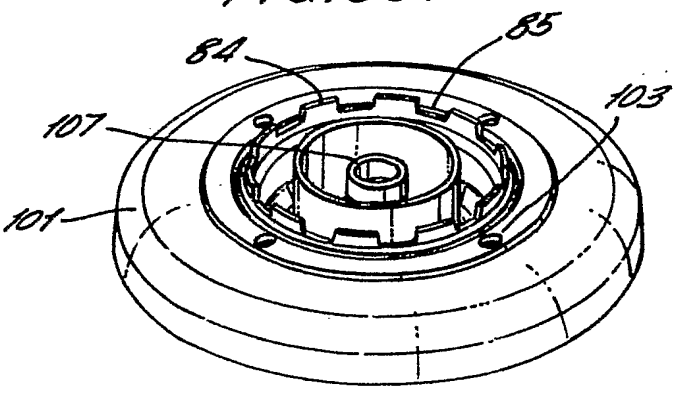


FIG. 33.



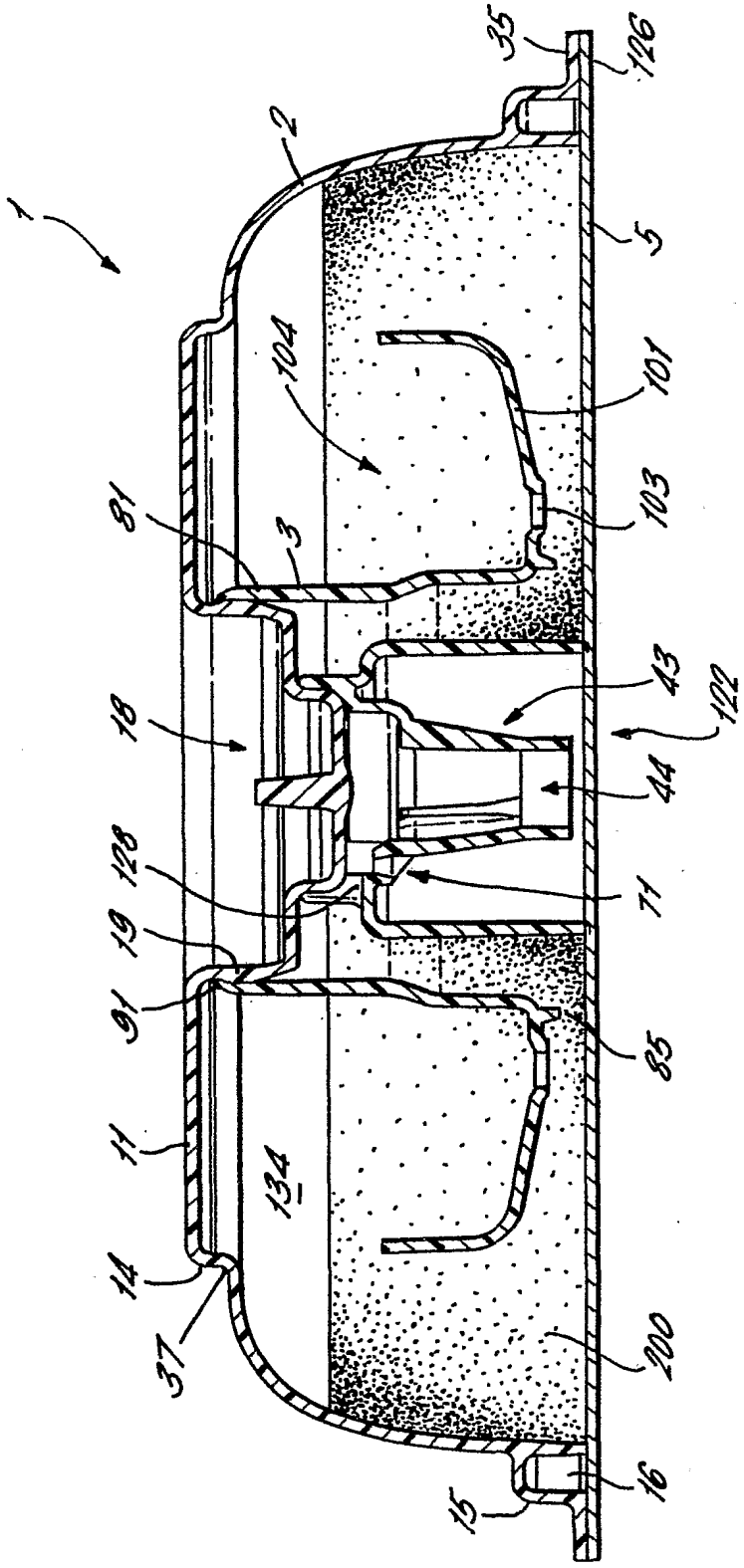

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FIG. 34.

FIG.35.

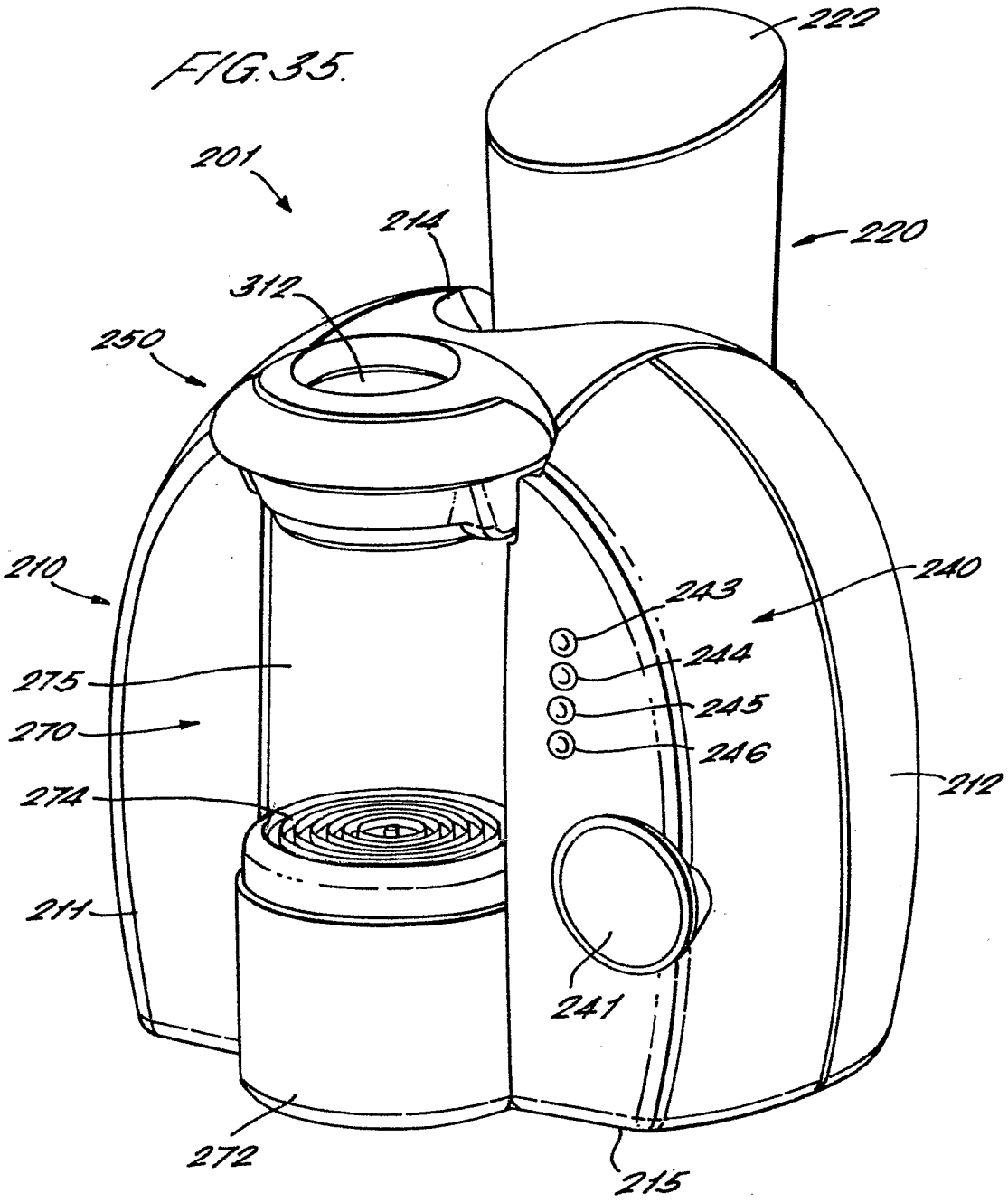

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FIG. 36.

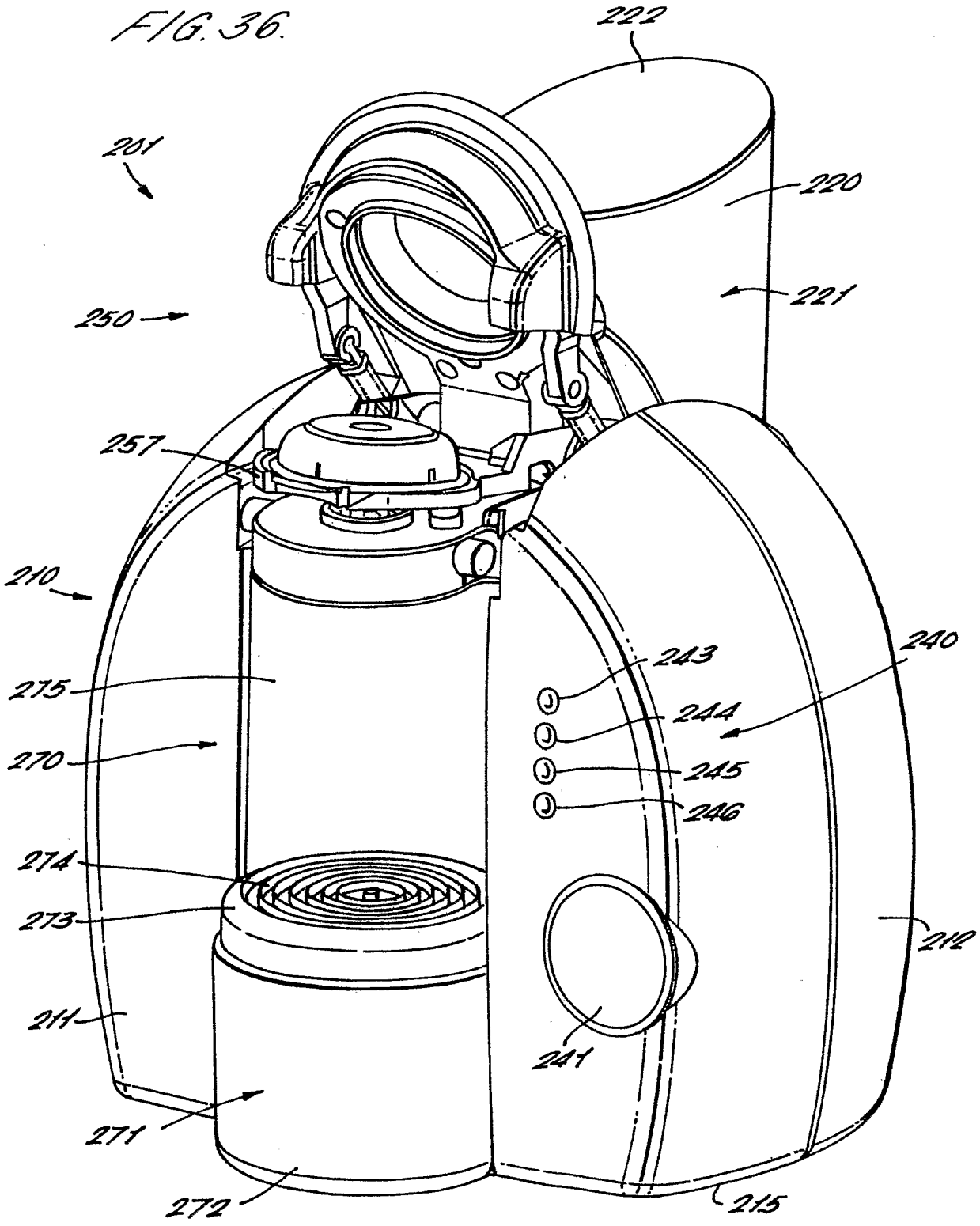
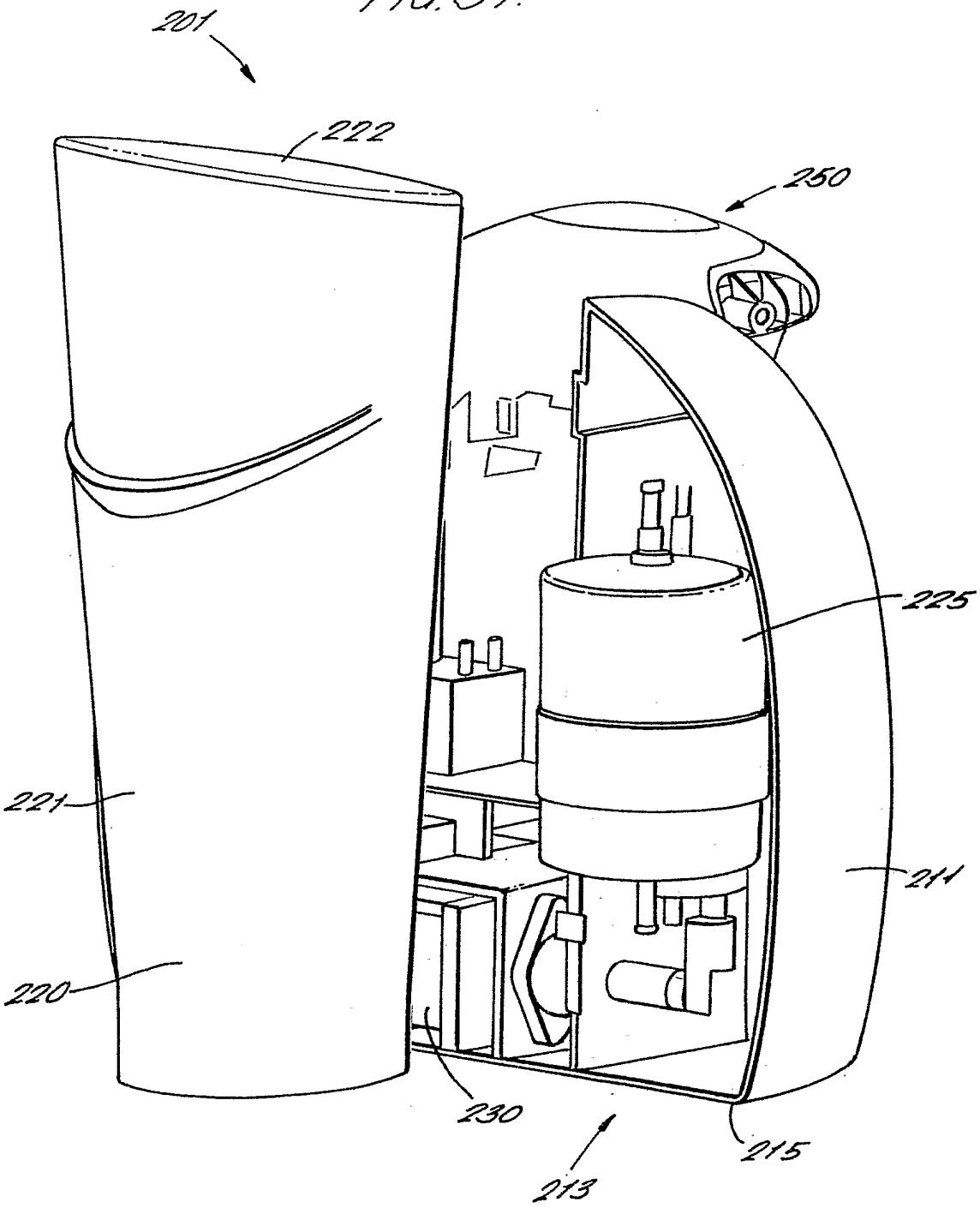
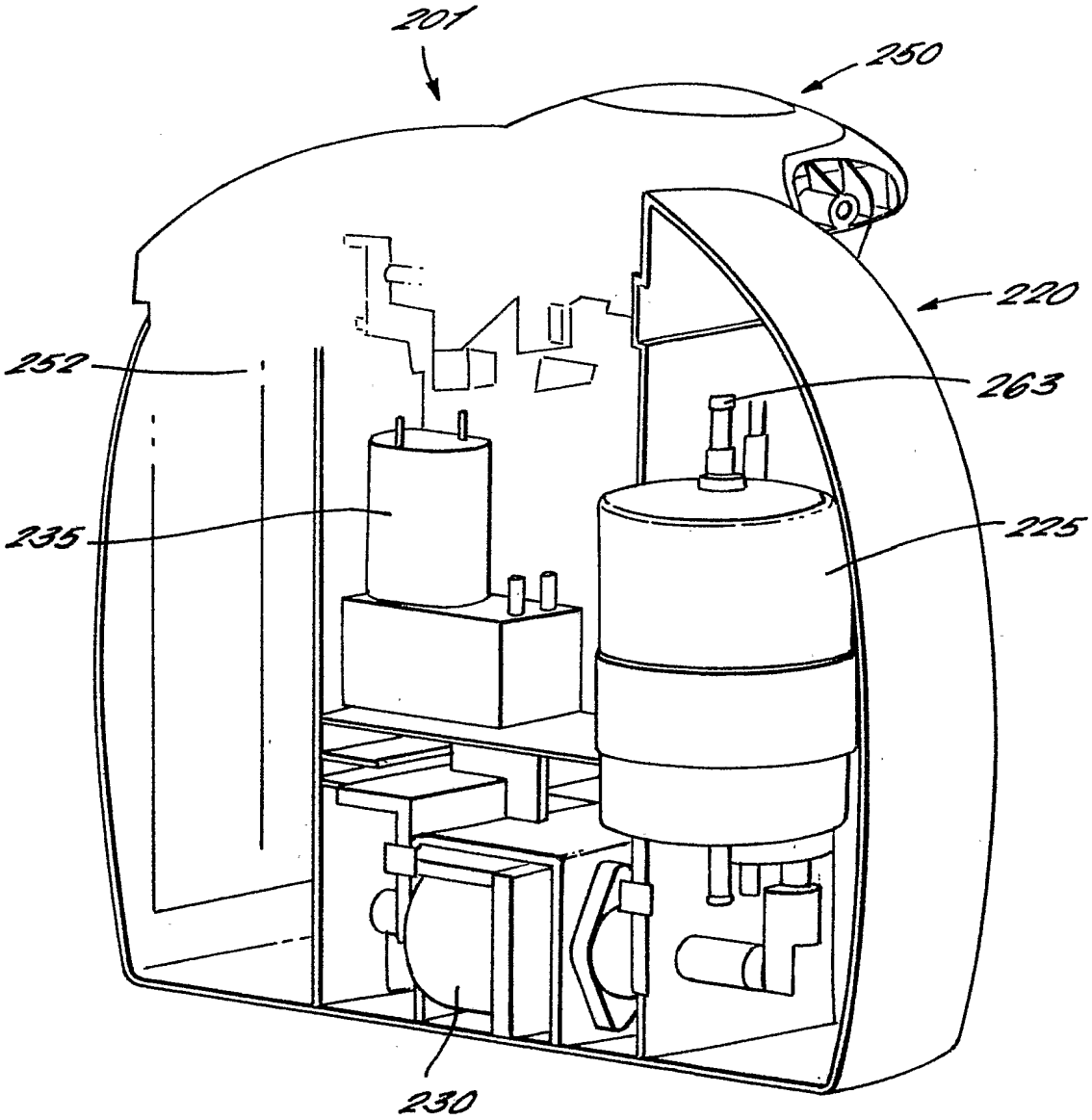

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FIG. 37.



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FIG. 38.



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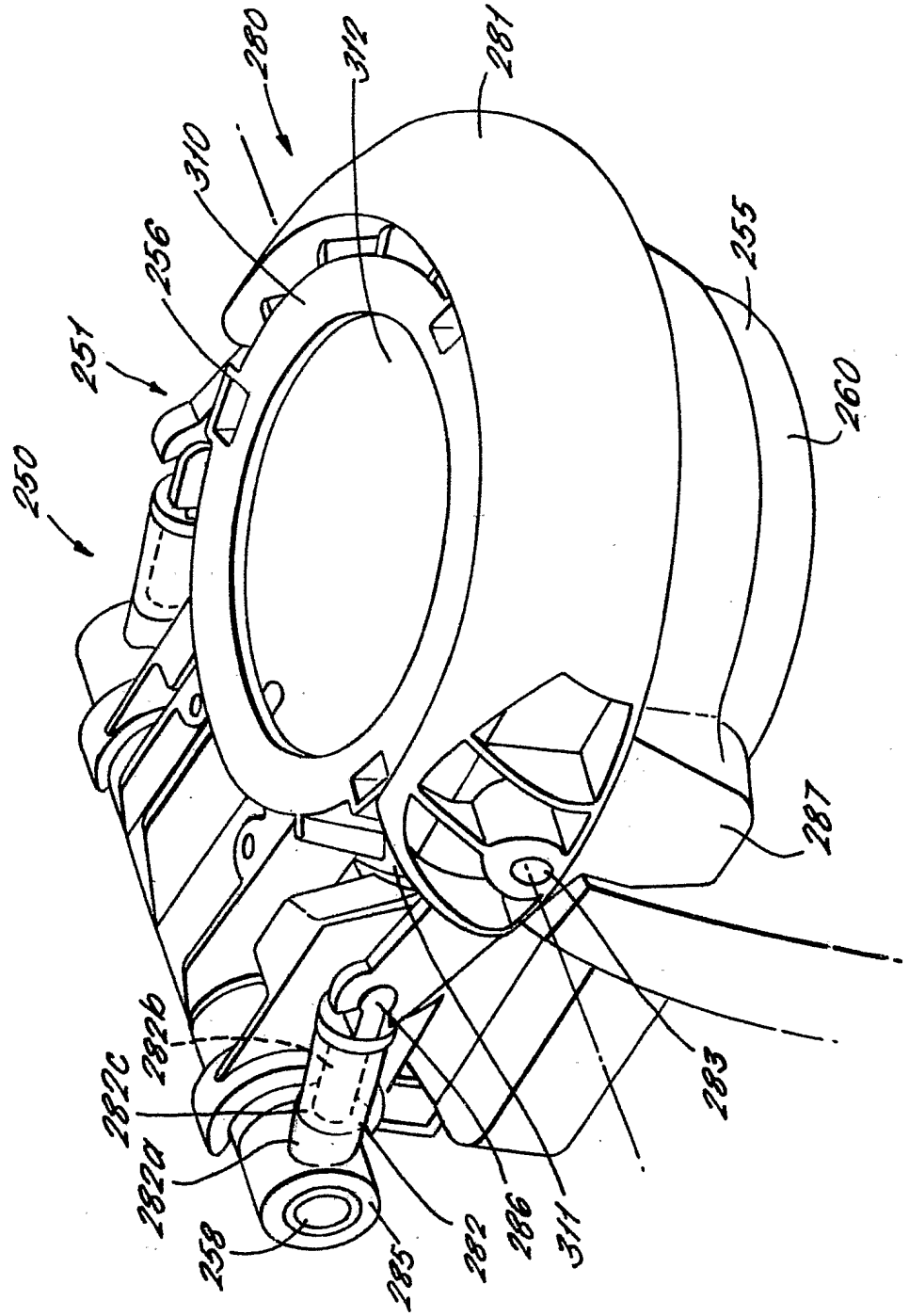
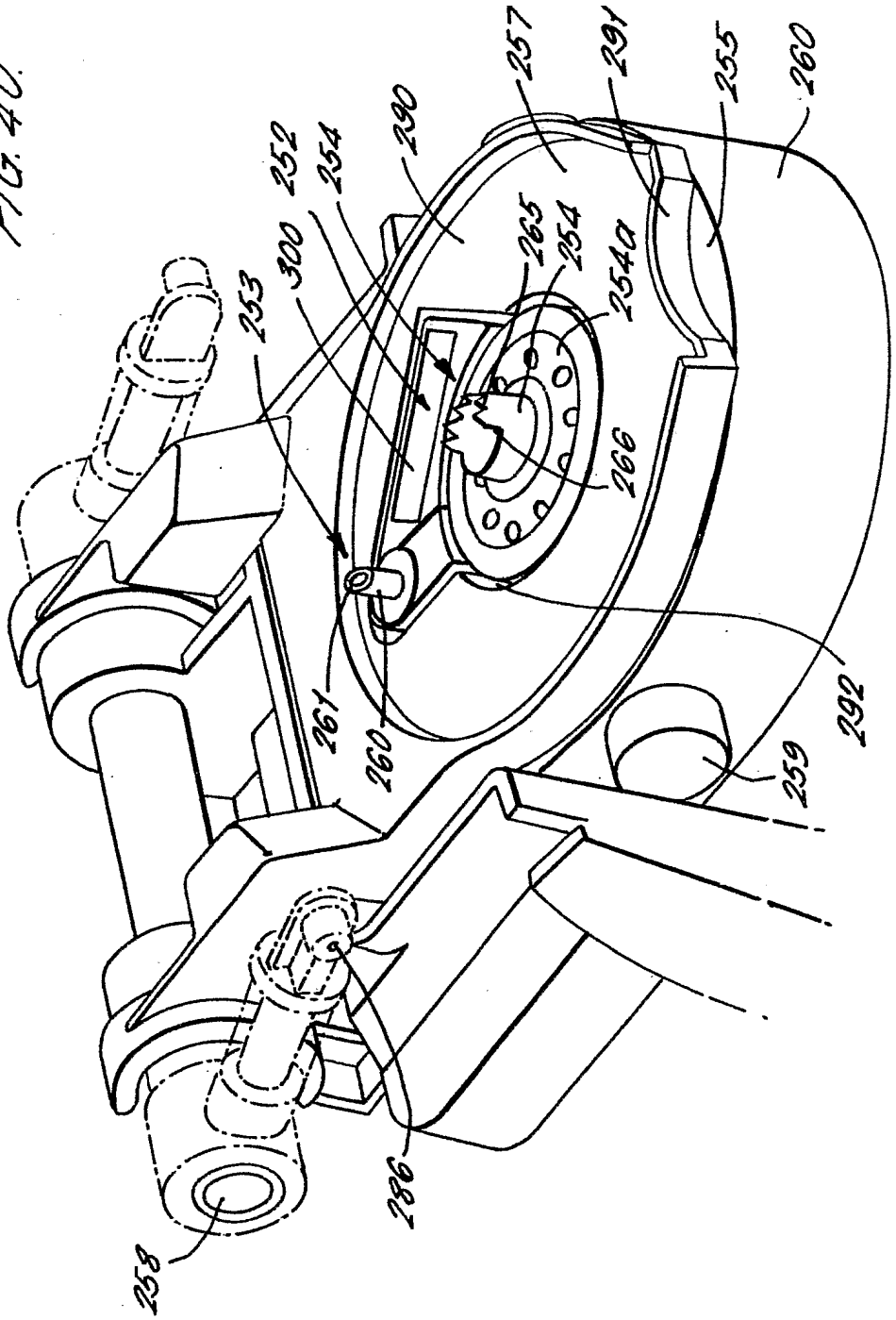

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FIG. 39.

FIG. 40.



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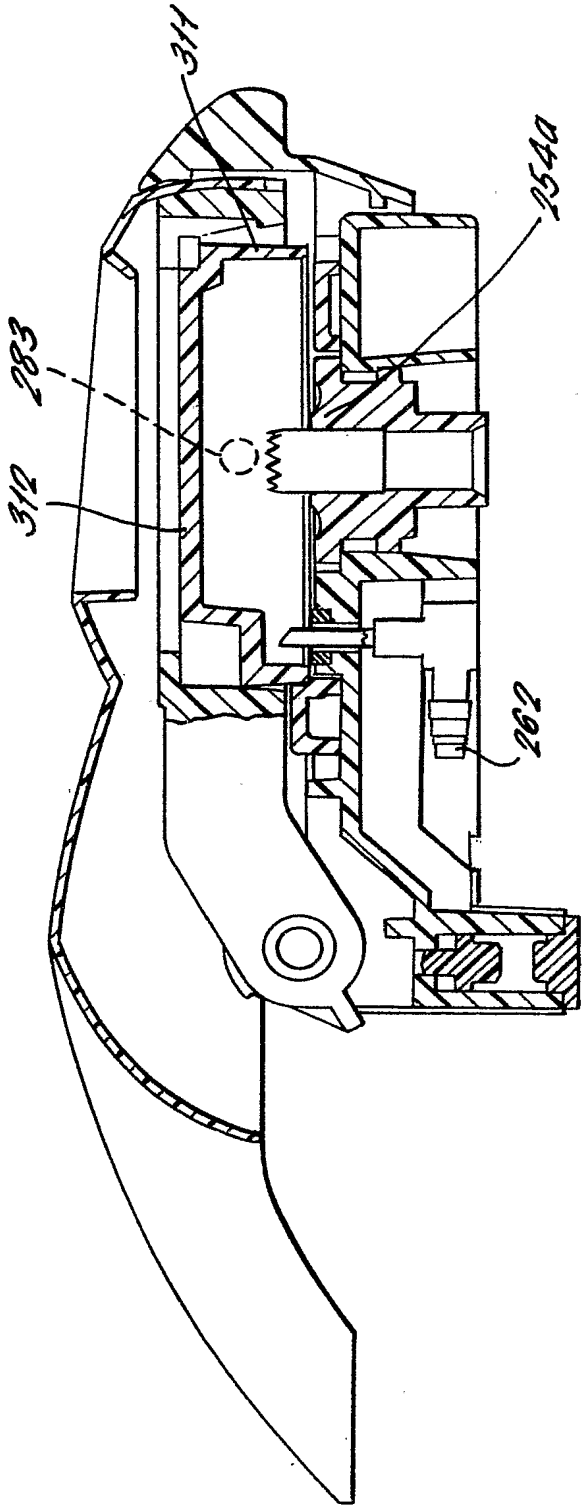
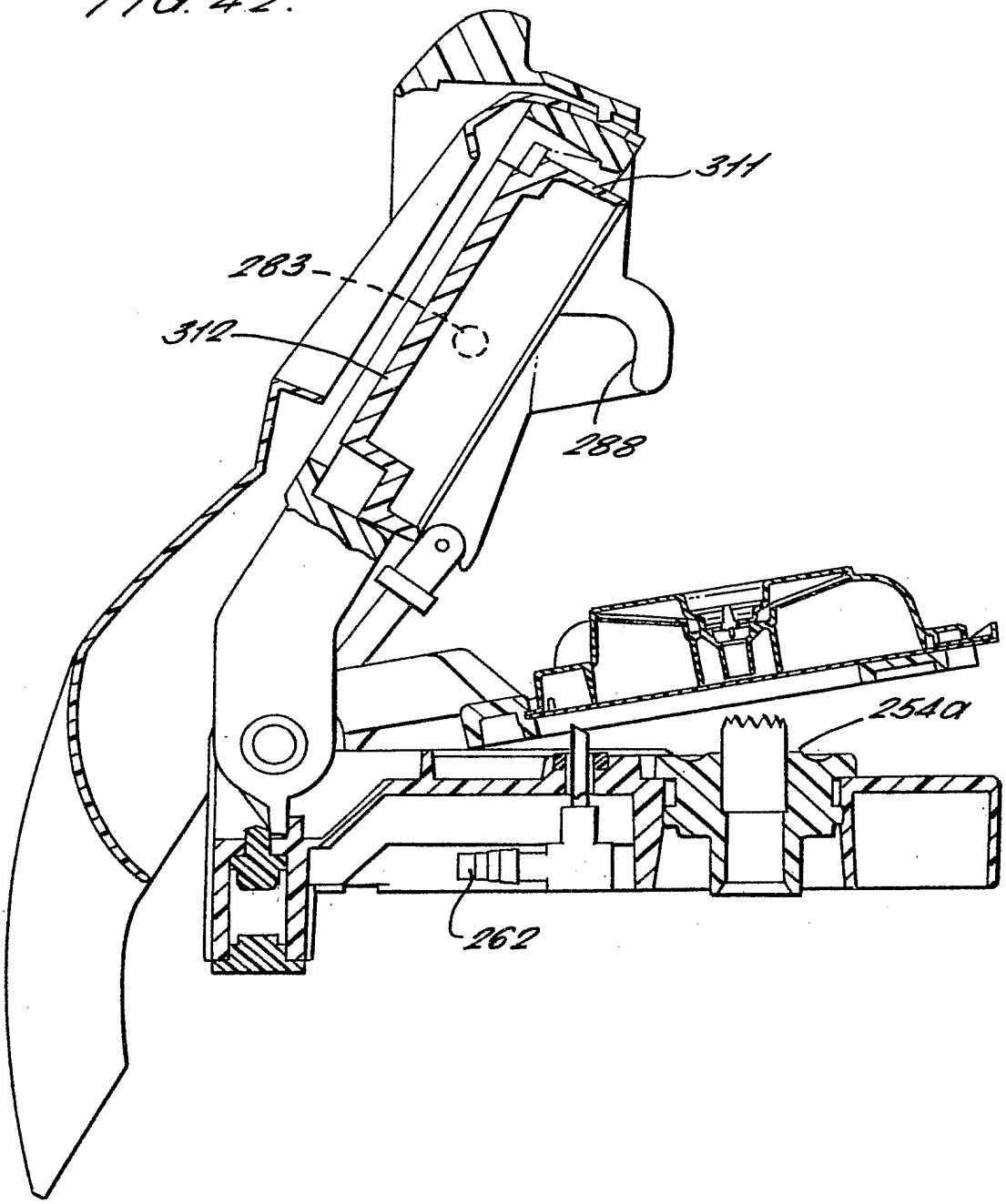


FIG. 41.

FIG. 42.



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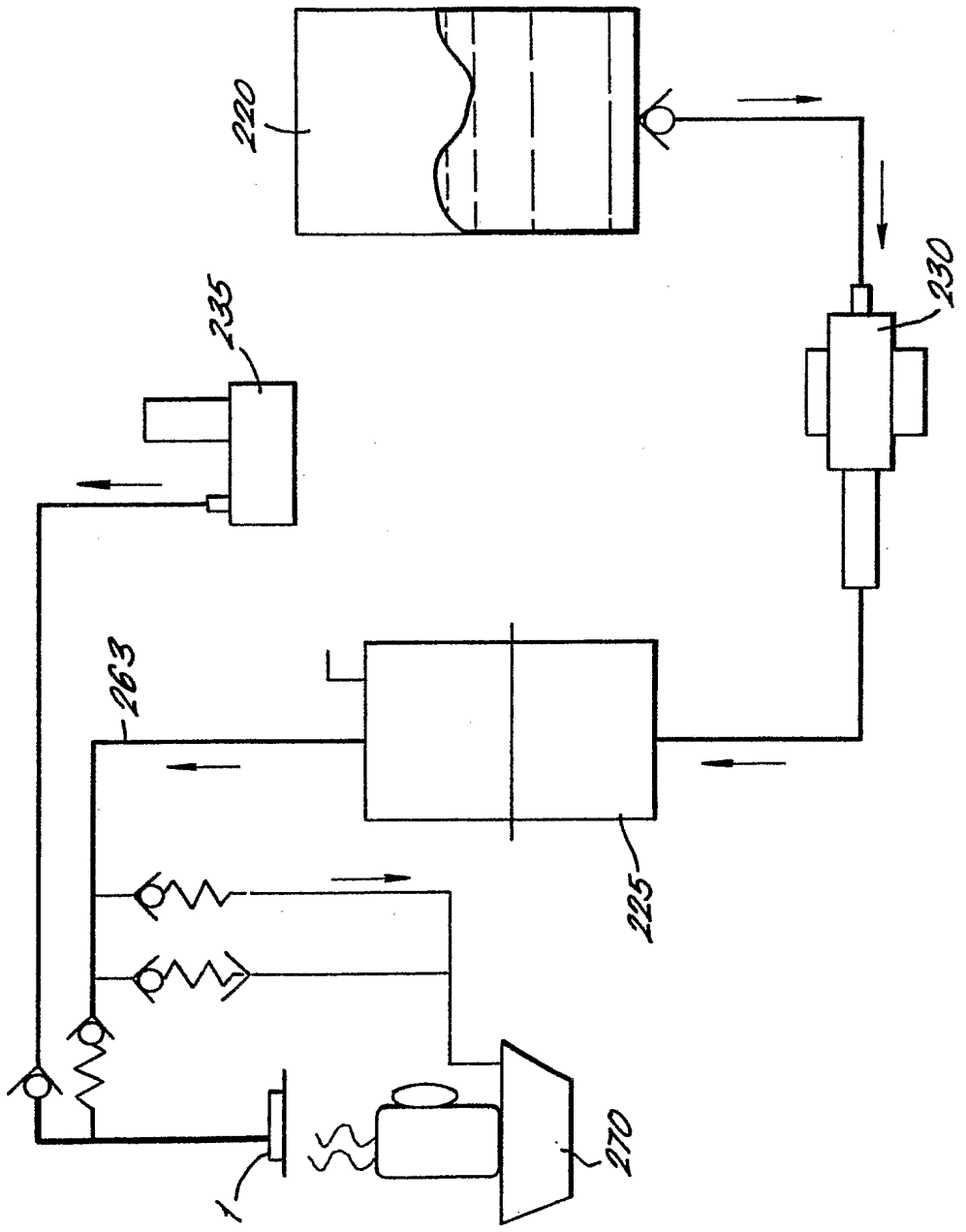


FIG. 43.

FIG. 44a.

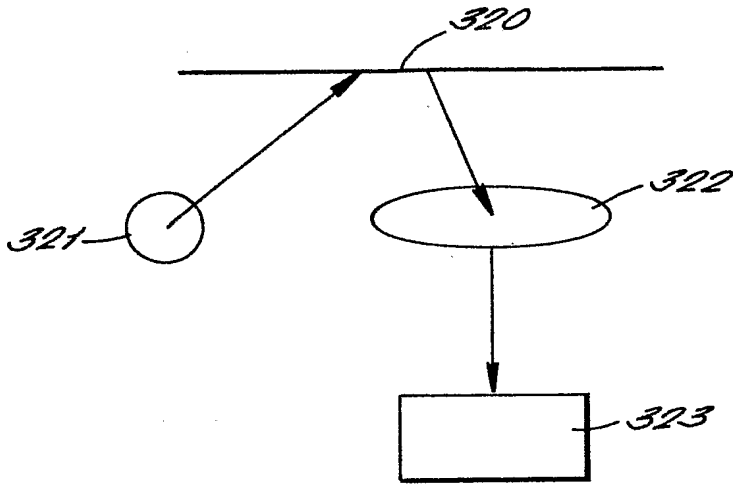


FIG. 44b.

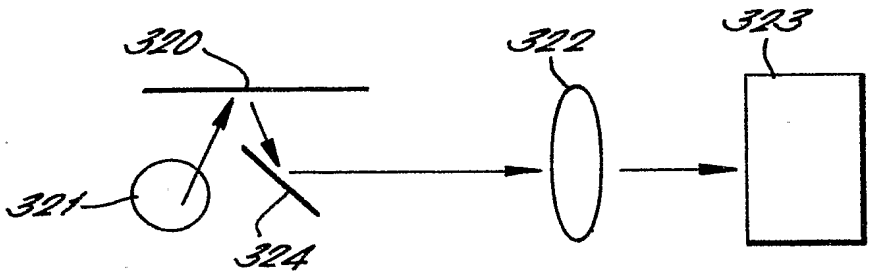
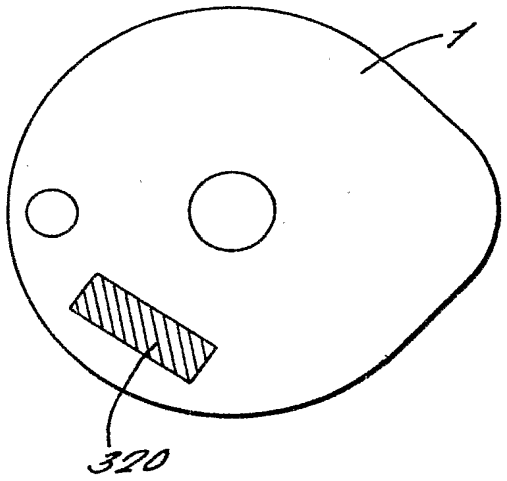


FIG. 45.



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FIG. 46a.

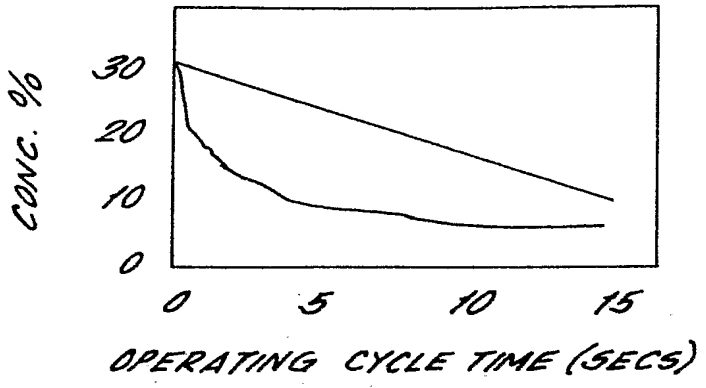


FIG. 46b.

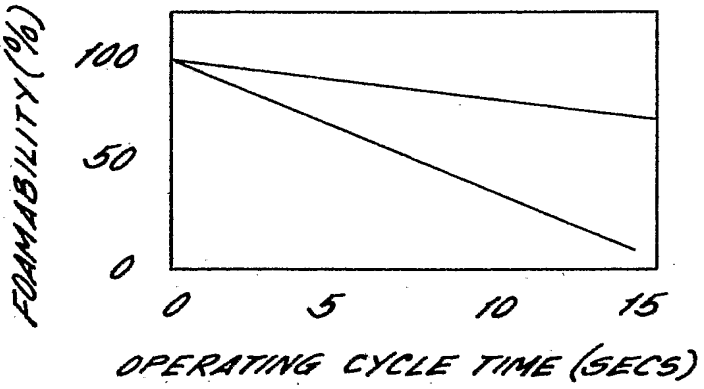
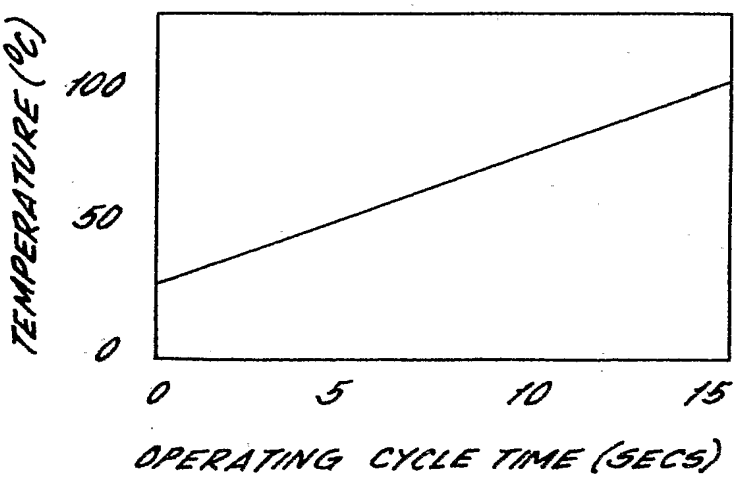


FIG. 46c.



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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

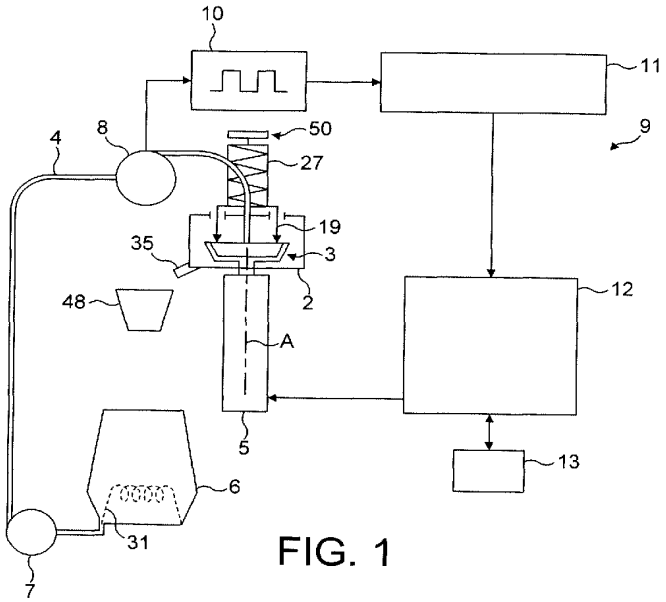


FIG. 1

(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.

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— *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.

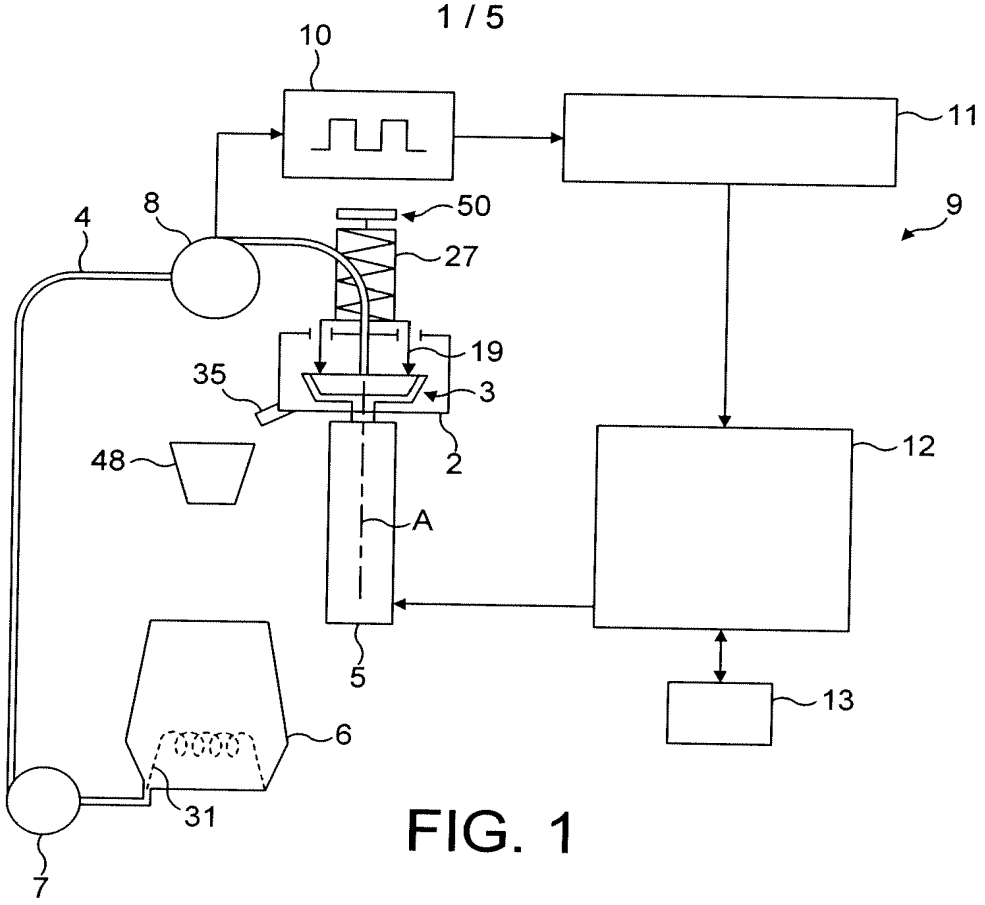

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FIG. 1

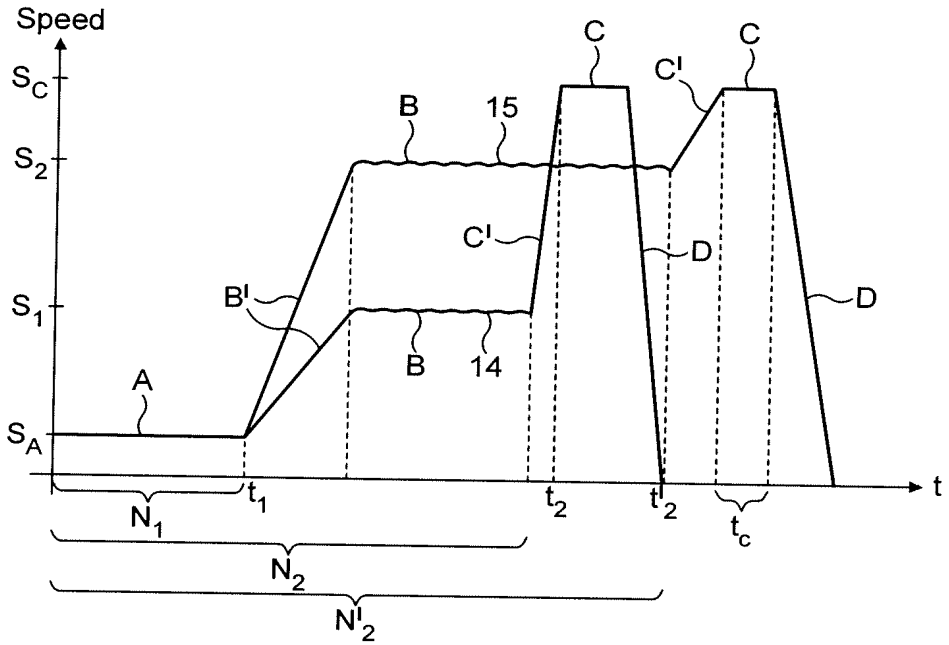

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FIG. 2

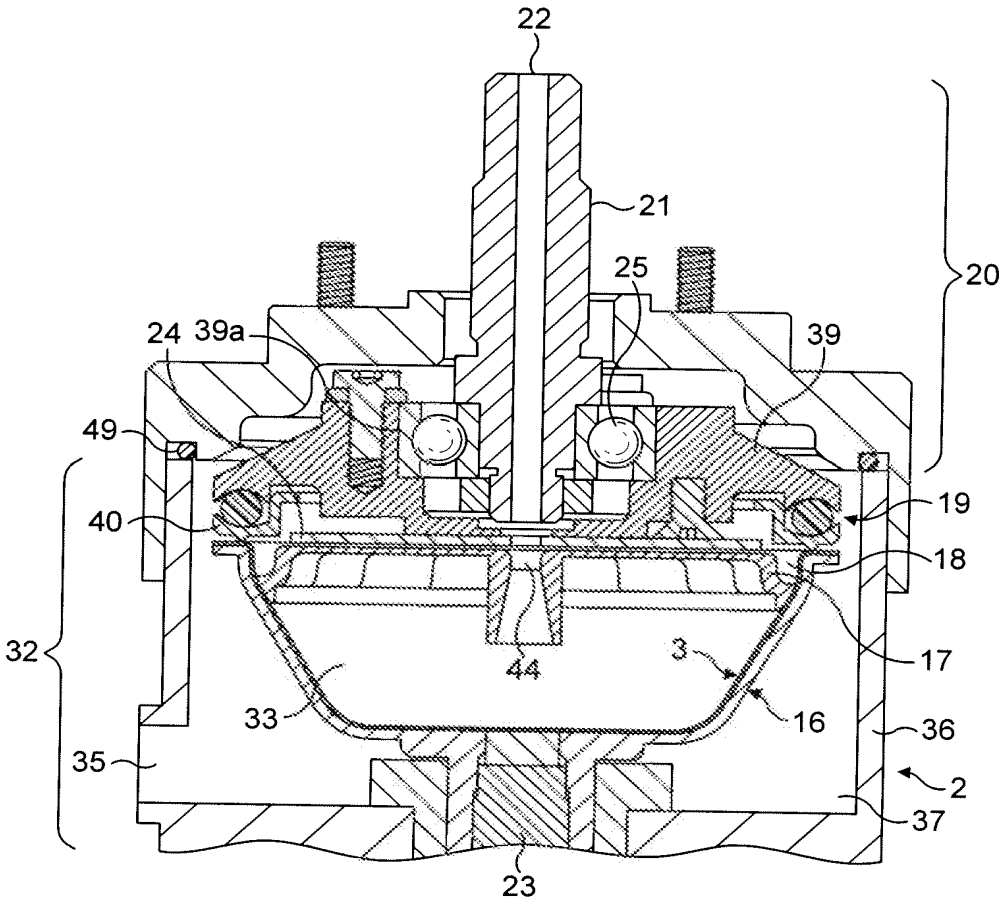

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FIG. 3

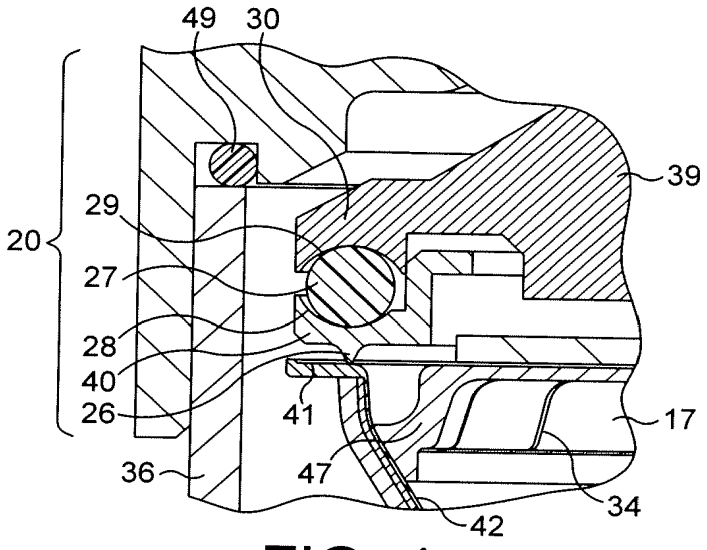

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FIG. 4

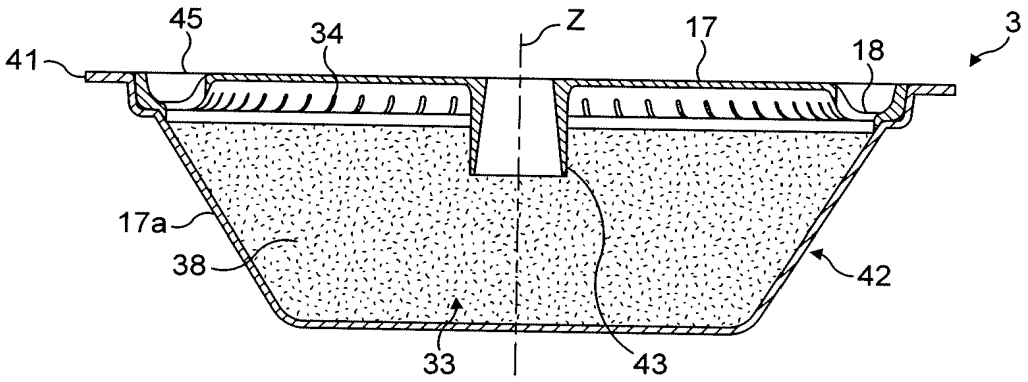


FIG. 5

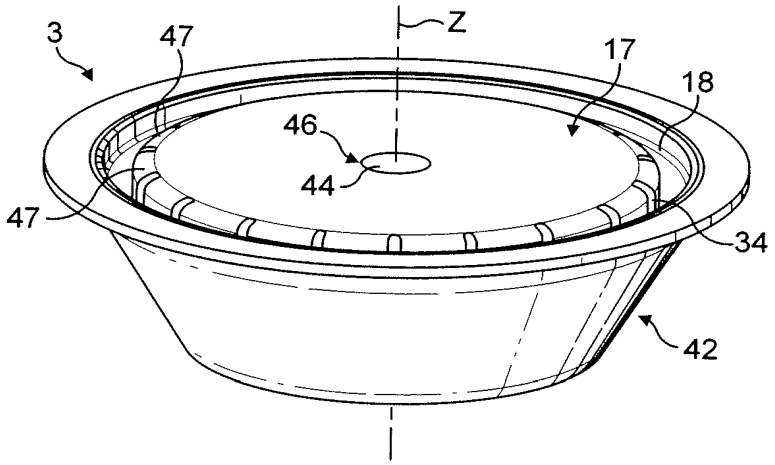


FIG. 6

K-FEE SYSTEM GMBH, EX2009, page 5571
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

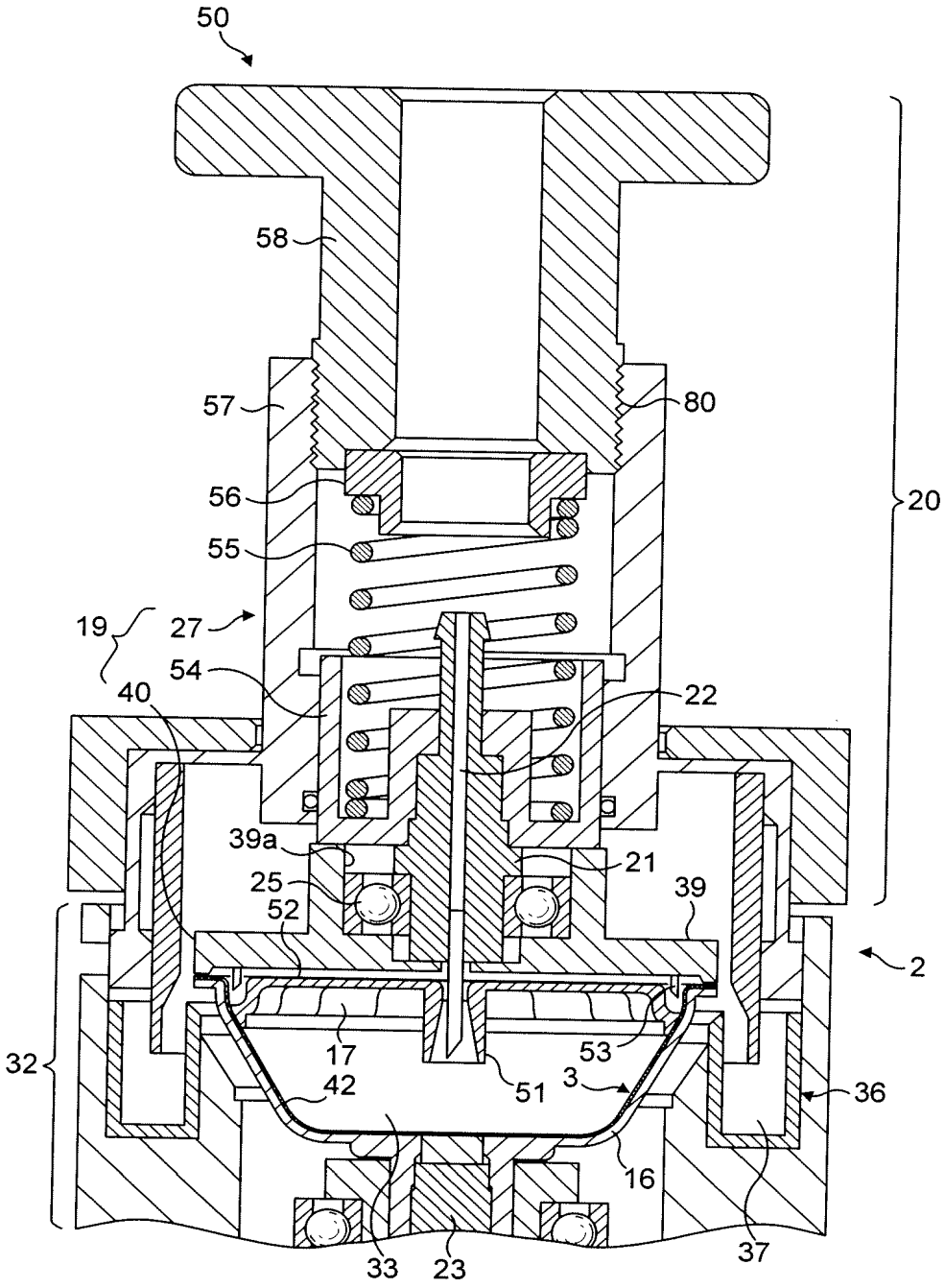

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FIG. 7

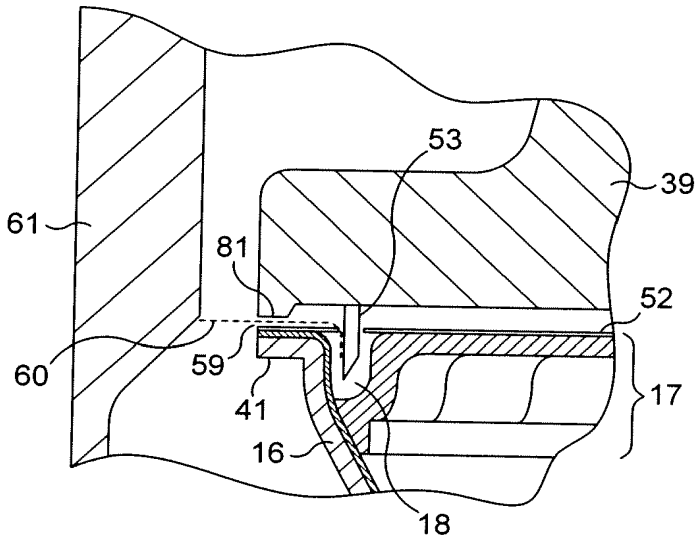

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FIG. 8

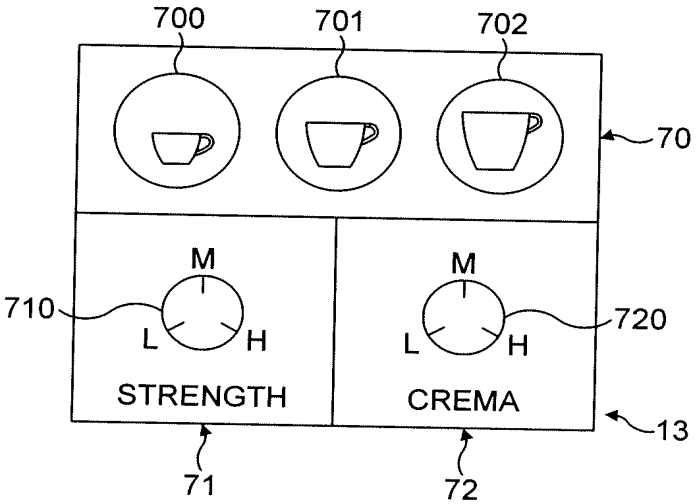

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FIG. 9

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

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

[X] See patent family annex.

* Special categories of cited documents :

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"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	

(12) DEMANDE INTERNATIONALE PUBLIÉE EN VERTU DU TRAITÉ DE COOPÉRATIONEN MATIÈRE DE BREVETS (PCT)

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(81) États désignés *(sauf indication contraire, pour tout titre de protection nationale disponible)* : 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.

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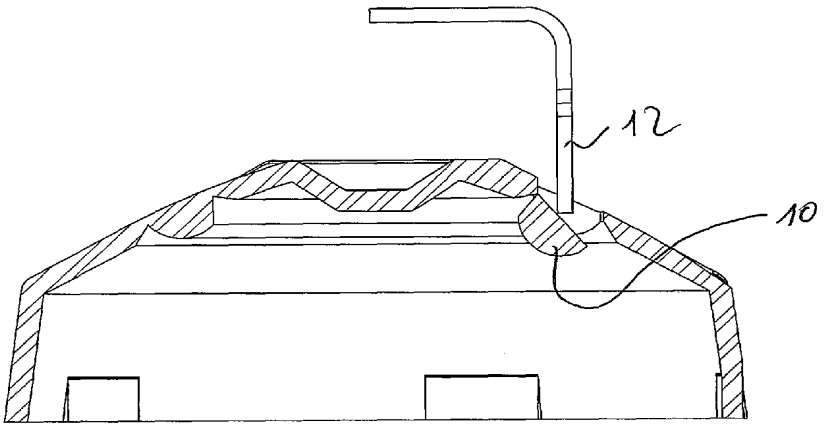
Publiée :

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(54) **Title** : CAPSULE FOR PREPARING A BEVERAGE

(54) **Titre** : CAPSULE POUR LA PRÉPARATION D'UNE BOISSON

FIG 12



(57) **Abstract** : The invention relates to a capsule (1) for preparing a beverage, for example coffee, comprising a hollow element intended to contain a metered amount, for example of ground coffee, said hollow element including a side wall (2), a top wall (3) and a bottom wall (4) comprising an extraction membrane; the top wall (3) comprising, on the inner surface thereof, a weakened area (11) capable of moving when an external element (12) exerts a force thereon, thereby providing a passage for the liquid to flow between the outside and the inside of the capsule (1).

(57) **Abrégé** :

[Suite sur la page suivante]

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K-FEE SYSTEM GMBH, EX2009, page 5577
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Capsule (1) pour la préparation d'une boisson, par exemple du café, comprenant un élément creux destiné à contenir une dose, p.ex. de café moulu, ledit élément creux comprenant une paroi latérale (2), une paroi supérieure (3) et une paroi inférieure (4) comportant une membrane d'extraction; la paroi supérieure (3) comportant sur sa face interne une zone d'affaiblissement (11) adaptée de manière à subir un déplacement lorsqu'un élément externe (12) exerce une force sur elle, offrant de la sorte un passage d'écoulement de liquide entre l'extérieur et l'intérieur de la capsule (1).

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

CAPSULE POUR LA PREPARATION D'UNE BOISSON

Domaine de l'invention

La présente invention se situe dans le domaine de la préparation de boissons, p.ex. à base de café, par extraction d'une dose concentrée, p.ex. de café moulu, contenue dans une capsule. Elle se rapporte plus particulièrement aux doses utilisées à cet effet ainsi qu'aux dispositifs utilisant de telles doses.

Etat de la technique

Des capsules et des machines fonctionnant selon le principe précité existent depuis de nombreuses décennies.

Les brevets US 2 899 886, US 2 968 560, US 3 403 617 et US 3 607 297 décrivent des dispositifs où la capsule est initialement perforée en plusieurs endroits, puis traversée par de l'eau sous pression.

La capsule décrite dans le brevet CH 605 293 ou dans le brevet EP 0 242 556 B1 comporte une membrane dans sa partie inférieure. De l'eau sous pression est initialement introduite dans la partie supérieure de la capsule, après percement de ladite capsule au moyen d'un élément tranchant (p.ex. une lame), ce qui entraîne un gonflement de la capsule, principalement au niveau de la membrane. A partir d'une certaine pression, la membrane se déchire, autorisant de la sorte l'écoulement d'un mélange eau-café.

D'autres capsules munies d'une membrane sont décrites dans les documents brevets suivants : EP 0 468 079 A, EP 0 806 373 A, EP 0 554 469 A.

Exposé général de l'invention

La présente invention comporte plusieurs améliorations par rapport aux capsules de l'état de la technique-

A cet effet, elle concerne une capsule pour la préparation d'une boisson, par exemple du café, comprenant un élément creux destiné à contenir une dose,

p.ex. de café moulu, ledit élément creux comprenant une paroi latérale, une paroi supérieure et une paroi inférieure comportant une membrane d'extraction; la paroi supérieure comportant sur sa face interne une zone d'affaiblissement adaptée de manière à subir un déplacement lorsqu'un élément externe exerce une force sur elle, offrant de la sorte un passage d'écoulement de liquide entre l'extérieur et l'intérieur de la capsule.

Un des avantages offert par la présente invention réside dans la possibilité de ménager des passages d'écoulement de liquide de section suffisamment large. Cela vaut particulièrement pour des capsules constituées d'un matériau biodégradable. Celui-ci a tendance à se gonfler en présence de liquide. En l'absence d'une zone d'affaiblissement de section suffisamment large le percement de la capsule par un élément tranchant n'autorise pas un écoulement suffisant du liquide au travers de la zone percée.
En dotant la capsule selon l'invention d'une zone d'affaiblissement de section large, la présence d'un espace d'écoulement est garantie.

Exposé détaillé de l'invention

L'invention est décrite plus en détail ci-après au moyen d'exemples non-limitatifs illustrés par les figures suivantes :

La figure 1 illustre un premier exemple de capsule selon l'invention
La figure 2 illustre une variante de la partie supérieure de la capsule de la figure 1
Les figures 3 illustre une autre variante de la partie supérieure de la capsule de la figure 1
La figure 4 présente l'intérieur de la capsule de la figure1
La figure 5 illustre un agrandissement d'une partie de l'intérieur de la capsule de la figure 1

La figure 6 illustre un enfoncement sur la face externe de la paroi latérale
La figure 7 présente un deuxième exemple de capsule selon l'invention.
La figure 8 présente un troisième exemple de capsule selon l'invention.
Les figures 9 et 10 illustrent la zone d'affaiblissement disposée sur la face interne de la paroi supérieure
Les figures 11 et 12 illustrent la rupture de la zone d'affaiblissement.

Liste des références numériques utilisées dans les figures :

1. Capsule
2. Paroi latérale
3. Paroi supérieure
4. Paroi inférieure
5. Evidement
6. Elément rigidifiant paroi supérieur
7. Elément rigidifiant paroi latérale
8. Elément rigidifiant bord supérieur
9. Protubérance interne
10. Bourrelet
11. Zone d'affaiblissement
12. Elément perçant

Il convient de relever en particulier les caractéristiques suivantes liées à la capsule selon l'invention :

a) Renforcement de la partie supérieure de la capsule par une architecture dite « poutraison », « renfort » ou « charpente » qui a pour but de renforcer la capsule à la pression de l'eau ainsi que lors de sa perforation. Il est également possible d'obtenir une structure renforcée au moyen de plis de matière. La renforcement

de la rigidité peut également être obetnu par une architecture de type « poutraison » ou « charpente » concave à la capsule (voir figure 2).
Avec cette structure, il est possible de diminuer la quantité de matière utilisée, p.ex. de matière biodégradable, des matières fines type PET, métal, ou tout autre matière à base des dérivés du pétrole.

b) L'intérieur de la capsule présente des éléments internes saillants ou une collerette circonférentielle qui ont pour fonction d'éviter un coincement lors de l'empilement des capsules à vide, préalablement à leur remplissage en usine. Ces mêmes éléments saillants offrent par ailleurs un renfort latéral de la capsule. (voir Figure 4).

c) A l'extérieur de la capsule, en regard de chaque élément saillant ou d'une collerette circonférentiel, un évidement est créé ce qui permet de renforcer les parties latérales de la capsule par effet de charpente, tout en économisant de la matière, (voire coupe) et permet notamment d'utiliser de la matière biodégradable et des matières fines type PET, métal, ou tout autre matière dérivée du pétrole. Le renfort latéral de la capsule peut aussi être créé par des plis de la matière (voir figure 5-6).

d) La partie latérale extérieure de la capsule présente des pants qui peuvent s'étendre jusque vers la partie inférieure de la capsule ou à une certaine distance sur la hauteur. Dans cette variante également, il est donc possible d'économiser de la matière tout en renforçant les parties latérales de la capsule (voir Figure 7-8).

En résumé, tous les systèmes de renfort mentionnés ci-dessus permettent d'être rigide avec moins de matière utilisée et d'utiliser avantageusement des matières biodégradables ou tout autre matière de type (PET, Métal), ou toute autre matière dérivée du pétrole.

La partie supérieure interne de la capsule est munie d'un bourrelet de matière au niveau des éléments perçants de la capsule (voir figure 4).
Sur les flans du bourrelet sont disposés des amorces de fissure. Lorsque qu'un élément perçant exerce une pression suffisante au niveau du bourrelet les amorces de fissure éclatent ce qui a pour effet de laisser de l'eau pénétrer dans la capsule (voir figure 9-12).

L'invention ne se limite pas aux exemples illustrés.

N'importe quelle structure de renfort peut être envisagée.

De préférence, la capsule est formée d'un matériau biodégradable.

Avantageusement, le matériau biodégradable peut être d'origine végétale.

Selon une variante, le matériau comprend les composants suivants :
Amidon (> 70 %), fibres, protéines, lipides, glycérine d'origine végétale, résines biodégradables.

Selon une autre variante, le matériau comprend les composants suivants :
Amidon (> 70 %), fibres, protéines, lipides, résine biodégradable, colorant minéral.

A relever enfin que la capsule selon l'invention peut également être utilisée avec des dispositifs de l'état de la technique qui sont dotés de lames pour l'introduction de l'eau dans la capsule.

Revendications

1. Capsule (1) pour la préparation d'une boisson, par exemple du café, comprenant un élément creux destiné à contenir une dose, p.ex. de café moulu, ledit élément creux comprenant une paroi latérale (2) , une paroi supérieure (3) et une paroi inférieure (4) comportant une membrane d'extraction; la paroi supérieure (3) comportant sur sa face interne une zone d'affaiblissement (11) adaptée de manière à subir un déplacement lorsqu'un élément externe (12) exerce une force sur elle, offrant de la sorte un passage d'écoulement de liquide entre l'extérieur et l'intérieur de la capsule (1).

2. Capsule selon la revendication 1 dans laquelle ladite zone d'affaiblissement se présente sous la forme d'un bourrelet dont les bords ont une épaisseur inférieure à l'épaisseur moyenne de la paroi supérieure.

3. Capsule selon la revendication 1 ou 2 dans laquelle la section de la zone d'affaiblissement est supérieure à la section dudit élément externe.

4. Capsule selon l'une des revendications 1 à 3 comprenant des évidements latéraux auxquels sont associés des protubérances internes.

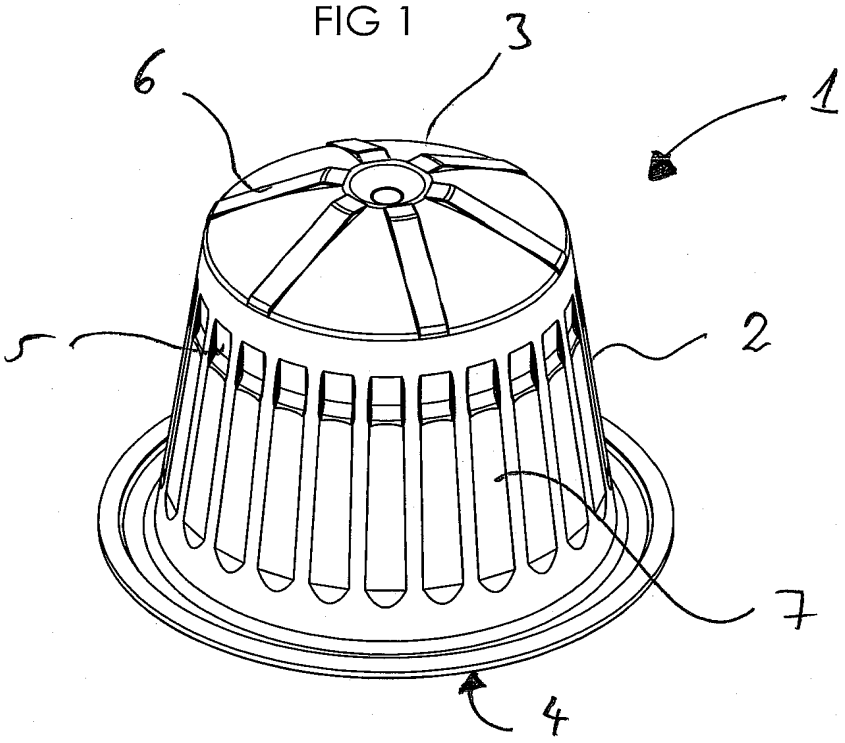
5. Capsule selon l'une des revendications précédentes comportant des éléments de renforcement de sa rigidité.

6. Capsule selon la revendication 5 dans laquelle lesdits éléments de renforcement sont disposés sur la paroi supérieure de la capsule.

7. Capsule selon la revendication 5 ou 6 dans laquelle lesdits éléments de renforcement sont disposés sur la paroi latérale de la capsule.

8. Capsule pour la préparation d'une boisson, par exemple du café, constituée d'un matériau biodégradable comprenant les éléments suivants : Amidon (> 70 %), fibres, protéines, lipides et au moins une résine biodégradable.

FIG 1



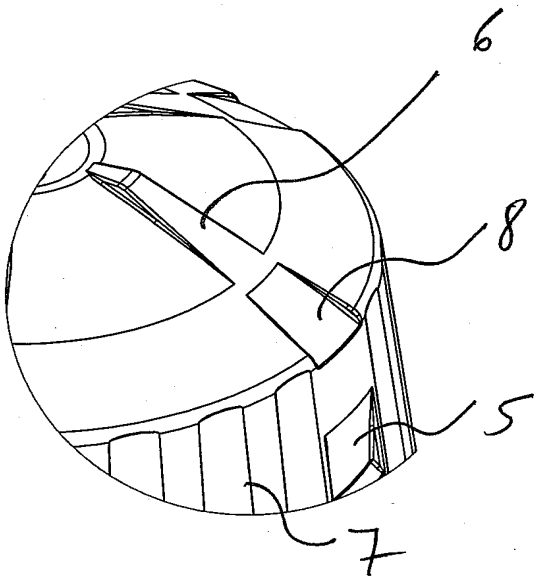


FIG 2

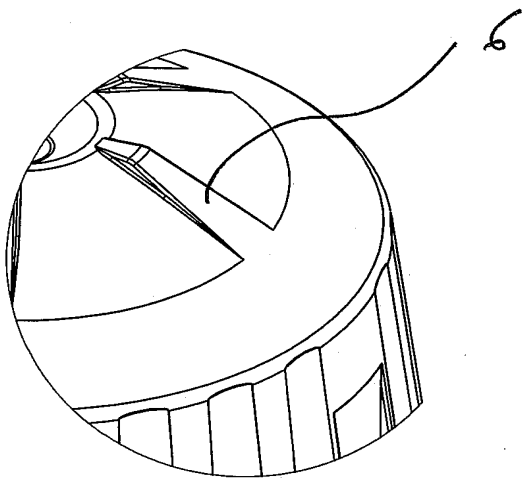


FIG 3

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FIG 4

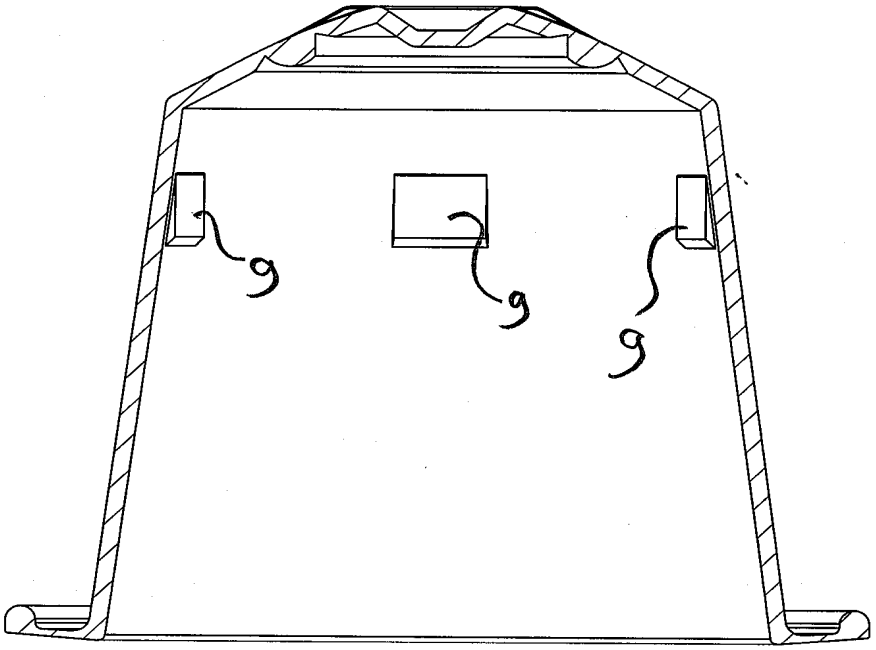


FIG 5

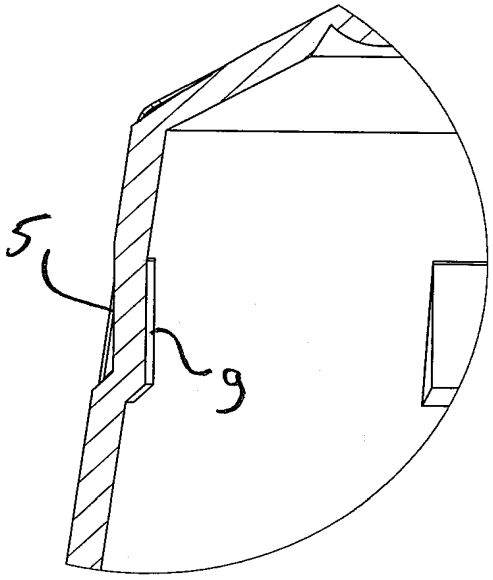
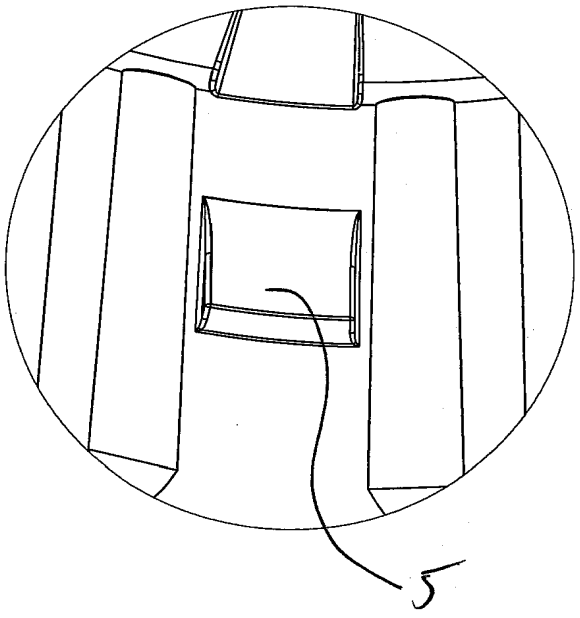


FIG 6



K-FEE SYSTEM GMBH, EX2009, page 5587
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

FIG 7

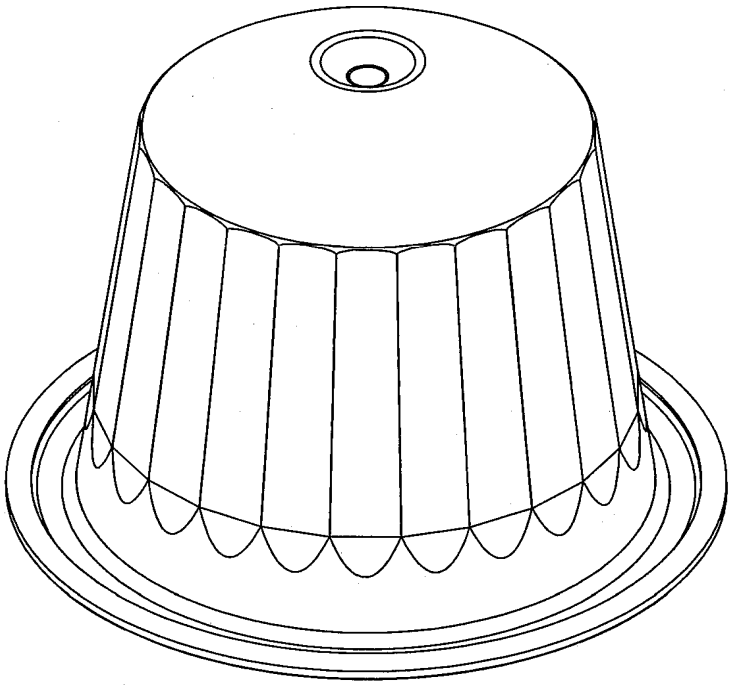


FIG 8

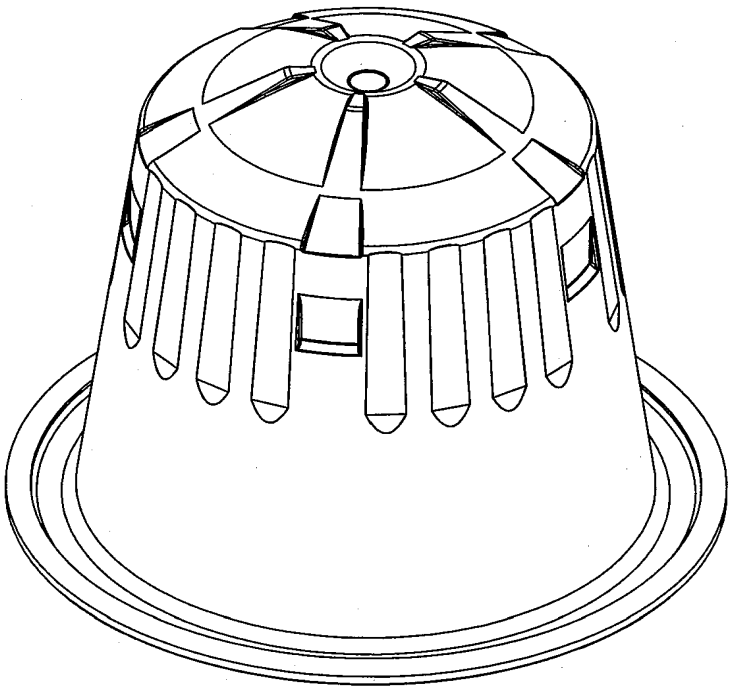


FIG 9

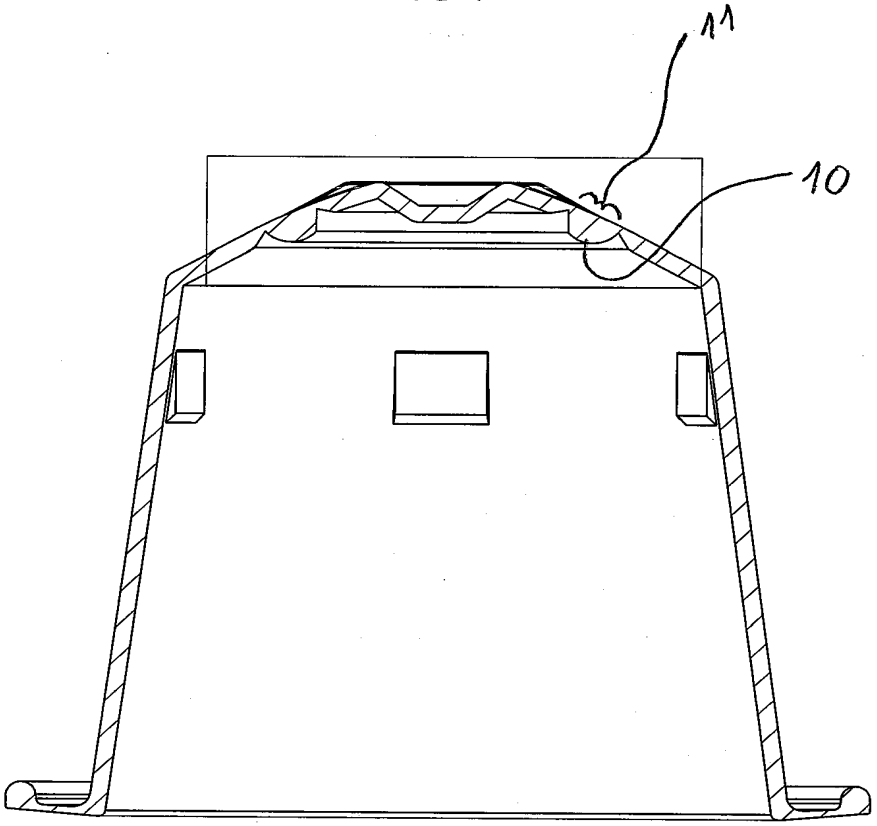


FIG 10

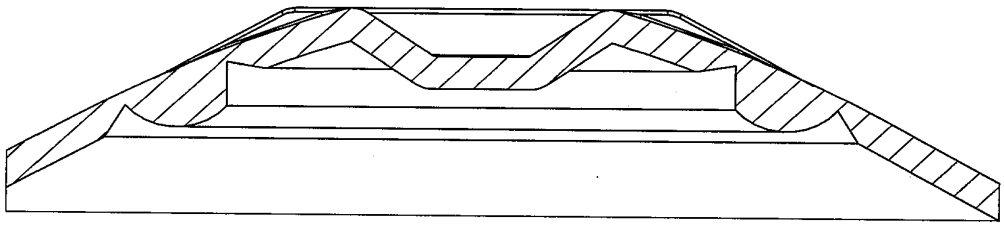


FIG 11

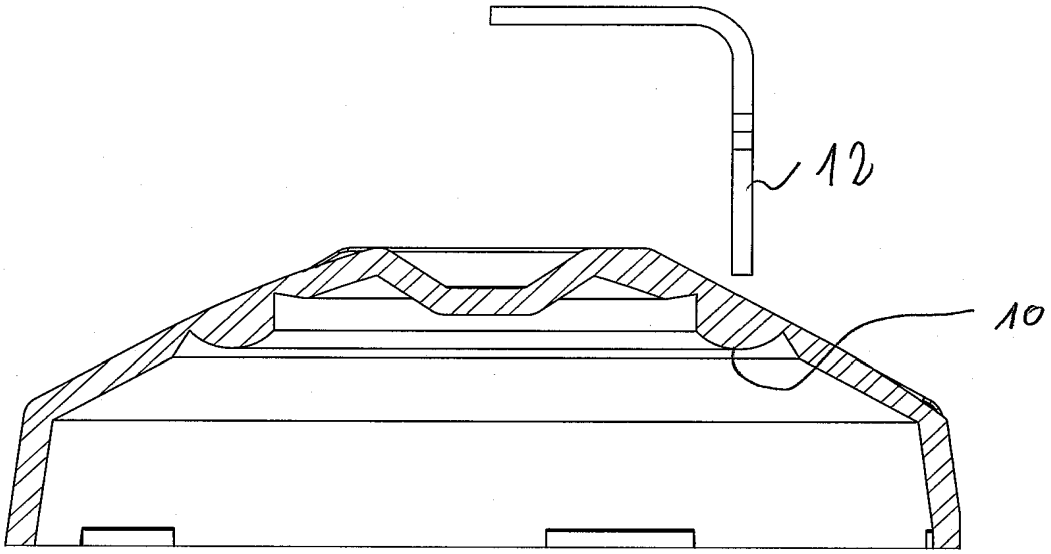
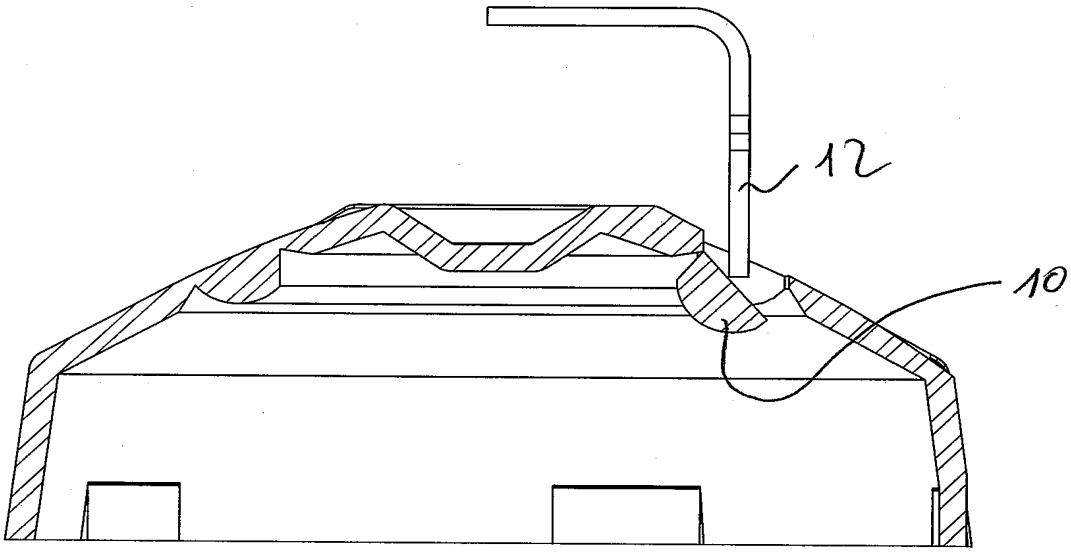


FIG 12



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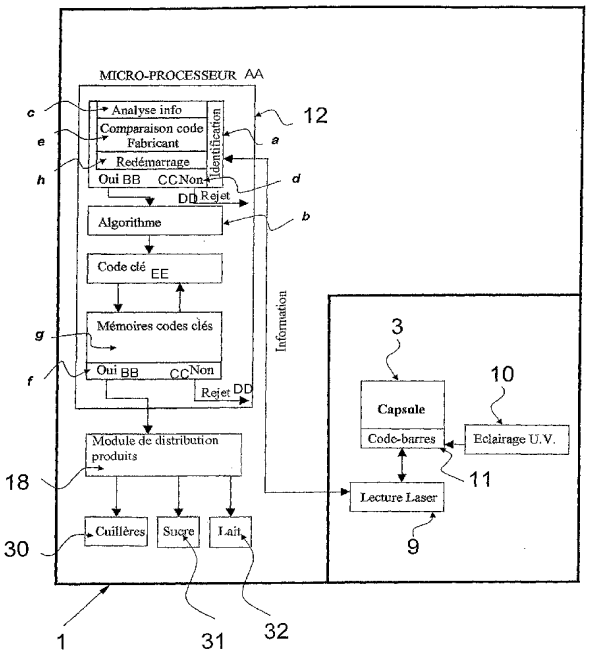
(81) États désignés *(sauf indication contraire, pour tout titre de protection nationale disponible)* : AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH,

[Suite sur la page suivante]

WO 2005/044067 A1

(54) Title: APPARATUS FOR DETERMINING THE TRACEABILITY OF THE CONTENTS OF A CONTAINER AND THE ORIGIN THEREOF

(54) Titre : APPAREIL PERMETTANT D'ETABLIR LA TRACABILITE D'UN CONTENU DANS UN RECEPTACLE ET L'ORIGINE DUDIT RECEPTACLE



AA MICROPROCESSOR
C PROCESS INFORMATION
E COMPARE MANUFACTURER CODE
H RESTART
BB YES
CC NO
DD REJECTION
B ALGORITHM
EE KEY CODE
G KEY CODE MEMORIES
18 PRODUCT DISPENSER MODULE
30 SPOONS
31 SUGAR
32 MILK
11 BARCODE
10 UV LIGHT
9 LASER READOUT

(57) **Abstract:** The aim of the present invention is to provide an apparatus for determining the traceability of the contents of a container (3) as well as the origin of said container (3), wherein information (11) provided on said container can be read out using an optical and/or magnetic reader but is invisible to the naked eye. Said container (3) comprises a pierceable upper portion for injecting a liquid into the container (3), and a pressure-pierceable lower diaphragm for discharging the liquid flavoured by the contents of the container (3). The apparatus includes an optical and/or magnetic reader (9) for reading said information (11) off a container (3) placed inside the apparatus, a microprocessor for encrypting and decrypting, processing, comparing, approving or rejecting and storing the information (11) read off a container (3), and for selectively initiating or not initiating an operative cycle which includes piercing the upper portion of the container (3) and injecting the liquid, as well as for storing (11) said information to ensure readiness for the initiation of a fresh cycle.

(57) **Abrégé :** Le but de la présente invention est de proposer un appareil permettant d'établir la traçabilité d'un contenu dans un réceptacle (3) et l'origine dudit réceptacle (3) sur lequel figurent des informations (11) lisibles au moyen d'un lecteur optique et/ou magnétique mais invisibles à l'ceil nu. Ledit réceptacle (3) est du type comportant une partie supérieure perforable pour l'injection du liquide dans le réceptacle (3) et une membrane inférieure perforable sous pression pour la sortie dudit liquide aromatisé par le contenu du réceptacle (3). L'appareil comprend un lecteur (9) optique et/ou magnétique pour la lecture desdites informations (11) sur un réceptacle

[Suite sur la page suivante]

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PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) États désignés *(sauf indication contraire, pour tout titre de protection régionale disponible)* **:** ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), eurasien (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), européen (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Déclarations en vertu de la règle 4.17 :

— *relative au droit du déposant de demander et d'obtenir un brevet (règle 4.17.ii)) pour toutes les désignations*

— *relative au droit du déposant de revendiquer la priorité de la demande antérieure (règle 4.17.iii)) pour toutes les désignations*

— *relative à la qualité d'inventeur (règle 4.17.iv)) pour US seulement*

Publiée :

— *avec rapport de recherche internationale*

En ce qui concerne les codes à deux lettres et autres abréviations, se référer aux "Notes explicatives relatives aux codes et abréviations" figurant au début de chaque numéro ordinaire de la Gazette du PCT.

(3) introduit dans l'appareil, un microprocesseur (12) permettant de crypter/décrypter, analyser, comparer, approuver/refuser et stocker des informations (11) lues sur un réceptacle (3), et agencé pour sélectivement démarrer ou non un cycle d'opérations comprenant le perçage de la partie supérieure du réceptacle (3) et l'injection du liquide, ainsi que pour le stockage des informations (11) lues afin d'être prêt pour démarrer un nouveau cycle.

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APPAREIL PERMETTANT D'ETABLIR LA TRAÇABILITE D'UN CONTENU DANS UN RECEPTACLE ET L'ORIGINE DUDIT RECEPTACLE

La présente invention est relative au domaine des réceptacles, plus particulièrement aux réceptacles permettant l'emmagasinage ou le transport de substances destinées à aromatiser des boissons.

Un réceptacle est un contenant qui reçoit son contenu de diverses provenances.

La traçabilité est la possibilité d'identifier l'origine d'un produit tout en reconstituant son parcours, depuis sa production jusqu'à sa diffusion.

Il est connu d'utiliser des appareils permettant d'obtenir du café par infusion, ce dernier étant conservé dans un réceptacle appelé capsule.

Un tel appareil est décrit dans la publication EP 0607159 A1 qui présente une machine pour produire automatiquement des cafés ou boissons similaires à partir d'une pluralité de réceptacles préformés. Ce type d'appareil n'utilise pas de moyens électroniques de reconnaissance des réceptacles dont la seule fonction est de préserver l'arôme du contenu afin qu'il conserve les meilleures saveurs.

Un procédé pour extraire une substance aromatique contenue dans un réceptacle hermétique est décrit dans le document EP 025810 A1 qui préconise l'injection d'eau chaude dans ledit réceptacle et, une fois des conditions de température/pression obtenues, amener une membrane de celui-ci à s'ouvrir permettant au liquide imprégné de la substance aromatique de s'en échapper. Ce dispositif n'utilise pas des réceptacles sécurisés permettant la traçabilité du contenu desdits réceptacles.

Le document DE20105605U présente un dispositif qui garantit l'hermétisme d'un réceptacle, assurant ainsi la qualité du produit qu'il contient. Il est à noter que ce dispositif est muni d'un transpondeur et permet de détruire un système visible de sécurité porté par les réceptacles qu'il utilise.

Le document WO02078498 présente un identificateur lisible situé sur le sommet de réceptacles utilisés par des machines à café Expresso, ce qui permet de garantir la qualité d'un produit en détruisant des informations d'hermétisme portées par ledit réceptacle. Ce dispositif est visible ce qui permet la reprise des informations contenues dans le dispositif.

Le but de la présente invention est de proposer un appareil permettant de lire la traçabilité d'un contenu dans un réceptacle et de déterminer l'origine des contenants que ledit appareil utilise.

Ce but est atteint par un appareil permettant d'établir la traçabilité d'un contenu dans un réceptacle et l'origine dudit réceptacle sur lequel figurent des informations lisibles au moyen d'un lecteur optique et/ou magnétique mais invisibles à l'œil nu, ledit réceptacle étant du type comportant une partie supérieure perforable pour l'injection du liquide dans le réceptacle et une membrane inférieure perforable sous pression pour la sortie dudit liquide aromatisé par le contenu du réceptacle, l'appareil comprenant un lecteur optique et/ou magnétique pour la lecture desdites informations sur un réceptacle introduit dans l'appareil, et un microprocesseur permettant de crypter/décrypter, analyser, comparer, approuver/refuser et stocker des informations lues sur un réceptacle, et agencé pour sélectivement démarrer ou non un cycle d'opérations comprenant le perçage de la partie supérieure du réceptacle et l'injection du liquide, ainsi que pour le stockage des informations lues afin d'être prêt pour démarrer un nouveau cycle.

On obtient ainsi un système qui identifie un réceptacle, compare l'information que porte celui-ci au code du fabricant contenu dans une mémoire du système, accepte ou refuse l'information, mémorise celle-ci afin de ne pas permettre sa récupération, autorise la distribution de produits et recommence un cycle de travail. Il est à noter que l'information contient les données concernant la traçabilité du produit mais également celles concernant l'origine du réceptacle et sont apposées sur ce dernier par le fabricant au moment de la production de celui-ci.

L'identification est opérée, notamment sur une base magnétique portant les informations de traçabilité et d'origine, par un lecteur à tête magnétique tournante qui lit l'information et la transmet.

L'acceptation/refus sont déterminés par un microprocesseur qui, après avoir crypter les informations d'origine, compare celles-ci aux codes clés du fabricant afin de libérer/refuser la distribution de produits.

La mémorisation est fournie par le fabricant au moyen notamment de puces électroniques qui sont installées sur le dispositif.

En fin de séquence, un redémarrage du cycle est entamé par logiciel incorporé ce qui permet à l'utilisateur de ne pas devoir agir manuellement d'une part et garantit la mise en place automatique des fonctions susmentionnées d'autre part.

Dans une forme d'exécution, l'information sur le réceptacle est indiquée sous forme de code-barre U.V. situé notamment autour de la surface latérale extérieure du réceptacle. Dans ce cas le dispositif comporte avantageusement des moyens de lecture à tête laser tridimensionnels. Le code-barre U.V. est inscrit à l'aide d'encre incolore, visible seulement sous exposition de rayons ultra violets (U.V.).

Dans une autre forme d'exécution, le réceptacle est en matière amagnétique et l'information se trouve sur un ruban circulaire à l'intérieur dudit réceptacle.

Enfin, une autre variante de l'invention présente un réceptacle où le code magnétique est placé entre le couvercle et le corps du réceptacle. Dans ce cas l'information est stockée dans une bande magnétique souple en forme d'anneau.

L'invention sera mieux comprise grâce à la description détaillée qui va suivre en se référant aux dessins annexés dans lesquels :

- La figure 1 représente, à titre d'exemple, un schéma de principe d'un système permettant de déterminer la traçabilité d'un contenu dans un réceptacle et l'origine dudit réceptacle.

- La figure 2 représente schématiquement une vue en perspective d'une information en code-barre visible par exposition aux rayons U.V. et lisible par lecture laser.

- La figure 3 représente une vue en perspective de la disposition du marquage code-barre sur un réceptacle.

- La figure 4 représente, en variante, une vue en perspective d'une bande magnétique contenant les informations de traçabilité/origine perpendiculaire à son support et introduite dans son support.

- La figure 5 représente, en variante, une vue en perspective et partiellement en coupe d'un assemblage du support des informations dans la base duquel s'introduit une bande magnétique contenant les informations.

- La figure 6 représente, en variante, une vue en perspective d'une bande magnétique contenant les informations de traçabilité/origine perpendiculaire à son support et située à l'extérieur dudit support.

- La figure 7 représente une vue en perspective et en coupe d'un fil magnétique entourant la base du support et contenant les informations de traçabilité/origine.

Dans une forme d'exécution, illustrée aux figures 1, 2 et 3, un système permettant la traçabilité d'un contenu dans un réceptacle (3) et l'origine dudit réceptacle comprend :

- un support (1),

- un microprocesseur (12),

- un module de distribution (18) de produits,
- un dispositif de lecture laser (9),
- un dispositif d'émission de rayons U.V. (10), et
- un réceptacle (3) comportant les informations (11) de traçabilité/origine.

Le support (1) est notamment une machine à café permettant l'injection de liquide dans le réceptacle (3).

Le microprocesseur (12) contrôle les fonctions suivantes et tel qu'illustré à la figure 1:

- L'identification (a) de la base portant les informations (11) de traçabilité/origine.
- Cryptage ou décryptage (b) des informations (11) situées sur le réceptacle (3).
- Analyse (c) des informations (11).
- Acceptation ou refus (d) des informations (11).
- Comparaison (e) des informations (11) situées sur le réceptacle (3) avec les données que contient le système.
- Approbation ou refus (f) de la distribution des produits (30, 31, 32).
- Stockage (g) des informations (11) après usage, notamment dans la mémoire.
- Redémarrage (h) automatique d'un cycle.

Le module de distribution de produits (18) comporte une électronique de commande des ouvertures notamment du liquide à injecter dans le réceptacle (3), des matières, telles que du sucre (31) et du lait (32), à insérer dans ledit

liquide aromatisé délivré par le réceptacle (3) et des dispositifs tels que des cuillères (30) permettant le brassage des matières au liquide et par simple numérotation de celle-ci, d'identifier le destinataire.

Le dispositif de lecture laser (9) est équipé notamment d'une tête de lecture (5 – Fig. 2) à travers laquelle les informations (11) sont distribuées au microprocesseur (12). La tête de lecture laser (5) est fixée au support (1) et située de manière à permettre la lecture des informations (11) sur un réceptacle (3) lorsque ce dernier est introduit dans le support (1).

Le réceptacle (3) comporte un support (13) de forme notamment cylindrique ou tronc conique sur lequel, dès son conditionnement, les informations (11) ont été apposées sur son pourtour, d'une base (14) circulaire qui permet de retenir la substance, notamment du café, devant être filtrée. Cette base (14) est perforable sous l'action de la pression du liquide de manière à laisser passer le liquide à filtrer et à aromatiser.

Les informations (11) se présentent sous forme de code-barre (23 – Fig. 2) invisible inscrit à l'aide d'une encre réactive à l'éclairage ultra-violet (U.V.). Le code-barre (23) est visible lorsqu'il est soumis à une source (6 – Fig. 2) de rayonnement ultra-violet (U.V.). Les informations (11) comportent toutes les indications relatives à la traçabilité du produit contenu dans le réceptacle (3) et à l'origine de ce dernier.

Le réceptacle (3), disposant du code-barre (23), est acheminé sous la tête de lecture laser (5). Le code-barre (23) est soumis au rayonnement U.V. émis par la source (6).

Les informations (11) sont lues et transmises au microprocesseur (12) qui déclenche, en cas de reconnaissance positive de celle-ci, les opérations susmentionnées et, en cas de reconnaissance négative, rejette lesdites informations (11) et arrête la procédure de déclenchement du module de distribution (18) pour interrompre la procédure de perçage de la partie supérieure du réceptacle (3) et d'extraction des produits (30, 31, 32).

Il est à noter que le microprocesseur (12) émet une clé, recalculée par algorithme, sous forme de chiffres et de lettres ce qui représente l'indication comparée aux données du fabricant. Toutes les clés, après traitement, sont mémorisées dans la mémoire interne du microprocesseur (12).

Une clé est attribuée avantageusement à un seul code-barre (23) ce qui permet d'utiliser le réceptacle (3) une seule fois. Un réceptacle (3) sans code-barre (23) est automatiquement rejeté de même qu'un code-barre (23) erroné et la réutilisation d'un code-barre (23) usagé sont rejetés par comparaison des clés.

Les figures 4 et 5 illustrent une forme d'exécution où le réceptacle (3) est en matière amagnétique et les informations (11) se trouvent sur un ruban notamment magnétique circulaire (20) à l'intérieur dudit réceptacle (3).

La figure 6 illustre une variante de l'invention qui présente un réceptacle (3) où les informations (11) sont placées entre un couvercle (17) perforable et la base (14) du réceptacle (3), sous la forme d'un anneau (15).

La figure 7 illustre une variante qui consiste à loger un fil métallique (8) dans la base (14) du réceptacle (3) de telle façon que les informations (11) soient enregistrées notamment sous forme magnétique.

REVENDICATIONS

1. Appareil permettant d'établir la traçabilité d'un contenu dans un réceptacle (3) et l'origine dudit réceptacle (3) sur lequel figurent des informations (11) lisibles au moyen d'un lecteur optique et/ou magnétique mais invisibles à l'œil nu, ledit réceptacle (3) étant du type comportant une partie supérieure perforable pour l'injection du liquide dans le réceptacle (3) et une membrane inférieure perforable sous pression pour la sortie dudit liquide aromatisé par le contenu du réceptacle (3), l'appareil comprenant :

   - un lecteur (9) optique et/ou magnétique pour la lecture desdites informations (11) sur un réceptacle (3) introduit dans l'appareil,

   - un microprocesseur (12) permettant de crypter/décrypter, analyser, comparer, approuver/refuser et stocker des informations (11) lues sur un réceptacle (3), et agencé pour sélectivement démarrer ou non un cycle d'opérations comprenant le perçage de la partie supérieure du réceptacle (3) et l'injection du liquide, ainsi que pour le stockage des informations (11) lues afin d'être prêt pour démarrer un nouveau cycle.

2. Appareil selon la revendication 1 caractérisé en ce qu'il comporte un dispositif d'émission de rayons UV permettant la lecture d'un code-barre (23) invisible à l'œil nu situé sur le réceptacle (3).

3. Appareil selon la revendication 1 ou 2 caractérisé en ce qu'il comporte une tête de lecture magnétique qui lit les informations (11) magnétiques portées par le réceptacle (3).

4. Appareil selon l'une des revendications précédentes caractérisé en ce qu'il comporte un module (18) pour distribuer des produits, tels que du sucre (31) et du lait (32) et des dispositifs tels que des cuillères (30) permettant le brassage avec le liquide et permettant l'identification du destinataire, ceci conjointement avec la sortie du liquide aromatisé.

5. Appareil selon l'une des revendications précédentes caractérisé en ce qu'il comporte une tête de lecture laser (5) fixée au support (1).

6. Réceptacle du type comportant une partie supérieure perforable pour l'injection du liquide dans le réceptacle (3) et une membrane inférieure perforable sous pression pour la sortie dudit liquide aromatisé par le contenu du réceptacle (3), utilisable par l'appareil selon l'une quelconque des revendications précédentes caractérisé en ce qu'il comporte des informations (11) lisibles au moyen d'un lecteur optique et/ou magnétique mais invisibles à l'œil nu.

7. Réceptacle utilisable par l'appareil selon la revendication 6 caractérisé en ce qu'il est en matière amagnétique et les informations (11) se trouvent sur un ruban circulaire (20) à l'intérieur dudit réceptacle (3).

8. Réceptacle utilisable par l'appareil selon l'une des revendications 6 ou 7 caractérisé en ce qu'il dispose d'un code magnétique (15) placé entre son couvercle (17) et sa base (14).

9. Réceptacle utilisable par l'appareil selon l'une des revendications 6, 7 ou 8 caractérisé en ce que les informations (11) qu'il porte se présentent sous forme de code-barre (23) invisible inscrit à l'aide d'une encre réactive à l'éclairage ultra-violet (UV).

10. Réceptacle utilisable par l'appareil selon l'une des revendications 6 à 9 caractérisé en ce que les informations (11) qu'il porte comportent des indications relatives à la traçabilité.

11. Réceptacle utilisable par l'appareil selon l'une des revendications 6 à 10 caractérisé en ce que les informations (11) qu'il porte comportent des indications relatives à l'origine du réceptacle (3).

12. Réceptacle utilisable par l'appareil selon l'une des revendications 6 à 11 caractérisé en ce que les informations (11) qu'il porte sont stockées sur une bande magnétique (15) souple.

13. Réceptacle utilisable par l'appareil selon l'une des revendications 6 à 12 caractérisé en ce que les informations (11) qu'il porte sont stockées sur un anneau (8).

14. Système permettant d'établir la traçabilité d'un contenu dans un réceptacle (3) et l'origine dudit réceptacle (3), comportant un appareil selon l'une des revendications 1 à 5 et une pluralité de réceptacles selon l'une des revendications 6 à 13.

15. Procédé d'utilisation d'un appareil selon l'une des revendications 1 à 5 et/ou d'un réceptacle selon l'une des revendications 6 à 13 caractérisé en ce qu'il comporte les étapes suivantes :

- identification (a) de la base portant les informations (11) de traçabilité du contenu dans le réceptacle (3) et d'origine dudit réceptacle (3),
- cryptage/décryptage (b) des informations (11) situées sur le réceptacle (3),
- analyse (c) des informations (11),
- acceptation ou refus (d) des informations (11),
- comparaison (e) des informations (11) situées sur le réceptacle (3) avec les données qu'il contient,
- approbation/refus (f) du perçage de la partie supérieure du réceptacle (3) et l'injection du liquide, éventuellement aussi de la distribution des produits (30, 31, 32) conjointement avec la sortie du liquide aromatisé.
- stockage (g) des informations (11) dans la mémoire interne après usage,
- redémarrage (h) automatique d'un cycle.

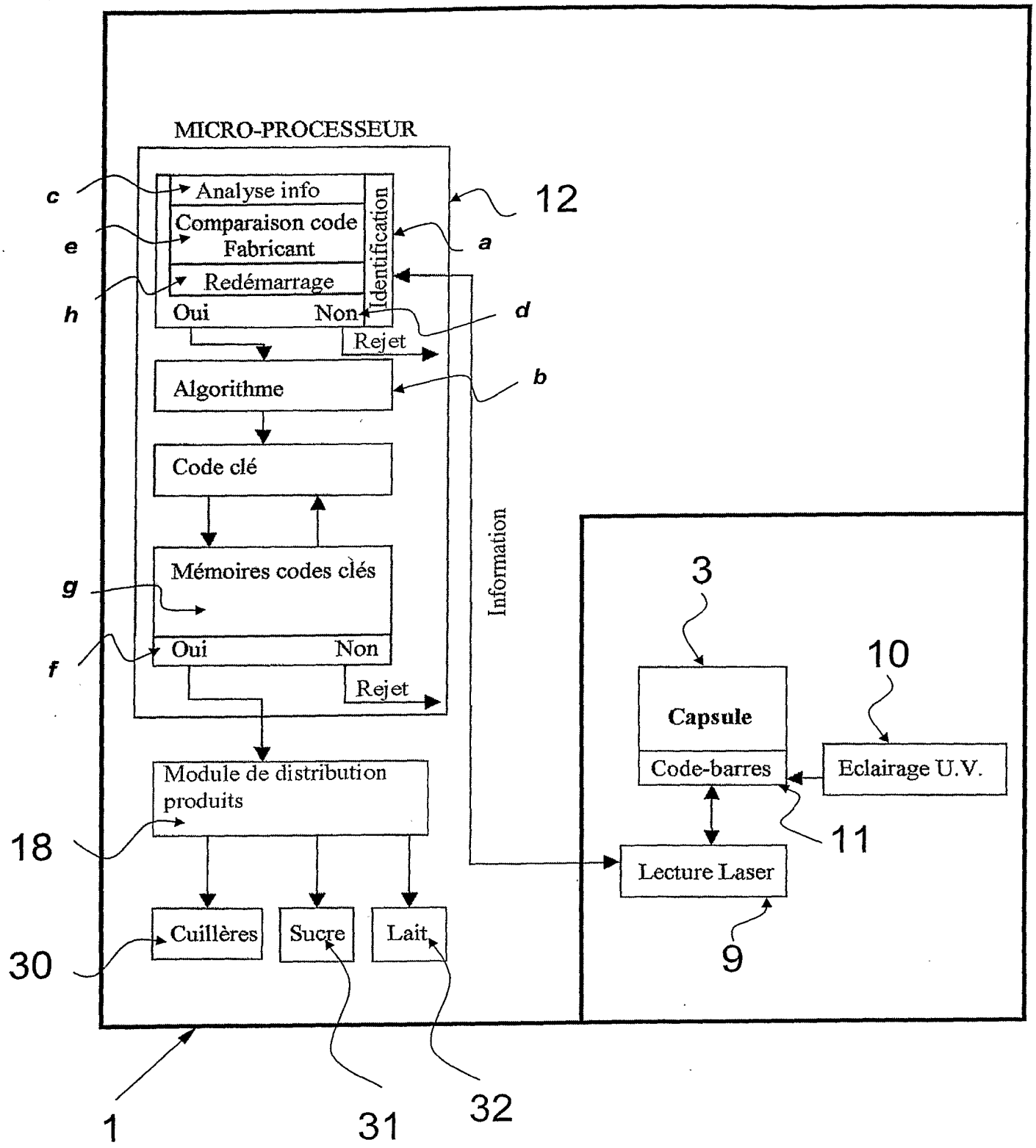

MICRO-PROCESSEUR
Analyse info
Comparaison code Fabricant
Redémarrage
Identification
Oui
Non
Rejet
Algorithme
Code clé
Mémoires codes clés
Oui
Non
Rejet
Module de distribution produits
Cuillères
Sucre
Lait
Information
Capsule
Code-barres
Eclairage U.V.
Lecture Laser
a
b
c
d
e
f
g
h
1
3
9
10
11
12
18
30
31
32

Fig. 1

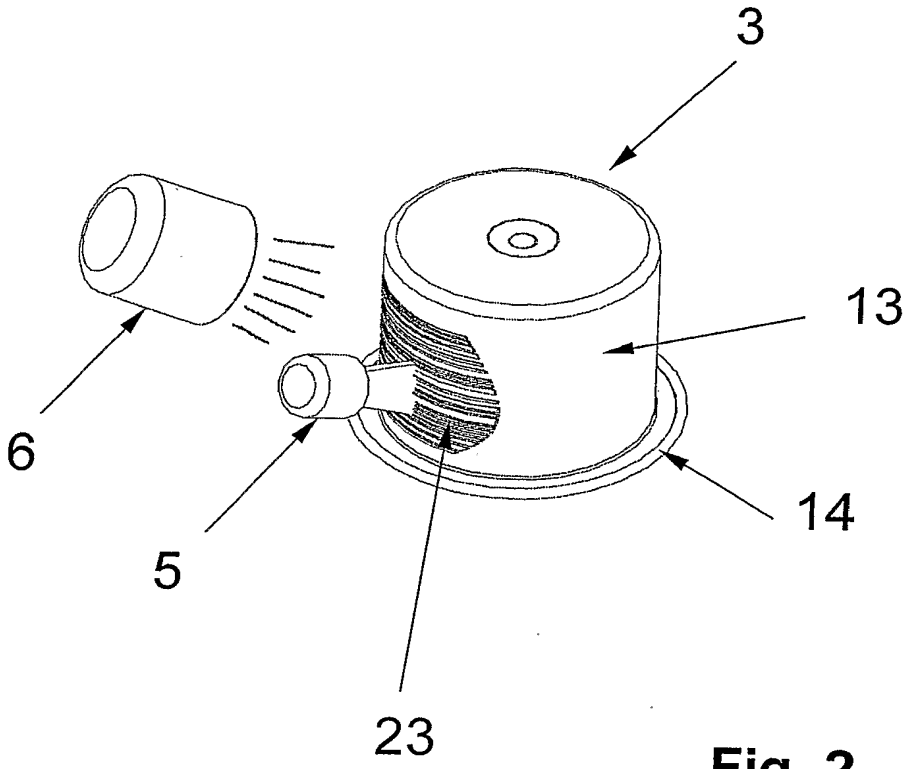


Fig. 2

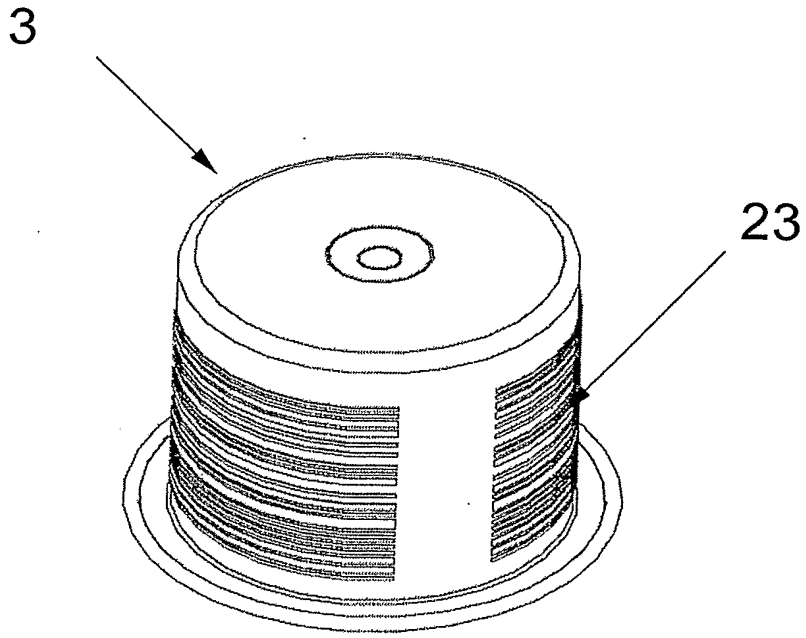


Fig. 3

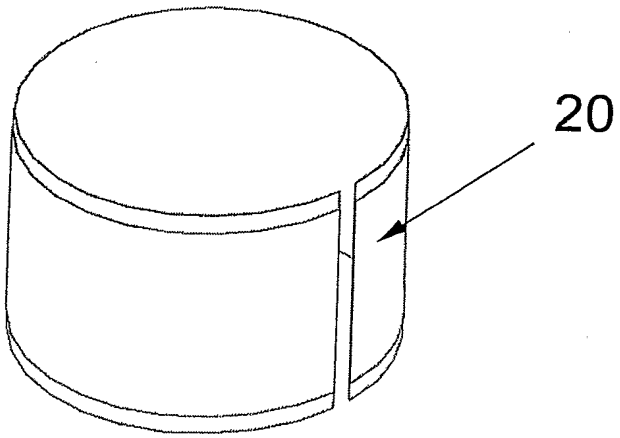


Fig. 4

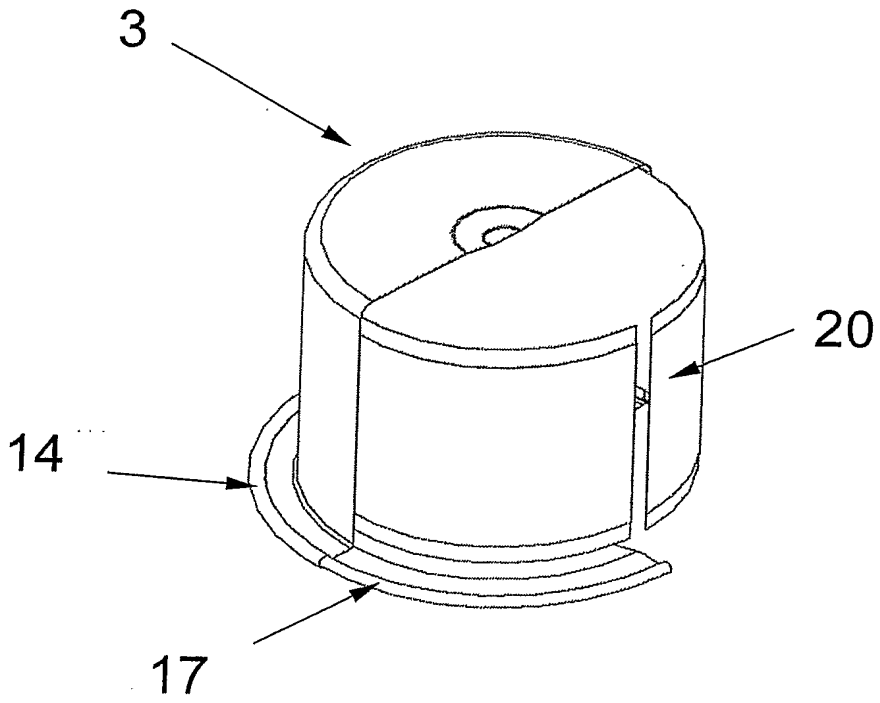


Fig. 5

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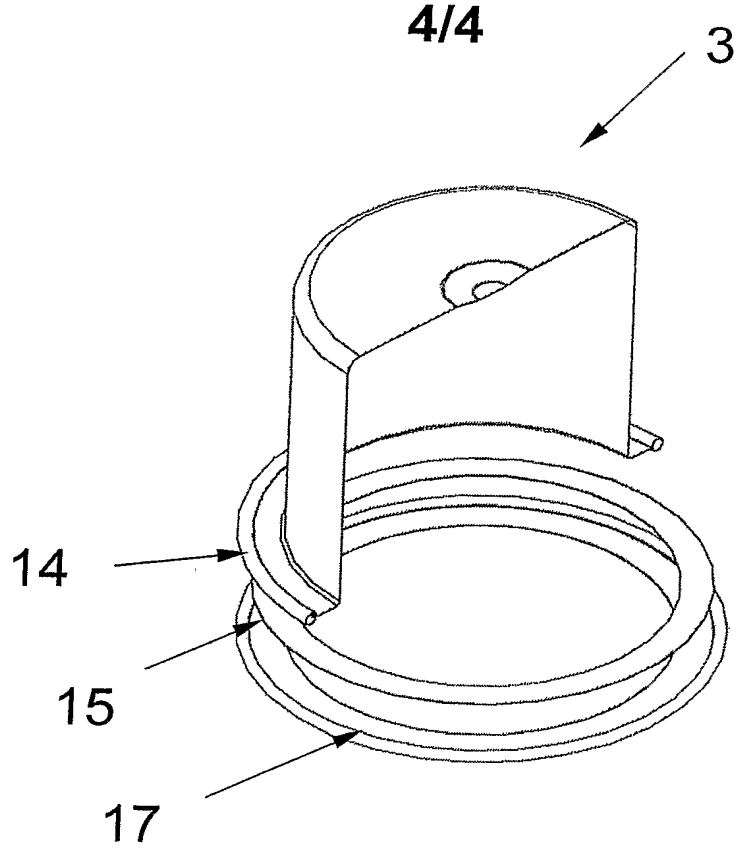


Fig. 6

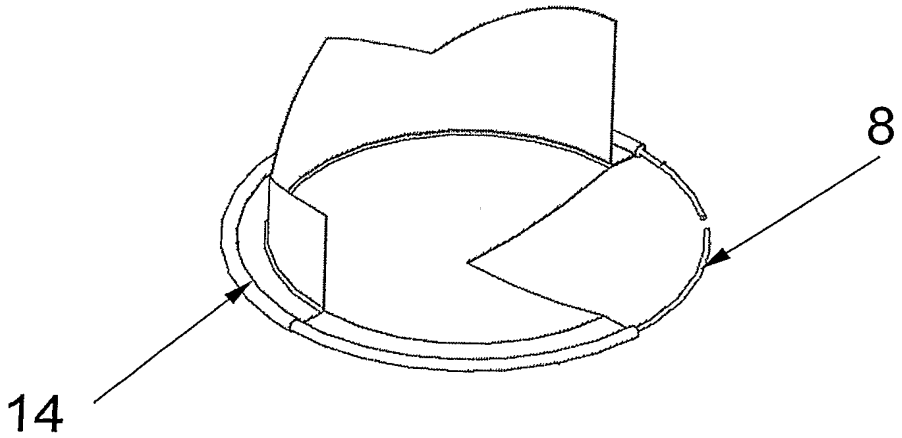


Fig. 7

INTERNATIONAL SEARCH REPORT

International Application No
IB2004/003524

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A47J31/40 B65D81/00

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 A47J B65D

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	WO 02/28241 A (BOYD COFFEE CO) 11 April 2002 (2002-04-11) page 5, paragraph 4 - page 11, paragraph 3 page 11, paragraph 3; figures claim 7	1,3,4,6, 8,10-15
A	WO 02/078498 A (EUGSTER FRISMAG AG ; MAHLICH GOTTHARD (DE)) 10 October 2002 (2002-10-10) cited in the application page 8, line 6 - page 10, line 9; figures	6-13
A	US 6 117 471 A (KING ALAN M) 12 September 2000 (2000-09-12) column 3, line 39 - column 5, line 23; figures	1,6,14, 15

-/--

[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
14 January 2005	21/01/2005

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	De Terlizzi, M

Form PCT/ISA/210 (second sheet) (January 2004)

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 4 858 523 A (HELBLING EDWARD) 22 August 1989 (1989-08-22) column 10, lines 25-35; claims 11,12; figure 2	1,6

K-FEE SYSTEM GMBH, EX2009, page 5608
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

INTERNATIONAL SEARCH REPORT

International Application No
IB2004/003524

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0228241 A	11-04-2002	AU 1148902 A	15-04-2002
		WO 0228241 A1	11-04-2002
		US 2002048621 A1	25-04-2002
WO 02078498 A	10-10-2002	DE 10116239 A1	17-10-2002
		CA 2442389 A1	10-10-2002
		DE 20121494 U1	17-10-2002
		WO 02078498 A1	10-10-2002
		EP 1379153 A1	14-01-2004
		JP 2004525829 T	26-08-2004
		NO 20034325 A	05-11-2003
		US 2004089158 A1	13-05-2004
US 6117471 A	12-09-2000	US 5974950 A	02-11-1999
US 4858523 A	22-08-1989	US 4967648 A	06-11-1990
		US 5080008 A	14-01-1992
		US 5072660 A	17-12-1991
		US 5158793 A	27-10-1992

K-FEE SYSTEM GMBH, EX2009, page 5609
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

RAPPORT DE RECHERCHE INTERNATIONALE

Demande Internationale No
IB2004/003524

A. CLASSEMENT DE L'OBJET DE LA DEMANDE
CIB 7 A47J31/40 B65D81/00

Selon la classification internationale des brevets (CIB) ou à la fois selon la classification nationale et la CIB

B. DOMAINES SUR LESQUELS LA RECHERCHE A PORTE

Documentation minimale consultée (système de classification suivi des symboles de classement)
CIB 7 A47J B65D

Documentation consultée autre que la documentation minimale dans la mesure où ces documents relèvent des domaines sur lesquels a porté la recherche

Base de données électronique consultée au cours de la recherche internationale (nom de la base de données, et si réalisable, termes de recherche utilisés)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERES COMME PERTINENTS

Catégorie °	Identification des documents cités, avec, le cas échéant, l'indication des passages pertinents	no. des revendications visées
X	WO 02/28241 A (BOYD COFFEE CO) 11 avril 2002 (2002-04-11) page 5, alinéa 4 - page 11, alinéa 3 page 11, alinéa 3; figures revendication 7	1,3,4,6, 8,10-15
A	WO 02/078498 A (EUGSTER FRISMAG AG ; MAHLICH GOTTHARD (DE)) 10 octobre 2002 (2002-10-10) cité dans la demande page 8, ligne 6 - page 10, ligne 9; figures	6-13
A	US 6 117 471 A (KING ALAN M) 12 septembre 2000 (2000-09-12) colonne 3, ligne 39 - colonne 5, ligne 23; figures	1,6,14, 15

-/--

[X] Voir la suite du cadre C pour la fin de la liste des documents

[X] Les documents de familles de brevets sont indiqués en annexe

° Catégories spéciales de documents cités:

"A" document définissant l'état général de la technique, non considéré comme particulièrement pertinent

"E" document antérieur, mais publié à la date de dépôt international ou après cette date

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"O" document se référant à une divulgation orale, à un usage, à une exposition ou tous autres moyens

"P" document publié avant la date de dépôt international, mais postérieurement à la date de priorité revendiquée

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"X" document particulièrement pertinent; l'invention revendiquée ne peut être considérée comme nouvelle ou comme impliquant une activité inventive par rapport au document considéré isolément

"Y" document particulièrement pertinent; l'invention revendiquée ne peut être considérée comme impliquant une activité inventive lorsque le document est associé à un ou plusieurs autres documents de même nature, cette combinaison étant évidente pour une personne du métier

"&" document qui fait partie de la même famille de brevets

Date à laquelle la recherche internationale a été effectivement achevée	Date d'expédition du présent rapport de recherche internationale
14 janvier 2005	21/01/2005

Nom et adresse postale de l'administration chargée de la recherche internationale	Fonctionnaire autorisé
Office Européen des Brevets, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	De Terlizzi, M

Formulaire PCT/ISA/210 (deuxième feuille) (Janvier 2004)

C.(suite) DOCUMENTS CONSIDERES COMME PERTINENTS

Catégorie °	Identification des documents cités, avec, le cas échéant, l'indication des passages pertinents	no. des revendications visées
A	US 4 858 523 A (HELBLING EDWARD) 22 août 1989 (1989-08-22) colonne 10, ligne 25-35; revendications 11,12; figure 2	1,6

K-FEE SYSTEM GMBH, EX2009, page 5611
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Document brevet cité au rapport de recherche		Date de publication	Membre(s) de la famille de brevet(s)		Date de publication
WO 0228241	A	11-04-2002	AU	1148902 A	15-04-2002
			WO	0228241 A1	11-04-2002
			US	2002048621 A1	25-04-2002
WO 02078498	A	10-10-2002	DE	10116239 A1	17-10-2002
			CA	2442389 A1	10-10-2002
			DE	20121494 U1	17-10-2002
			WO	02078498 A1	10-10-2002
			EP	1379153 A1	14-01-2004
			JP	2004525829 T	26-08-2004
			NO	20034325 A	05-11-2003
			US	2004089158 A1	13-05-2004
US 6117471	A	12-09-2000	US	5974950 A	02-11-1999
US 4858523	A	22-08-1989	US	4967648 A	06-11-1990
			US	5080008 A	14-01-1992
			US	5072660 A	17-12-1991
			US	5158793 A	27-10-1992

K-FEE SYSTEM GMBH, EX2009, page 5612
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 April 2002 (11.04.2002)

PCT

(10) International Publication Number
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(51) International Patent Classification[7]: A47J 31/00, B65B 29/02

(21) International Application Number: PCT/US01/31348

(22) International Filing Date: 5 October 2001 (05.10.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/238,802 6 October 2000 (06.10.2000) US

(71) Applicant: **BOYD COFFEE COMPANY** [US/US]; 19730 NE Sandy Boulevard, Portland, OR 97220 (US).

(72) Inventors: **BOYD, David, D.**; 5215 SE 32nd Avenue, Portland, OR 97202 (US). **JOHNSON, Michael, W.**; 26 Crescent Drive, St. Helens, OR 97501 (US).

(74) Agents: **KOLISCH, Pierre, J.** et al.; Kolisch, Hartwell, Dickinson, McCormack, & Heuser, 520 S.W. Yamhill Street, Portland, OR 97204 (US).

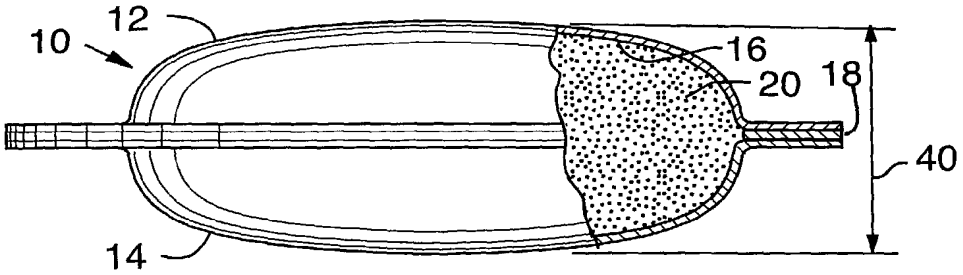
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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: ENCODED COFFEE PACKET



(57) Abstract: A brewing packet (10) is provided for use in the preparation of hot or cold beverages. The brewing packet envelops a brewing ingredient (20) chosen according to the tastes of a beverage drinker. The packet includes a machine interpretable feature (30) that contains encoded data capable of being read by a beverage producing device (100). Furthermore, the data on the packet is capable of directing the beverage producing device to employ a specific brewing operation suited for the particular brewing packet. This allows for producing the optimal beverage from the brewing ingredient. The packet may be utilized with a variety of brewing ingredients to produce a variety of beverages. Similarly, the packet may be configured to produce single or multiple servings of a beverage.

WO 02/28241 A1

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

Electronic Acknowledgement Receipt

EFS ID:	39822884
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:	25-JUN-2020
Filing Date:	09-NOV-2012
Time Stamp:	12:53:43
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	01693SB08-5.pdf	78486 0d8a7c2e1e5531c81234aeb8e1d7e5e101b0e058	no	6

Warnings:

Information:					
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2	Foreign Reference	FR1_WO2011141532.pdf	787213 0a0340e31a8e50ccd4ece6a347807cfd392cdf2d9	no	20
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3	Foreign Reference	FR2_WP1772398.pdf	4604183 5fa09d8b53a65aba2a0daf5d9cabf7ca0d2e2ab0	no	23
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4	Foreign Reference	FR3_WO2005044067.pdf	860646 4a0d4d3da1d49d4d7c47b68d0ffd6751f28f0fc3	no	22
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5	Foreign Reference	FR4_WO0199047.pdf	1920585 9cd644c559b56adfdbbdcb6e1646df6eaa36c8bf	no	55
Warnings:					
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6	Foreign Reference	FR5_WO0199047.pdf	813377 ee1c8e2383458916fe8e3cc4e542c1a9328b7122	no	22
Warnings:					
Information:					
7	Foreign Reference	FR6_EP0638486.pdf	863347 782f9442f50baa9b3ae8dae830996117 4de58341	no	16
Warnings:					
Information:					
8	Foreign Reference	FR7_EP0455337.pdf	685810 09a63e4bfb617997b26e4dc437aab86ef15e58dc	no	13
Warnings:					
Information:					

9	Foreign Reference	FR8_EP1849718.pdf	55317 78a15cc59f4352902d15451036614 4e3ba0d2243	no	1
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Information:					
10	Foreign Reference	FR9_DE3432339.pdf	600613 f0700b3de9f1347bfc06dac397b3af6c5fc81a4b	no	14
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11	Foreign Reference	FR10_JP2003235733.pdf	544437 b173c8ea51a06c3100d2a793793c82601ca256cd	no	9
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12	Foreign Reference	FR11_WO2010041179.pdf	61687 18855a89bcc8adda9d92c65dcac71b5d539205b1	no	1
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13	Foreign Reference	FR12_WO2011047836.pdf	61668 df6b8224cd56d7b6782f87329b87030f9024135c	no	1
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14	Foreign Reference	FR13_Wo0160712.pdf	783564 50f0fa023c28e85e3b7ed9b6ef9b22d548291742	no	20
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Information:					
15	Foreign Reference	FR14_WO2010026053.pdf	2140872 05a64a129ee9dc47500b8ec2d0a5f1cc1cf13114	no	62
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16	Non Patent Literature	npl1.pdf	183867 104e49bf61b560dc2792be5238754a0ff4ac0a40	no	7
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17	Non Patent Literature	NPL3.pdf	83677 557bbcbe613783e911ede63b45e271fa2d0b644b	no	1
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18	Non Patent Literature	NPL4.pdf	34178 fc2bff31c99eea77e53160135cf242d2159529ff	no	1
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Information:					
19	Non Patent Literature	NPL5.pdf	4357671 7d51cd52d7be8c2ca5a32a252e36e9c41478fad2	no	68
Warnings:					
Information:					
20	Non Patent Literature	nple2.pdf	4241365 3cd43e4145de1749d7a865c631b6318a5fff96c0	no	27
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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.

(12) DEMANDE INTERNATIONALE PUBLIÉE EN VERTU DU TRAITÉ DE COOPÉRATIONEN MATIÈRE DE BREVETS (PCT)

(19) Organisation Mondiale de la Propriété Intellectuelle
Bureau international

(43) Date de la publication internationale
15 avril 2010 (15.04.2010)

PCT

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(51) Classification internationale des brevets :
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(25) Langue de dépôt : français

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(30) Données relatives à la priorité :
PCT/IB2008/054130
8 octobre 2008 (08.10.2008) IB

(71) Déposant *(pour tous les États désignés sauf US)* : **ETHICAL COFFEE COMPANY SA** [CH/CH]; Rue de Faucigny 5, CH-1700 Fribourg (CH).

(72) Inventeur; et
(75) Inventeur/Déposant *(pour US seulement)* : **MARILLER, Alain** [CH/CH]; chemin de l'Hôtel du Parc 3, CH-1801 Le Mont-Pèlerin (CH).

(74) Mandataire : **ROLAND, André**; c/o André Roland S.A., P.O. Box 1255, CH-1001 Lausanne (CH).

(81) États désignés *(sauf indication contraire, pour tout titre de protection nationale disponible)* : 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) États désignés *(sauf indication contraire, pour tout titre de protection régionale disponible)* : ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), eurasien (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), européen (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).

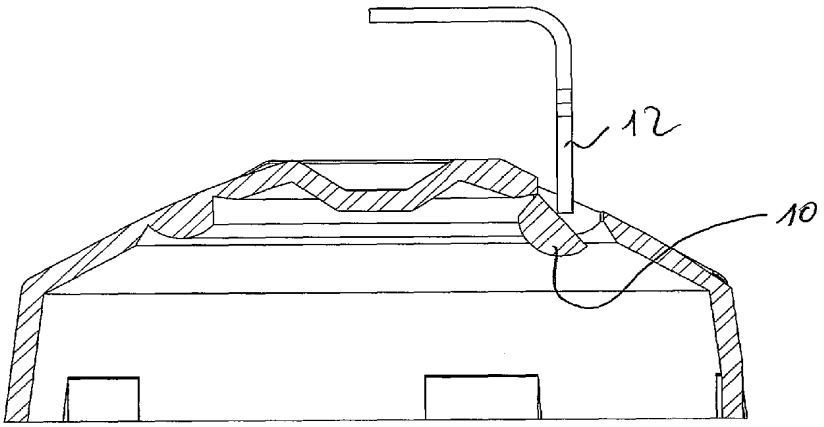
Publiée :

— *sans rapport de recherche internationale, sera republiée dès réception de ce rapport (règle 48.2.g))*

(54) **Title** : CAPSULE FOR PREPARING A BEVERAGE

(54) **Titre** : CAPSULE POUR LA PRÉPARATION D'UNE BOISSON

FIG 12



(57) **Abstract** : The invention relates to a capsule (1) for preparing a beverage, for example coffee, comprising a hollow element intended to contain a metered amount, for example of ground coffee, said hollow element including a side wall (2), a top wall (3) and a bottom wall (4) comprising an extraction membrane; the top wall (3) comprising, on the inner surface thereof, a weakened area (11) capable of moving when an external element (12) exerts a force thereon, thereby providing a passage for the liquid to flow between the outside and the inside of the capsule (1).

(57) **Abrégé** :

[Suite sur la page suivante]

WO 2010/041179 A2

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

(19) World Intellectual Property Organization
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17 November 2011 (17.11.2011)

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(10) International Publication Number
WO 2011/141532 A1

(51) International Patent Classification:
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(21) International Application Number:
PCT/EP2011/057657

(22) International Filing Date:
12 May 2011 (12.05.2011)

(25) Filing Language: English

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(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. Nestlé 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-Vièze 10, CH-1870 Monthey (CH). **GERBAULET, Arnaud** [FR/FR]; 24 rue du chalet, F-25160 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 Rances (CH).

(74) Agent: **BORNE, Patrice**; Avenue 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, 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 next page]

(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.

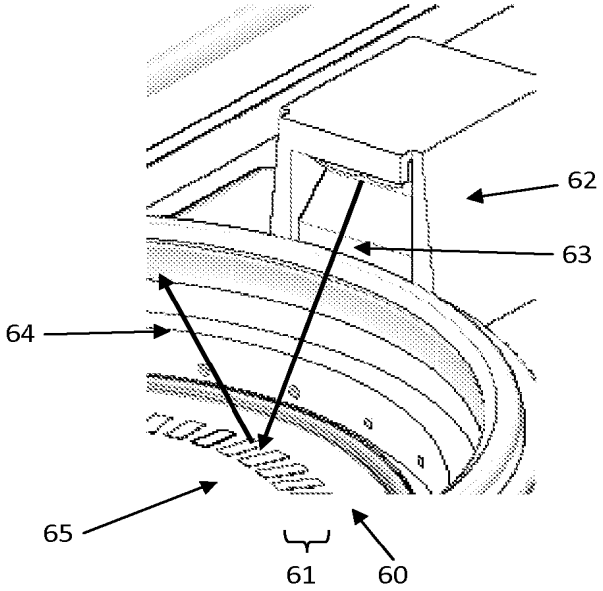


Fig. 2

WO 2011/141532 A1

K-FEE SYSTEM GMBH, EX2009, page 5620
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

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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.

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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

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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,

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- 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

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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

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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.

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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.

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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 deflect 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,

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- 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.

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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.

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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.

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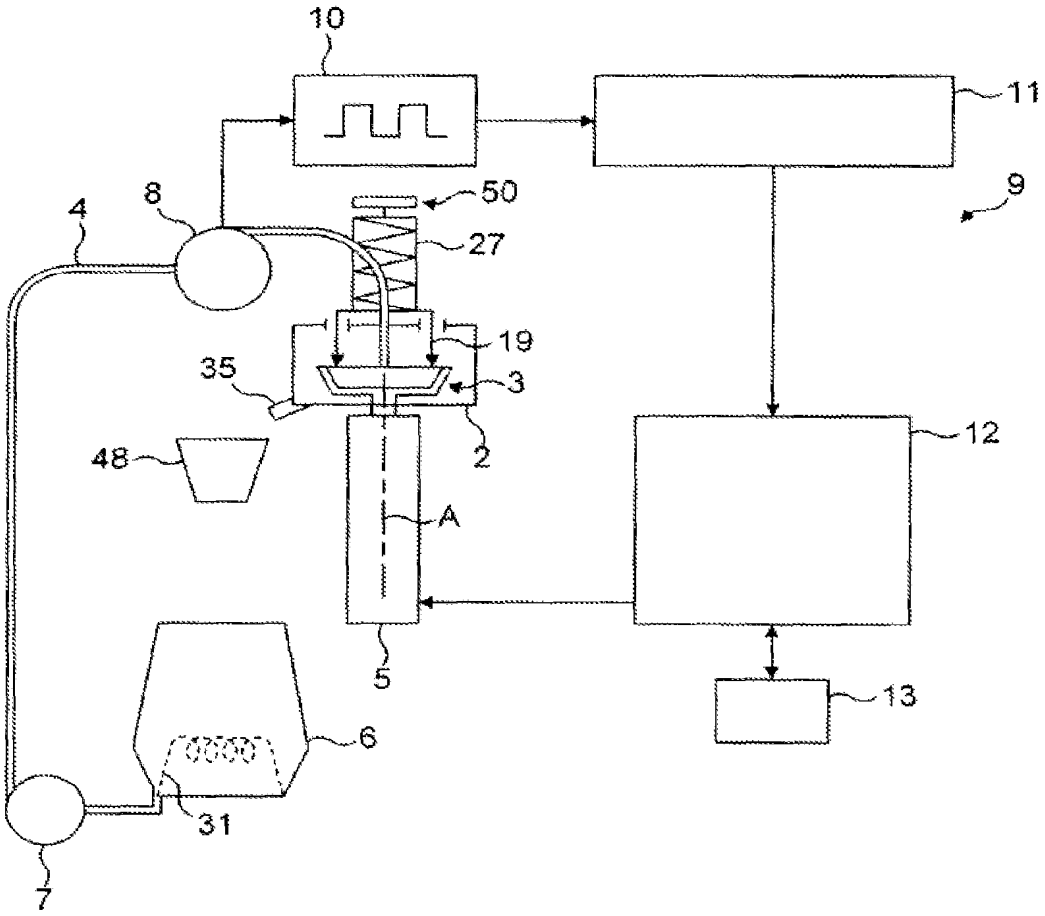


Fig. 1

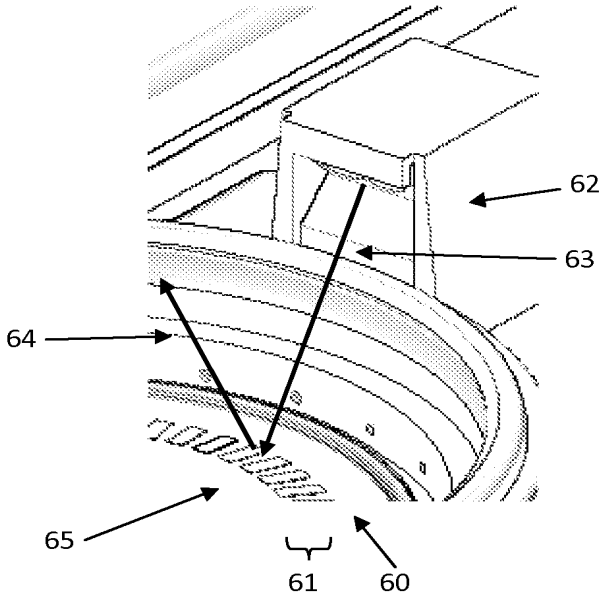


Fig. 2

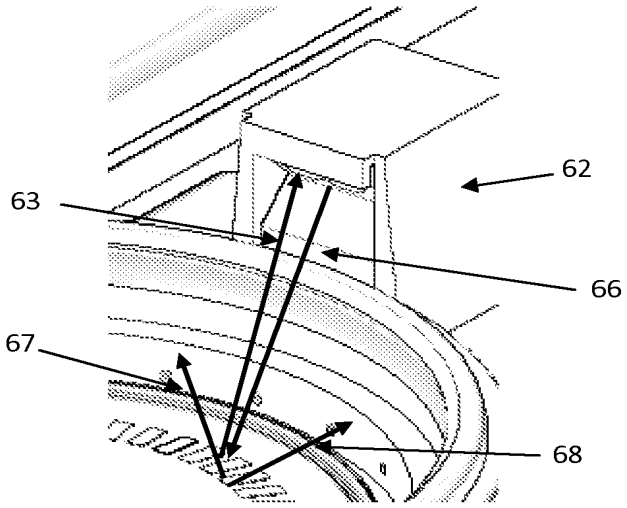


Fig. 3

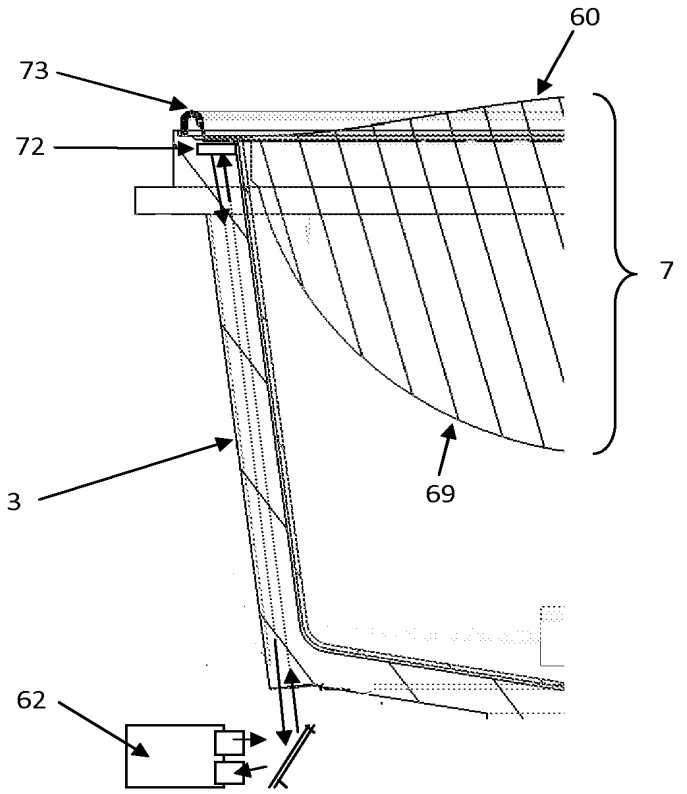


Fig. 4

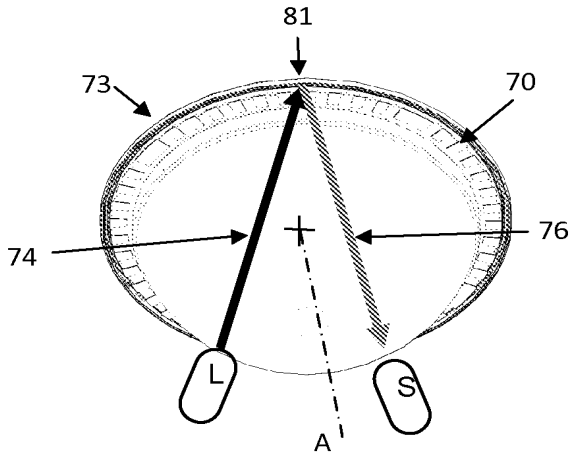


Fig. 5

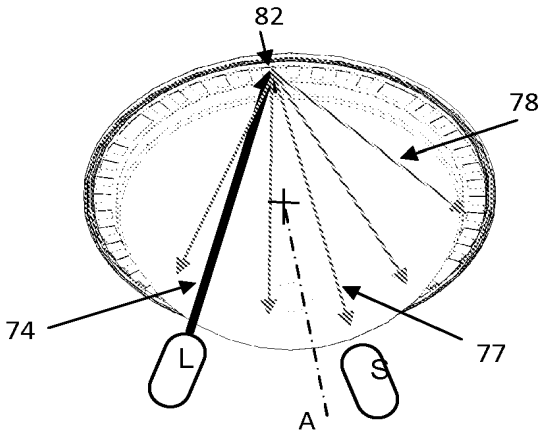

82
78
74
77
L
S
A

Fig. 6

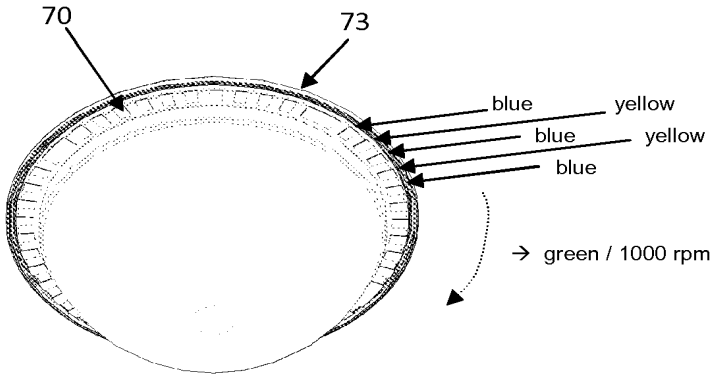

70
73
blue
yellow
blue
yellow
blue
→ green / 1000 rpm

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 :

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"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

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"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

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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

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[Continued on next page]

(54) **Title**: CONTROLLED BEVERAGE PRODUCTION DEVICE USING CENTRIFUGAL FORCES

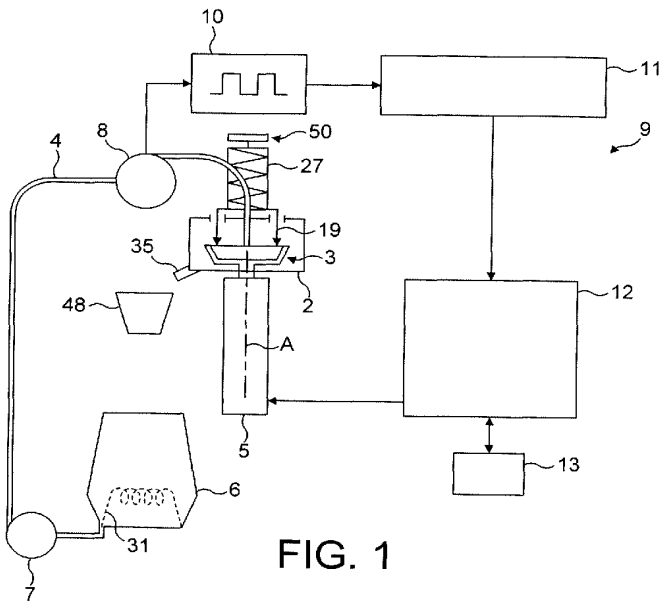


FIG. 1

(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.

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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.

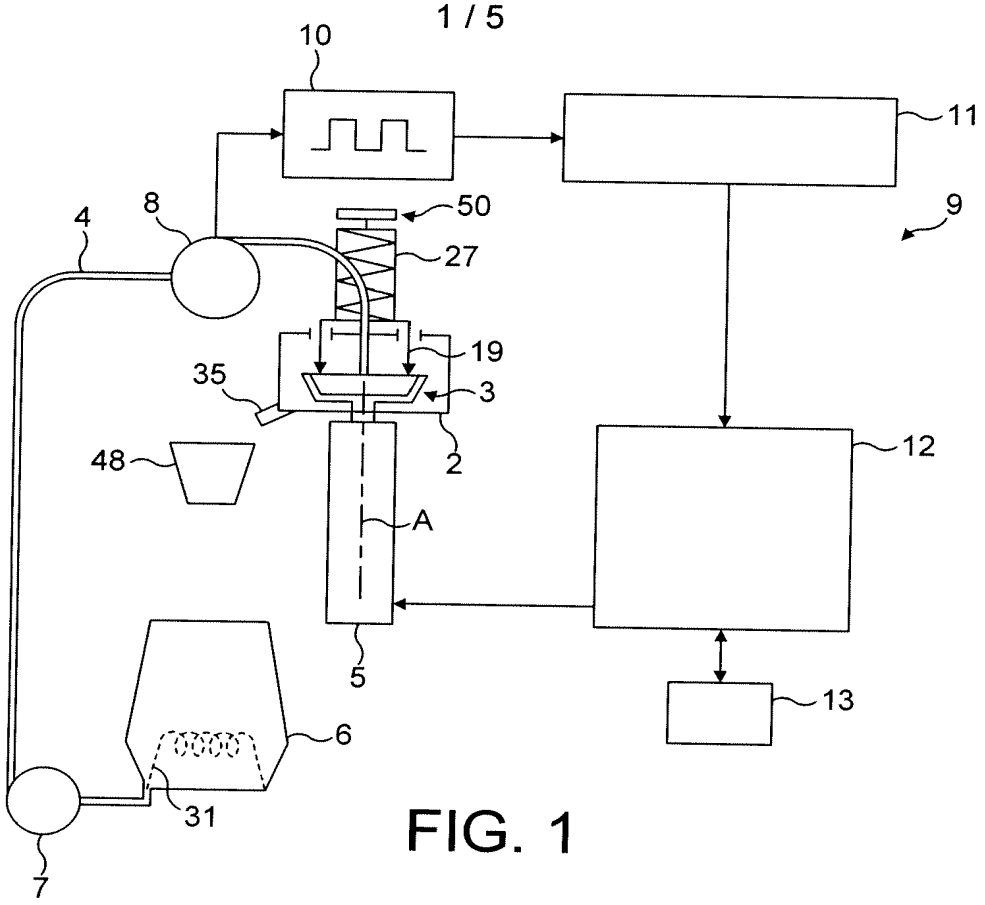

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FIG. 1

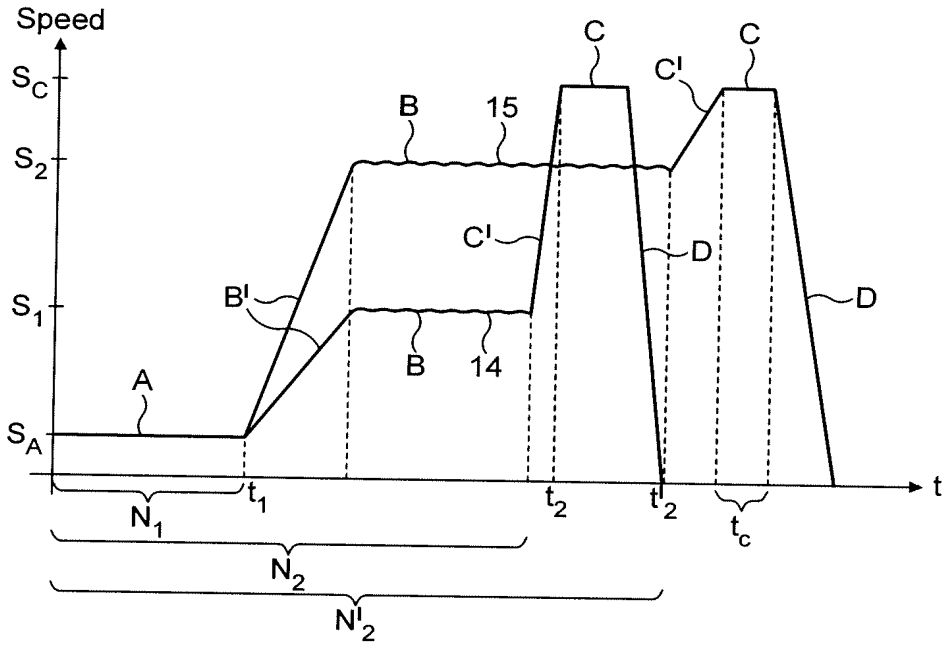

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FIG. 2

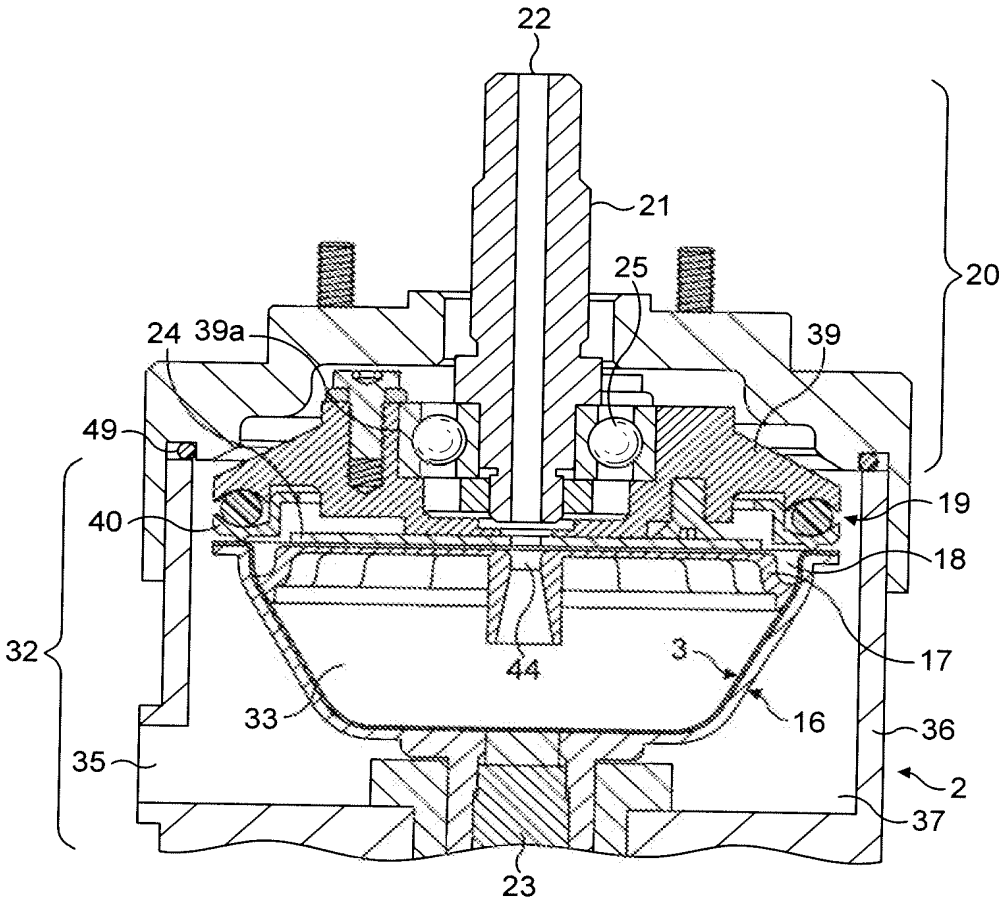

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FIG. 3

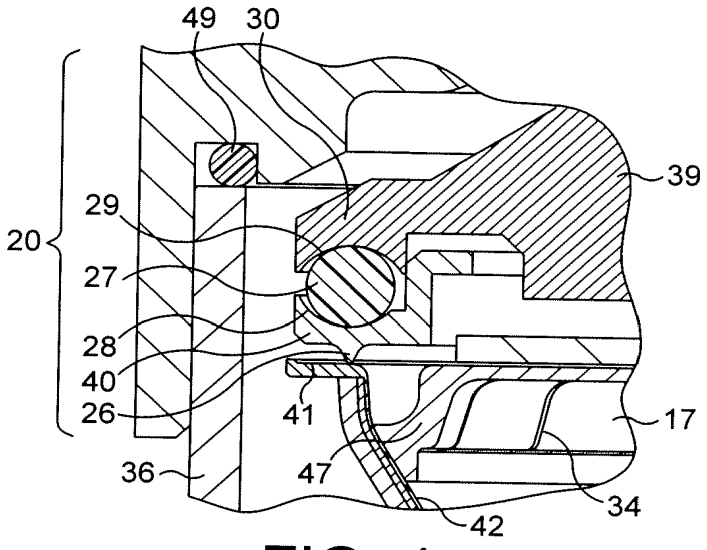

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FIG. 4

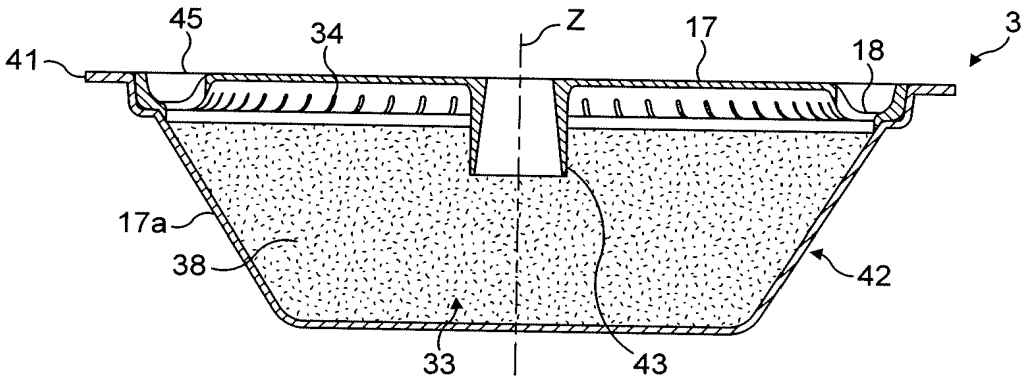


FIG. 5

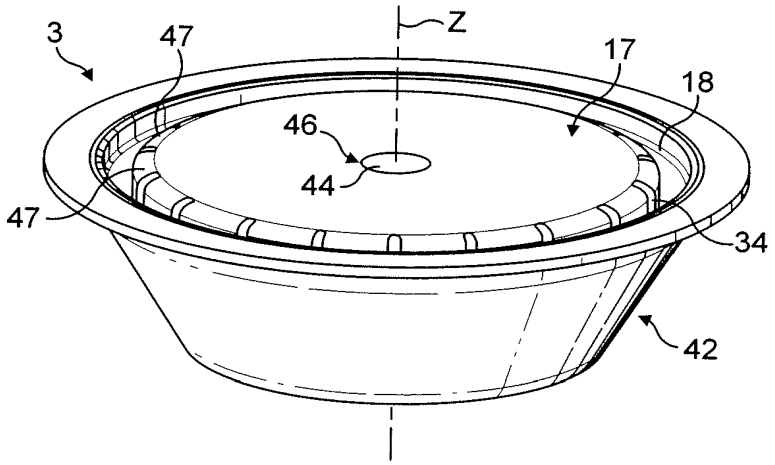


FIG. 6

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

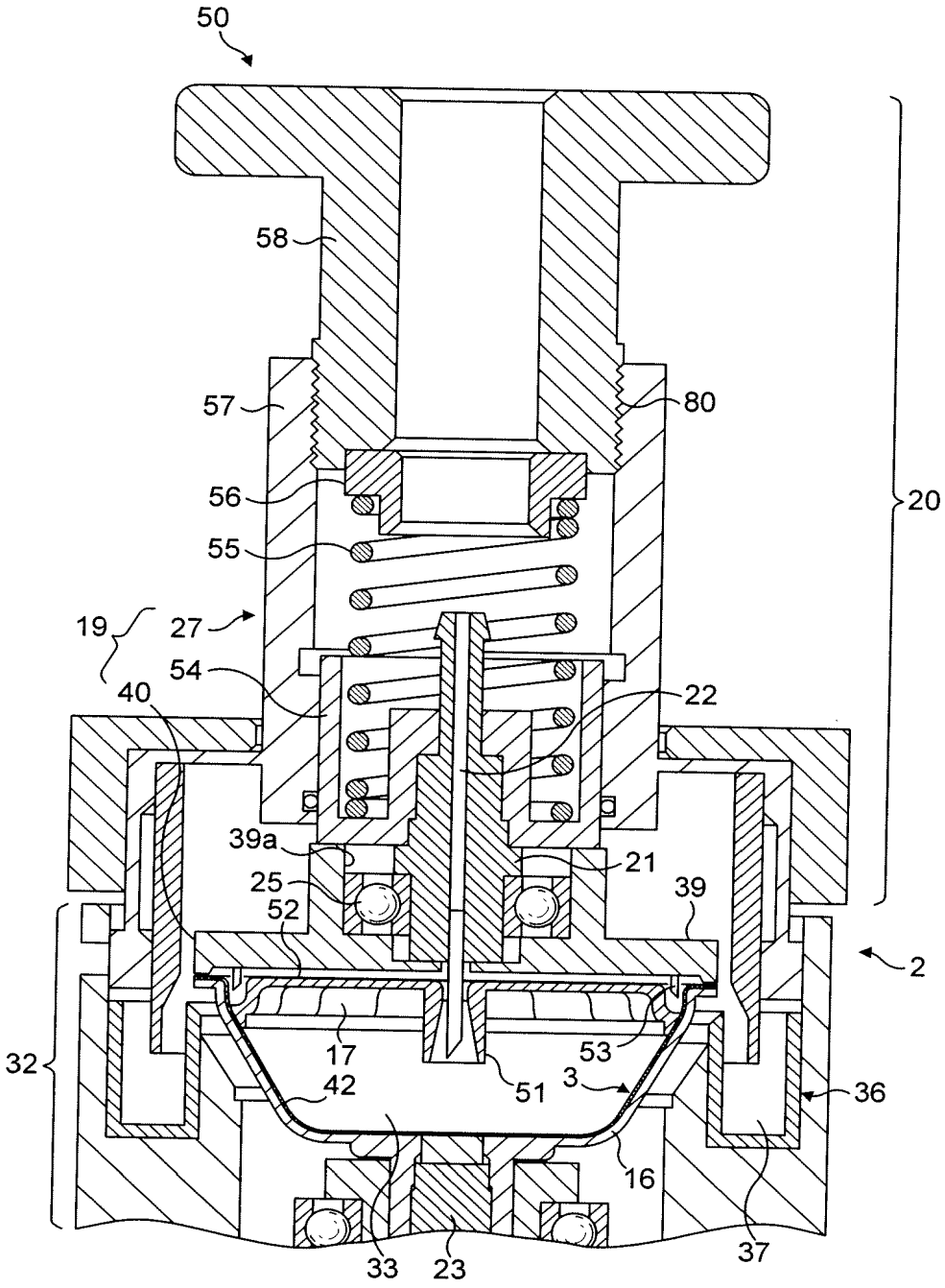

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FIG. 7

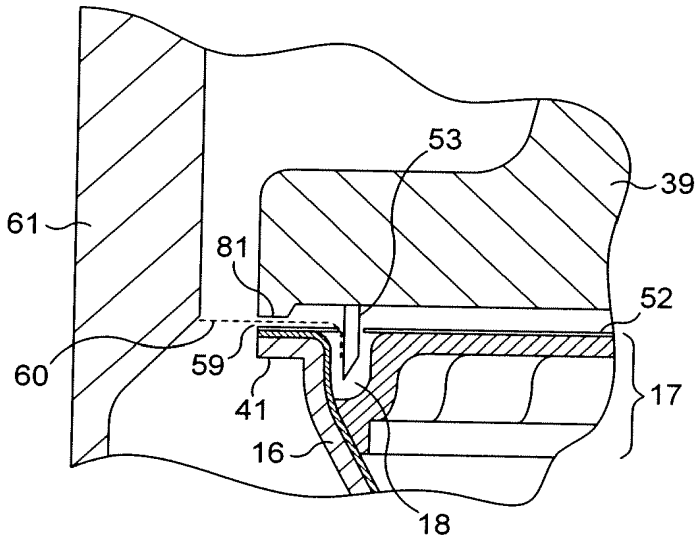

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FIG. 8

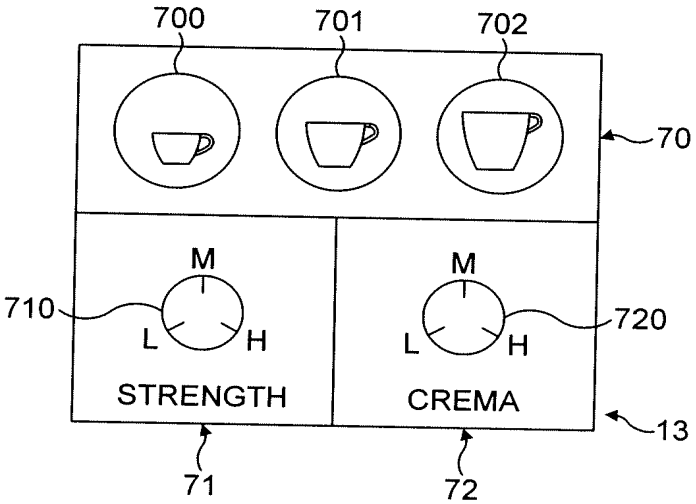

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FIG. 9

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.

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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	

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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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	5243164		1993-09-07	Erickson et al.	
	2	5285041		1994-02-08	Wright	

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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	20020148356		2002-10-17	Lazaris et al.	
	2	20100078480		2010-04-01	AKER	

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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	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	2011141532	WO		2011-11-17	NESTEC S.A.		☐

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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

	2	1772398	EP		2007-04-11	CENSE D'ALMEZ S.A.		☐
	3	2005044067	WO		2005-05-19	GRIFFES, CONSULTING, SA		☐
	4	0199047	WO		2001-12-27	MONEY CONTROLS PLC		☐
	5	0228241	WO		2002-04-11	BOYD COFFEE COMPANY		☐
	6	0638486	EP		1996-10-23	KRAFT JACOBS SUCHARD LTD.		☐
	7	0455337	EP		1991-11-06	KRAFT GENERAL FOODS LIMITED		☐
	8	1849718	EP		2007-04-23	CAFE DO BRASIL S.P.A.		☐
	9	3432339	DE		1986-03-13	SHULZ HORN S., DIPL. ING		☐
	10	2003235733	JP		2003-08-26	KASHIWAGI MOLD:KK		☐
	11	2010041179	WO		2010-04-15	ETHICAL COFFEE COMPANY SA		☐
	12	2011047836	WO		2011-04-28	RAPPARINI, GINO		☐

K-FEE SYSTEM GMBH, EX2009, page 5703
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

	13	0160712	WO		2001-08-23	KEURIG, INC.		☐
	14	2010026053	WO		2010-03-11	NESTEC S.A.		☐

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	1	Notice of opposition to a European Patent Patent No. EP3521210 dated January 14, 2020	☐
	2	English Translation of JP2003235733	☐
	3	Konkordanzliste, Citations, Societe des Prouis Nestle S.A.	☐
	4	Notice of opposition against European Patent No. EP 3521210 dated August 1, 2020	☐
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	Filing Date	2012-11-09
	First Named Inventor	Jarisch et al.
	Art Unit	1792
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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
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(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

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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☐ 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)	2020-06-25
Name/Print	Aaron J. Morrow	Registration Number	55819

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IPR2023-00502, U.S. PATENT 10,994,923

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European Patent Office
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(11) EP 0 638 486 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
23.10.1996 Bulletin 1996/43

(51) Int. Cl.[6]: **B65D 81/34**

(21) Application number: **94305730.7**

(22) Date of filing: **02.08.1994**

(54) **Cartridge and method for the preparation of whipped beverages**

Patrone und Verfahren zur Zubereitung von verschäumten Getränken

Cartouche et méthode pour la préparation de boissons fouettées

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(56) References cited:
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Description

The present invention relates to a cartridge and method for the preparation of whipped beverages and, in particular, to sealed cartridges which are formed from substantially air- and water-impermeable materials and which contain one or more ingredients for the preparation of beverages and to a method of preparing whipped beverages from such cartridges.

It has previously been proposed to seal beverage preparation ingredients in individual air-impermeable packages. For example, cartridges or capsules containing compacted ground coffee are known for use in certain coffee making machines which are generally termed "espresso" machines. In the production of coffee using these coffee machines the coffee cartridge is placed in a brewing chamber and hot water is generally caused to pass under pressure through the cartridge, thereby extracting the aromatic coffee constituents from the ground coffee and producing a coffee beverage. Typically in the production of "espresso" coffee a brewing time of about 25 seconds is used at a pressure of about 6×10^5 Pa.

Cartridges containing roast and ground coffee in which hot water flows under gravimetric force through the cartridge are also known. A cartridge of this general type is described in British Patent No. 1397116.

In our EP-A-0272922 there is described a package which contains at least one beverage preparation ingredient, e.g. roast and ground coffee. In a preferred embodiment the package is formed from a substantially air- and water-impermeable material and comprises a sealed body portion having a compartment containing the beverage ingredient and an outlet channel, the compartment and the outlet channel co-operating in such a manner that, in use, the beverage is filtered, thereby avoiding the necessity for an external filter.

There is also described in EP-A-0272922 a method for preparing a beverage which comprises positioning the beverage containing package at a brewing station, introducing water through water introduction means into the package, allowing the water to commingle with the beverage ingredient, and collecting the beverage so-formed through an outlet formed in the package.

The beverage packages as described in EP-A-0272922 are primarily intended to be used with a beverage preparation machine which handles the packages automatically or semi-automatically. A machine of this type is described in our EP-A-0334572. The packages may contain roast and ground coffee, leaf tea or one or more powdered beverage preparation ingredients such as powdered chocolate, powdered coffee or powdered soup.

The machines described in EP-A-0272922 operate at a relatively low pressure of less than 2×10^5 Pa and thus, although by varying the amount of water introduced into packages containing roast and ground coffee it is possible to obain a coffee beverage of the same strength as "espresso" coffee, it is not possible to incorporate gases into the coffee beverage at this pressure to provide the beverage with the foamed texture and appearance of "espresso" coffee.

We have now developed a cartridge operating at relatively low pressures which is capable of producing whipped beverages.

Accordingly, the present invention provides a cartridge containing one or more beverage ingredients and being formed from substantially air- and water-impermeable materials, the said cartridge comprising an inlet for the introduction of an aqueous medium into the cartridge, a compartment containing the beverage ingredient or ingredients, an outlet for the beverage produced from the beverage ingredients characterised in that the cartridge includes whipping means provided in the path of the beverage prior to the outlet to whip the said beverage.

The cartridge which is used in the present invention may be of a known type, for example as described in EP-A-0272922 or EP-A-0455337, modified to include whipping means provided in the path of the beverage prior to the outlet.

The whipping means will preferably comprise an impeller which is adapted to engage an external driving device on the beverage preparation machine, for example a machine of the type as described in EP-A-0334573. The impeller may comprise a rotor with a plurality of radial vanes, for example from 4 to 8 radial vanes. The vanes may be regularly or irregularly spaced, flat or curled, or offset, as desired. Preferably the rotor is provided with a hollow drive shaft which is adapted for engagement with the external driving device. The rotor may be made from a moulded plastics material such as polyacetal, for example Delrin (Registered Trade Mark) from DuPont, or polyester, or from nylon.

Preferably the impeller is positioned in a whipping chamber integrally formed within the cartridge, the beverage being diverted through this chamber before passing to the outlet. The whipping chamber is preferably provided with a plurality of fixed vanes or ribs formed integrally with the walls thereof. The whipping chamber is preferably also provided with means to position the impeller therein, for example, a cylindrical hole into which a drive shaft on the impeller is adapted to fit.

The cartridge of the present invention preferably has a body portion which may be formed, for example, from a moulded plastics material such as polypropylene. The inlet and/or outlet of the cartridge may be closed by a plug of a plastics material moulded into the inlet and/or outlet nozzle during the moulding of the body portion. Alternatively, the inlet and/or outlet may be covered by a substantially air- and water-impermeable material, for example aluminium foil or a laminated material, such as a laminate of plastic material/metal foil/plastic material, prior to the opening of the inlet and/or outlet. Specific examples of materials which may be used are aluminium foil having a thickness in the range of from 30 to 60 micrometres coated with a layer

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of polypropylene or a laminate of polypropylene/aluminium foil/polyester.

The outlet in the cartridge may be prepared during the beverage preparation cycle using a cutting and piercing tool for example of the type as described in our EP-A-0334573.

Alternatively, the inlet and/or outlet may be open and the cartridge provided with an outer wrapping or the like. For example, a plurality of packages may be provided with a shrink wrapped outer layer.

In the cartridges of the present invention, the communication between the inlet and the compartment containing the beverage preparation ingredient(s) is preferably via a channel which is separated from the compartment by a wall which has a plurality of openings formed therein for the entry of a liquid medium into the compartment. The channel preferably extends along at least one side of the compartment, more preferably along three sides of the compartment. The openings in the wall are preferably in the form of elongate slots which are generally arranged in a manner such that an even distribution of the liquid medium through the beverage preparation ingredients is acheived.

The cartridge of the present invention may have a filter disposed between the compartment containing the beverage ingredient(s) and a least a part of the under surface of the top of the cartridge, one or more passages being formed between the filter and the top of the cartridge, the passages communicating with the outlet. This type of cartridge is particularly preferred when the beverage ingredient is roast and ground coffee.

The filter is preferably made from a material with a high wet strength, for example a non-woven polyester fibre material or polypropylene. Other materials which may be used include a water-permeable cellulosic material, such as a cellulosic material comprising woven paper fibres. The woven paper fibres may be admixed with fibres of polypropylene, polyvinyl-chloride and/or polyethylene. The incorporation of these plastics materials into the cellulosic material renders the cellulosic material heat-sealable. The filter material may also be coated with a material which is activated by heat and/or pressure so that it can readily be sealed to ribs formed in the under surface of the top of the package, thereby forming one or more passages which communicate with the outlet.

The beverage preparation ingredients contained in the cartridges of the invention are preferably roast and ground coffee, powdered chocolate, and according to individual taste, powdered milk or creamer, sugar or artificial sweetner.

It will be understood that it may be convenient for the compartment containing the beverage preparation ingredients to be separated into two or more sections, for example, one section containing roast and ground coffee and another section containing powdered milk or creamer. In such an arrangement the means for the entry of the liquid medium into the separate compartments would be varied to suit the requirements for filtration or dissolution of the particular ingredients.

The cartridge of the present invention, when filled with roast and ground coffee, preferably contains from 2.5 to 10 grams of roast and ground coffee, preferably from 4.5 to 7 grams for the preparation of a single cup. However, cartridges which are intended to provide multiple servings of coffee will contain an appropriate amount of roast and ground coffee, for example, packages intended to provide say five cups of coffee will contain from 20 to 50 grams of roast and ground coffee, preferably from 25 to 30 grams. The roast and ground coffee is generally compacted when the beverage package is filled in order to aid the distribution and transport of water through the package.

The cartridges of the present invention are preferably provided with at least one recognition means whereby, in use, the cartridge is identified by the machine into which it is placed for treatment and the identification of the cartridge thereby causes it to be subjected to the correct treatment steps including the introduction of the aqueous medium into the cartridge and the activation of the whipping means.

The recognition means may comprise one or more surface features formed in the body of the cartridge. For example, the cartridge body may be provided with one or more indents, cut outs, protrusions or holes which can be identified by a mechanical sensor in the beverage preparation machine, the mechanical sensor registering the presence or absence of the indents, cut outs, protrusions or holes.

The recognition means may, alternatively, comprise a system which can be sensed by a simple optical device, for example a bar code printed onto the body of the cartridge, a pattern of through holes in the cartridge, a pattern of contrasting tones or colours printed onto the cartridge or cartridges containing different comestibles being of different colours.

The recognition means may also comprise one or more strips of a magnetic material applied to the body of the cartridge which can be read by an appropriate magnetic sensor; one or more shaped or divided areas of metal foil applied to the cartridge body which cause an inductive effect on movement of the cartridge in the machine, which inductive effect can be sensed; or one or more electrically conductive areas formed on the body of the cartridge which can be sensed electrically.

As mentioned above, the cartridge of the present invention contains one or more beverage preparation ingredients, for example, roast and ground coffee or leaf tea and sugar and/or creamer, as desired. One machine which can readily be adapted for the preparation of a beverage from the preferred cartridge of the invention which includes a recognition means is described in our EP-A-0334573. The only modification required to be made to such a beverage preparation machine is to incorporate an appropriate sensor or sensors into it, the sensor or sensors being designed to read the particular coding on the cartridge and to send a signal to the con-

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troller, which then selects the appropriate beverage preparation cycle and activates the whipping means.

The sensor may be, for example, a mechanical sensor, an optical sensor, a magnetic sensor, an electrical sensor or an inductive sensor. The machine is preferably adapted so that the cartridge is handled automatically following its insertion into the machine.

The present invention also includes within its scope a method for the production of a whipped beverage from a cartridge containing one or more beverage ingredients, which method comprises introducing an aqueous medium into the cartridge, extracting constituents from the beverage ingredient(s) and/or dissolving the beverage ingredient(s) to form a beverage, whipping the beverage so produced and collecting the whipped beverage as it leaves the cartridge.

The whipping of the beverage, for example by means of an impeller, will generally incorporate air into the beverage to produce a foamy, frothy beverage. Beverages which can be produced in this manner are, for example, whipped chocolate and espresso-type coffee. Preferably the whipping of the beverage to incorporate air therein will result in from 5 to 30 percent by volume of air being incorporated into the beverage as bubbles having a bubble size preferably of below 300 micrometres, more preferably in the range of from 10 to 200 micrometres. Generally, whipped chocolate will incorporate a higher percentage of air by volume therein than whipped coffee.

Alternatively, the whipping of the beverage may be used to produce carbonated drinks. For example, the aqueous medium introduced into the cartridge may be carbonated water. On contact with powdered ingredients or a syrup for the preparation of a beverage the carbonated water will generally loose some of the carbon dioxide incorporated therein. The whipping of the beverage reintroduces into the beverage at least some of the carbon dioxide which has been lost from solution during the passage of the carbonated water through the cartridge. Alternatively, carbon dioxide may be introduced into the cartridge before the beverage is whipped, for example by direct passage into the chamber which contains the whipping means.

The present invention will be further described with reference to the accompanying drawings, in which:-

Figure 1 is a perspective view from above of a beverage cartridge of the invention;

Figure 2 is a perspective view from below of the beverage cartridge of Figure 1;

Figure 3 is a section through the beverage cartridge of Figure 1 along the lines III-III;

Figure 4 is a section through the beverage cartridge 1 along the line IV-IV;

Figure 5 illustrates one variant of an external driving mechanism;

Figure 6 illustrates another variant of an external driving mechanism;

Figure 7 illustrates a part of the driving mechanism of Figure 6 on a larger scale; and

Figure 8 illustrates a rotor of the beverage cartridge with which the driving mechanism engages.

Referring to the drawings, a cartridge of the present invention is shown generally at 1. The cartridge is mainly formed from a moulded plastics material and has a top 2 which may be decorated to identify the contents of the capsule, or which may have foil or paper laminated thereto with appropriate identification thereon. The bottom 3 of the capsule may be formed from an aluminium foil or a laminated foil.

The cartridge 1 has an inlet 4 and an outlet 5 which are formed in use of the cartridge by piercing or cutting the material covering the inlet and outlet openings.

As best shown in Figure 4, water enters the cartridge 1 via inlet 4 where it enters channel 6 formed along the edges of the package and communicates via slots 7 with the beverage ingredients 8 which are contained in a compartment within the cartridge. The water mixes with the beverage preparation ingredients contained within compartment 9 and is forced upwardly through the beverage preparation ingredients. The beverage formed by passage of water through the beverage preparation ingredients passes through filter material 10 into a plurality of passages which are formed between ribs 12 onto which the filter paper is sealed. The sealing of the filter material onto ribs 12 prevents any short circuit and all of the beverage has to pass through the filter. The passages 11 are closed at the end remote from the outlet by transverse rib 13. The beverage collected via passages 11 is funneled in area 14 in the direction as shown by the arrows and passes through inlets 15 and 16 to a whipping chamber 17 in which a rotor 18 is disposed.

The whipping chamber 17 has a plurality of fixed vanes 20 provided therein, as best shown in Figure 2. The whipper chamber 17 is provided with a hole 21 into which rotor 18 is adapted to fit. The rotor 18 is provided with a plurality of vanes 22 positioned around the central hollow drive shaft 23. The hollow drive shaft 23 has ribs 24 which are adapted for engagement with an external driving device. The rotor has an annular ring 25 fixed to the bottom of the vanes 22 which, in use, is lubricated by the beverage and the film of liquid between the annular ring and the bottom surface 3 of the cartridge 1 acts as a bearing. The film of liquid assists in pushing the rotor upwards and assists in cooling the under surface of the ring 25.

The drive shaft 23 of rotor 18 engages by means of ribs 24, an external driving mechanism which causes the rotor to rotate at very high speeds, for example at a speed of from 10,000 to 20,000 rpm. Air is drawn into the whipping chamber by a passage through the space provided between the edges of the hole 21 and the drive shaft 23. The rotor 18 rotates freely in the whipping chamber 17 and the high speed of the rotor causes considerable turbulence with the passage of the rotor vanes

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22 close to the fixed vanes 20 in whipping chamber 17. The rotation of the rotor 18 in whipping chamber 17 causes a centrifugal/centripetal effect on the beverage which causes a negative pressure in the area of the base of the shaft 23 of the rotor 18 which draws air into the whipping chamber 17. This has two benefits, namely it obviates the need for a seal on the shaft 23 and provides the air to incorporate into the beverage in the form of bubbles. The whipped beverage then exits from the whipping chamber 17 in the direction as shown by the arrows in Figure 3 to the outlet 5 from the capsule.

The cartridge as described with reference to Figures 1 to 4 is suitable for insertion into a beverage preparation machine, for example of the type as described in EP-A-0334573 longitudinally through a slot.

The cartridge is also provided, as best shown in Figure 1 with teeth 30 moulded along one side edge of the cartridge. The teeth 30 have recessess 31 formed therebetween. The teeth 30 are intended to enable the cartridge to be driven through a beverage preparation machine by the engagement of the teeth 30 with the tooth (not shown) of a cam 35 as shown in Figure 5.

The side edge of cartridge 1 opposite to the edge provided with teeth 30 has a plurality of pegs 32, 33 and 34 provided thereon. As the package is driven into the machine by the engagement of teeth 30 with cam 35, the presence or absence of the upstanding pegs 32, 33, 34 is sensed by a sensing arm (not shown). If one or more of pegs 32, 33, 34 is not present the sensing arm will thereby identify a different type of cartridge. The sensing arm operates a switch (not shown) which thereby transmits information concerning the presence or absence of the pegs on the package to the control mechanism for the beverage dispensing machine. The arrangement of pegs 32, 33, 34 on the cartridge thus identifies the type of cartridge to a controller which then selects the appropriate beverage preparation conditions.

When the beverage preparation machine has selected the appropriate beverage preparation conditions, the water inlet 4 of the package is pierced or cut, the outlet 5 in the package is uncovered and the foil 36 originally covering the outlet folded back into an outlet surround chamber 37. Water is caused to flow under pressure through the compartment containing the beverage ingredients and, after whipping, the chosen beverage is then collected in a cup or receptacle placed below the outlet 5 of the package.

The rotor 18 of the cartridge is driven by an external drive mechanism, one variant of which is shown in Figure 5. The external drive mechanism shown in Figure 5 comprises a drive wire 40 with a shaped end 41. The drive wire 40 is mounted through a sliding drive 42 and a bearing bush 43. The drive wire 40 is driven by motor 44 which is attached to a motor mounting arm 45. The flexible end 41 of driving wire 40 is adapted to pierce the foil covering the drive shaft 23 of the rotor and to engage the ribs 24 of the rotor 18. The flexibility of the drive wire 40 allows for some mis-alignment and also reduces noise which would be caused by any mis-alignment. The flexibility also allows for motor 44 to be non-critically mounted.

The high speed motor 44 is caused to move in an arc by a cam action from the main cam 35 of the brewing mechanism. The motor mounting arm 45 is also provided with a sensing arm 46 which senses the depth of the cartridge inserted into the brewing machine at location 50 thereof. If the depth of the ledge at 50 is the correct depth for the beverage to be produced from the capsule to require whipping, then the tip 41 of the drive wire will be caused to penetrate the foil covering the rotor drive shaft 23 and to engage the ribs 24 thereof. Accordingly, the brewing machine will then cause the motor 44 to be switched on and whip the beverage by means of the rotation of flexible drive 41 being transmitted to the rotor 18.

If the capsule is not of the type which requires whipping, i.e. if sensor 46 does not sense the correct depth of ledge 50, then an override spring arm 51 will be depressed, but the driving device will not penetrate the top foil of the cartridge and the motor 44 will not be activated.

Referring to Figure 6, a second variant of an external drive mechanism is shown. The drive mechanism comprises a driving dog 60 which is attached through ferrule 61 to a motor 62. The motor is located within a motor mount 63 by means of claws 64 and 65. The upper arm 66 of the motor mount 63 has a spherical shaped under surface (not shown) which allows the motor to rock in all directions and therefore allows the alignment of the driving dog in the rotor shaft, as more fully described below with reference to Figures 7 and 8.

The motor mount 63 is supported by a motor carriage 70 via the spherical under surface of the upper arm 66 of the motor mount, allowing the motor angular motion as discussed above.

The operation of the device to engage the driving dog 60 of the rotor described below with reference to Figure 8 is driven by a track in the main cam of a brewing mechanism as described with reference to European Patent No. 0334573 (not shown). This cam operates a peg 71 in a cam follower lever 72 which pivots on a support 73 of the side plate 74 of the brewing mechanism. The position of the cam (not shown) ensures that the capsule is correctly placed before the lever 72 is operated. The lever 72 is moved downwards and causes the motor carriage to move downwards via a spring 75 one end of which is located on peg 76 of the cam follower lever and one end of which is located on peg 77 on the motor carriage 70. The motor carriage 70 is provided with a feeler blade 78 which is adapted to sense if the capsule is of the type the beverage from which will require whipping. When the capsule is of the correct type the feeler locates at a lower position on the capsule than if it is not of the correct type which allows the driving dog to press onto and pierce the foil covering the rotor drive shaft. The motor is then switched on due

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to the sensing of the correct capsule and the electrical and software control supplying power to the motor.

The movement of the motor carriage in the vertical direction is achieved by means of two guides positioned on the side plate 74 of the brewing mechanism. One guide 79 is shown which locates in a complementary slot 80 on the motor carriage. The other guide is not shown.

At the end of the brewing cycle, when the whipping of the beverage is complete, the cam follower lever 72 bears against the ledge 81 on the motor carriage thereby to ensure that the driving dog 60 is positively removed from the capsule by the action of the lever 72.

The driving dog 60 is shown on a larger scale in Figure 7. The driving dog has a pointed end 85 which is adapted to pierce the film which covers the aperture 90 of the rotor shown in Figure 8. The driving dog has a shaft 86 which is attached to the ferrule 61 shown in Figure 6. The pointed end 85 of the driving dog is attached via a section 87 of circular cross section to a flat section 88.

In operation, the driving dog pierces the film covering the aperture 90 of the rotor 89 and enters the hollow drive shaft 91 of the rotor 89. The drive shaft 91 of the rotor 89 is provided with two opposing pairs of splines 92 and 93 which centre section 87 of the driving dog. The pair of splines 92 are higher than the opposing pair of splines 93. This arrangement ensures that as the driving dog 60 enters the shaft 91 of the rotor 89 it is rotated until the shaft 88 is in aligned between, or to one side, of the two adjacent higher splines 92. This arrangement also prevents the flattened section 88 from attempting to pass down the same side of the opposing splines, particularly if the driving dog is entering at an angle.

The rotor 89 as shown in Figure 8 is provided with a plurality of blades 95 which are connected to the central shaft 96 of the rotor and at their lower outer edges to an annular ring 97 which also acts as a liquid bearing surface. A gap 99 is provided between the annular ring 97 and the central shaft 96 of the rotor which allows passage of liquid beneath the ring to assist in lubrication of the rotor as it bears against the bottom surface 3 of the cartridge.

The rotor 89 is also provided with a plurality of lugs 98, one of which is shown in Figure 8, which assist in retaining the rotor in the capsule during the manufacturing process by means of an interference fit within the hole 21 of the capsule into which the rotor fits (see Figure 3). Alternatively, the hole 21 may be provided with a shoulder (not shown) upon which the lugs 78 rest when the rotor is located in the hole during manufacture. The film of liquid between the bottom surface of the ring 97 and the surface 3 of the cartridge assists in pushing the rotor upwards within the hole 21 of the cartridge. In one embodiment where the hole 21 is provided with a shoulder on which lugs 98 rest, the upwards movement of the rotor prevents the lugs from rubbing on the shoulder and, as previously described, assists in cooling the under surface of the annular ring 97.

Claims

1. A cartridge (1) containing one or more beverage ingredients (8) and being formed from substantially air- and water-impermeable materials, the said cartridge (1) comprising an inlet (4) for the introduction of an aqueous medium into the cartridge, a compartment containing the beverage ingredient or ingredients, an outlet (5) for the beverage produced from the beverage ingredients characterised in that the cartridge includes whipping means (18) provided in the path of the beverage prior to the outlet (5), to whip the said beverage.

2. A cartridge as claimed in claim 1 wherein the whipping means (18) comprises an impeller (23,24) adapted to engage an external driving device (40, 41, 60).

3. A cartridge as claimed in claim 2 wherein the impeller comprises a rotor (18) with a plurality of radial vanes(22).

4. A cartridge as claimed in claim 3 wherein the rotor (18) has a hollow drive shaft adapted for engagement with the external driving device (40, 41, 60).

5. A cartridge as claimed in any one of the preceding claims wherein the whipping means is positioned in a chamber (17) integrally formed within the cartridge (1).

6. A cartridge as claimed in claim 5 wherein the chamber (17) has a plurality of fixed vanes (20) provided therein.

7. A cartridge as claimed in any one of the preceding claims wherein the inlet (4) and/or outlet (5) is covered by a substantially air- and water-impermeable material prior to the formation, in use , of the inlet (4) and/or outlet (5) in the cartridge (1).

8. A cartridge as claimed in any one of the preceding claims wherein a channel (6) communicates with the inlet (4) for the entry of an aqueous medium into the cartridge, the channel (6) being separated from the compartment containing the beverage ingredient or ingredients (8) by a wall which has a plurality of openings (7) formed therein for the entry of the aqueous medium into the compartment containing the beverage preparation ingredient(s) (8).

9. A cartridge as claimed in claim 8 wherein the channel (6) extends along at least one side of the compartment containing the beverage preparation ingredient(s)(8).

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10. A cartridge as claimed in claim 8 or claim 9 wherein the channel (6) extends around three sides of the compartment containing the beverage preparation ingredient(s)(8).

11. A cartridge as claimed in any one of claims 8 to 10 wherein the openings (7) comprise a plurality of elongate slots.

12. A cartridge as claimed in any one of the preceding claims wherein a filter (10) is disposed between the compartment and at least a part of the under surface of the top of the cartridge (1), one or more passages (11) being formed between the filter (10) and the top of the cartridge (1), which passage(s) (11) communicate(s) with the outlet (5).

13. A cartridge as claimed in claim 12 wherein the filter (10) is made from a water-impermeable material.

14. A cartridge as claimed in any of the preceding claims wherein the beverage preparation ingredient (8) is powdered chocolate or roast and ground coffee.

15. A cartridge as claimed in any one of the preceding claims which is provided with at least one recognition means (32,33,34) whereby, in use, the cartridge (1) is identified by the machine into which it is placed for treatment therefrom and the identification of the cartridge (1) thereby causes it to be subjected to the correct treatment steps including the introduction of a aqueous medium into the cartridge (1) and the engagement of the whipping means (18) by an external driving device (40,41,60) incorporated into the machine.

16. A cartridge as claimed in claim 15 wherein the recognition means (32,33,34) comprises one or more surface features formed in the body of the cartridge (1).

17. A method for the production of a whipped beverage from a cartridge (1) containing one or more beverage ingredients (8), which method comprises introducing an aqueous medium into the cartridge (1), extracting constituents from the beverage ingredient(s) (8) and/or dissolving the beverage ingredient(s) (8) to form a beverage, whipping the beverage so produced and collecting the whipped beverage as it leaves the cartridge (1).

18. A method as claimed in claim 17 wherein the beverage is whipped by means of an impeller (18).

19. A method as claimed in claim 17 or claim 18 wherein the whipping of the beverage incorporates air therein.

20. A method as claimed in claim 17 or claim 18 wherein carbon dioxide is introduced into the cartridge before the beverage is whipped.

21. A method as claimed in claim 17 or claim 18 wherein the aqueous medium is carbonated water and the whipping of the beverage reintroduces into the beverage any carbon dioxide lost from solution during the passage of the aqueous medium through the cartridge.

22. A method as claimed in any one of claims 17 to 19 wherein the beverage produced is whipped chocolate or espresso-type coffee.

Patentansprüche

1. Patrone (1), die einen oder mehrere Getränkebestandteile (8) enthält und aus im wesentlichen luft- und wasserundurchlässigen Materialien gebildet ist, wobei die Patrone (1) umfaßt: einen Einlaß (4) für die Einführung eines wäßrigen Mediums in die Patrone, eine den Getränkebestandteil oder die -bestandteile enthaltende Kammer, einen Auslaß (5) für das aus den Getränkebestandteilen erzeugte Getränk,
dadurch gekennzeichnet, daß die Patrone ein Aufschäummittel (18) umfaßt, das in dem Weg des Getränks vor dem Auslaß (5) vorgesehen ist, um das Getränk aufzuschäumen.

2. Patrone nach Anspruch 1, bei welcher das Aufschäummittel (18) ein Flügelrad (23, 24) umfaßt, welches zum Eingriff mit einer externen Antriebsvorrichtung (40, 41, 60) ausgeführt ist.

3. Patrone nach Anspruch 2, bei welcher das Flügelrad einen Rotor (18) mit einer Mehrzahl von radialen Flügeln (22) umfaßt.

4. Patrone nach Anspruch 3, bei welcher der Rotor (18) eine hohle Antriebswelle aufweist, die zum Eingriff mit der externen Antriebsvorrichtung (40, 41, 60) ausgeführt ist.

5. Patrone nach einem der vorhergehenden Ansprüche, bei welcher das Aufschäummittel in einer Kammer (17) angeordnet ist, die in der Patrone (1) integral ausgebildet ist.

6. Patrone nach Anspruch 5, bei welcher die Kammer (17) eine Mehrzahl von darin vorgesehenen festen Flügeln (20) aufweist.

7. Patrone nach einem der vorhergehenden Ansprüche, bei welcher der Einlaß (4) und/oder der Auslaß (5) - vor der Bildung des Einlasses (4) und/oder des Auslasses (5) in der Patrone (1) bei Verwendung -

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von einem im wesentlichen luft- und wasserundurchlässigen Material abgedeckt ist.

8. Patrone nach einem der vorhergehenden Ansprüche, bei welcher ein Kanal (6) mit dem Einlaß (4) für den Eintritt eines wäßrigen Mediums in die Patrone in Verbindung steht, wobei der Kanal (6) von der den Getränkebestandteil oder die -bestandteile (8) enthaltenden Kammer durch eine Wand getrennt ist, in der für den Eintritt des wäßrigen Mediums in die den Getränkezubereitungsbestandteil bzw. die -bestandteile (8) enthaltende Kammer eine Mehrzahl von Öffnungen (7) ausgebildet sind.

9. Patrone nach Anspruch 8, bei welcher sich der Kanal (6) entlang wenigstens einer Seite der den Getränkezubereitungsbestandteil bzw. die -bestandteile (8) enthaltenden Kammer erstreckt.

10. Patrone nach Anspruch 8 oder 9, bei welcher sich der Kanal (6) um drei Seiten der den Getränkezubereitungsbestandteil bzw. die -bestandteile (8) enthaltenden Kammer erstreckt.

11. Patrone nach einem der Ansprüche 8 bis 10, bei welcher die Öffnungen (7) eine Mehrzahl von länglichen Schlitzen umfassen.

12. Patrone nach einem der vorhergehenden Ansprüche, bei welcher ein Filter (10) zwischen der Kammer und wenigstens einem Teil der unteren Fläche der Oberseite der Patrone (1) angeordnet ist, wobei ein oder mehrere Durchgänge (11) zwischen dem Filter (10) und der Oberseite der Patrone (1) gebildet sind, welcher bzw. welche Durchgänge (11) mit dem Auslaß (5) in Verbindung steht bzw. stehen.

13. Patrone nach Anspruch 12, bei welcher der Filter (10) aus einem wasserundurchlässigen Material hergestellt ist.

14. Patrone nach einem der vorhergehenden Ansprüche, bei welcher das Getränkezubereitungsbestandteil (8) Schokoladenpulver oder gerösteter und gemahlener Kaffee ist.

15. Patrone nach einem der vorhergehenden Ansprüche, die mit wenigstens einem Erkennungsmittel (32, 33, 34) versehen ist, durch welches die Patrone (1) bei Verwendung von der Maschine, in welche sie zur Behandlung durch diese eingesetzt ist, identifiziert wird und wobei die Identifizierung der Patrone (1) zur Folge hat, daß sie den richtigen Behandlungsschritten unterzogen wird, einschließlich der Einführung eines wäßrigen Mediums in die Patrone (1) und dem Eingriff einer externen Antriebsvorrichtung (40, 41, 60), die in der Maschine enthalten ist, mit dem Aufschäummittel (18) .

16. Patrone nach Anspruch 15, bei welcher das Erkennungsmittel (32, 33, 34) ein oder mehrere Oberflächenmerkmale umfaßt, die in dem Körper der Patrone (1) ausgebildet sind.

17. Verfahren zur Herstellung eines aufgeschäumten Getränks aus einer Patrone (1), die einen oder mehrere Getränkebestandteile (8) enthält, wobei das Verfahren umfaßt: das Einführen eines wäßrigen Mediums in die Patrone (1), das Extrahieren von Bestandteilen aus dem/den Getränkebestandteil(en) (8) und/oder das Auflösen des bzw. der Getränkebestandteile (8) zur Bildung eines Getränks, Aufschäumen des so erzeugten Getränks und Auffangen des aufgeschäumten Getränks, wenn es die Patrone (1) verläßt.

18. Verfahren nach Anspruch 17, bei welchem das Getränk mittels eines Flügelrads (18) aufgeschäumt wird.

19. Verfahren nach Anspruch 17 oder Anspruch 18, bei welchem durch das Aufschäumen des Getränks diesem Luft zugesetzt wird.

20. Verfahren nach Anspruch 17 oder 18, bei welchem vor dem Aufschäumen des Getränks Kohlensäure in die Patrone eingeführt wird.

21. Verfahren nach Anspruch 17 oder Anspruch 18, bei welchem das wäßrige Medium mit Kohlensäure versetztes Wasser ist und das Aufschäumen des Getränks in das Getränk Kohlensäure wieder einführt, die während des Durchtritts des wäßrigen Mediums durch die Patrone aus der Lösung verlorengegangen ist.

22. Verfahren nach einem der Ansprüche 17 bis 19, bei welchem das erzeugte Getränk aufgeschäumte Schokolade oder aufgeschäumter Kaffee vom Typ Espresso ist.

Revendications

1. Cartouche (1) contenant un ou plusieurs ingrédient(s) de boisson (8) et réalisée en matières sensiblement imperméables à l'air et à l'eau, ladite cartouche (1) comprenant une admission (4) pour l'introduction d'un fluide aqueux dans la cartouche, un compartiment contenant l'ingrédient ou les ingrédients de boisson, une sortie (5) de la boisson produite à l'aide des ingrédients de la boisson, caractérisée en ce que la cartouche comprend un moyen de battage (18) placé sur le trajet de la boisson au-devant de la sortie (5) pour battre ladite boisson.

2. Cartouche selon la revendication 1, dans laquelle le moyen de battage (18) consiste en une roue à

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palettes (23, 24) conçue pour s'enclencher avec un dispositif extérieur d'entraînement (40, 41, 60).

3. Cartouche selon la revendication 2, dans laquelle la roue à palettes comprend un rotor (18) comportant plusieurs palettes radiales (22).

4. Cartouche selon la revendication 3, dans laquelle le rotor (18) comprend un arbre creux d'entraînement conçu pour s'enclencher sur le dispositif extérieur d'entraînement (40, 41, 60).

5. Cartouche selon l'une quelconque des revendications précédentes, dans laquelle le moyen de battage est placé dans une chambre (17) réalisée monobloc à l'intérieur de la cartouche (1).

6. Cartouche selon la revendication 5, dans laquelle la chambre (17) comporte intérieurement plusieurs palettes fixes (20).

7. Cartouche selon l'une quelconque des revendications précédentes, dans laquelle l'admission (4) et/ou la sortie (5) est recouverte d'une matière sensiblement imperméable à l'air et à l'eau avant la formation, à l'utilisation, de l'admission (4) et/ou de la sortie (5) de la cartouche (1).

8. Cartouche selon l'une quelconque des revendications précédentes, dans laquelle un canal (6) communique avec l'admission (4) pour l'entrée d'un fluide aqueux dans la cartouche, le canal (6) étant séparé du compartiment contenant l'ingrédient ou les ingrédients de la boisson (8) par une cloison qui comporte plusieurs trous (7) pour l'entrée du fluide aqueux dans le compartiment contenant l'ingrédient ou les ingrédients (8) de préparation de la boisson.

9. Cartouche selon la revendication 8, dans laquelle le canal (6) est disposé le long d'au moins un côté du compartiment contenant l'ingrédient ou les ingrédients (8) de préparation de la boisson.

10. Cartouche selon la revendication 8 ou la revendication 9, dans laquelle le canal (6) est disposé autour de trois côtés du compartiment contenant l'ingrédient ou les ingrédients (8) de préparation de la boisson.

11. Cartouche selon l'une quelconque des revendications 8 à 10, dans laquelle les trous (7) consistent en plusieurs fentes allongées.

12. Cartouche selon l'une quelconque des revendications précédentes, dans laquelle un filtre (10) est disposé entre le compartiment et au moins une partie de la surface inférieure de la surface supérieure de la cartouche (1), un ou plusieurs passages (11) étant réalisés entre le filtre (10) et la cloison supérieure de la cartouche (1), ledit ou lesdits passage(s) (11) communiquant avec la sortie (5).

13. Cartouche selon la revendication 12, dans laquelle le filtre (10) est réalisé en une matière imperméable à l'eau.

14. Cartouche selon l'une quelconque des revendications précédentes, dans laquelle l'ingrédient de préparation de la boisson (8) est du chocolat en poudre ou du café grillé et moulu.

15. Cartouche selon l'une quelconque des revendications précédentes, qui est équipée d'au moins un moyen de reconnaissance (32, 33, 34) de manière qu'à l'utilisation, la cartouche (1) soit identifiée par la machine dans laquelle elle est placée pour son traitement et que l'identification de la cartouche (1) par celle-ci lui fasse subir les étapes correctes de traitement, y compris l'introduction d'un fluide aqueux dans la cartouche (1) et l'enclenchement du moyen de battage (18) sur le dispositif extérieur d'entraînement (40, 41, 60) incorporé dans la machine.

16. Cartouche selon la revendication 15, dans laquelle le moyen de reconnaissance (32, 33, 34) comprend une ou plusieurs structure(s) de surface réalisé(es) dans le corps de la cartouche (1).

17. Procédé de production d'une boisson battue à partir d'une cartouche (1) contenant un ou plusieurs ingrédient(s) de boisson (8), ledit procédé comprenant l'introduction d'un fluide aqueux dans la cartouche (1), l'extraction des constituants de l'ingrédient ou des ingrédients de la boisson (8) et/ou la dissolution de l'ingrédient ou des ingrédients de la boisson (8) pour former une boisson, le battage de la boisson ainsi produite et la récupération de la boisson battue lorsqu'elle quitte la cartouche (1).

18. Procédé selon la revendication 17, suivant lequel la boisson est battue à l'aide d'une roue à palettes (18).

19. Procédé selon la revendication 17 ou la revendication 18, suivant lequel le battage de la boisson incorpore de l'air dans celle-ci.

20. Procédé selon la revendication 17 ou la revendication 18, suivant lequel de l'anhydride carbonique est introduit dans la cartouche avant que la boisson soit battue.

21. Procédé selon la revendication 17 ou la revendication 18, suivant lequel le fluide aqueux est de l'eau gazeuse et le battage de la boisson réintroduit dans

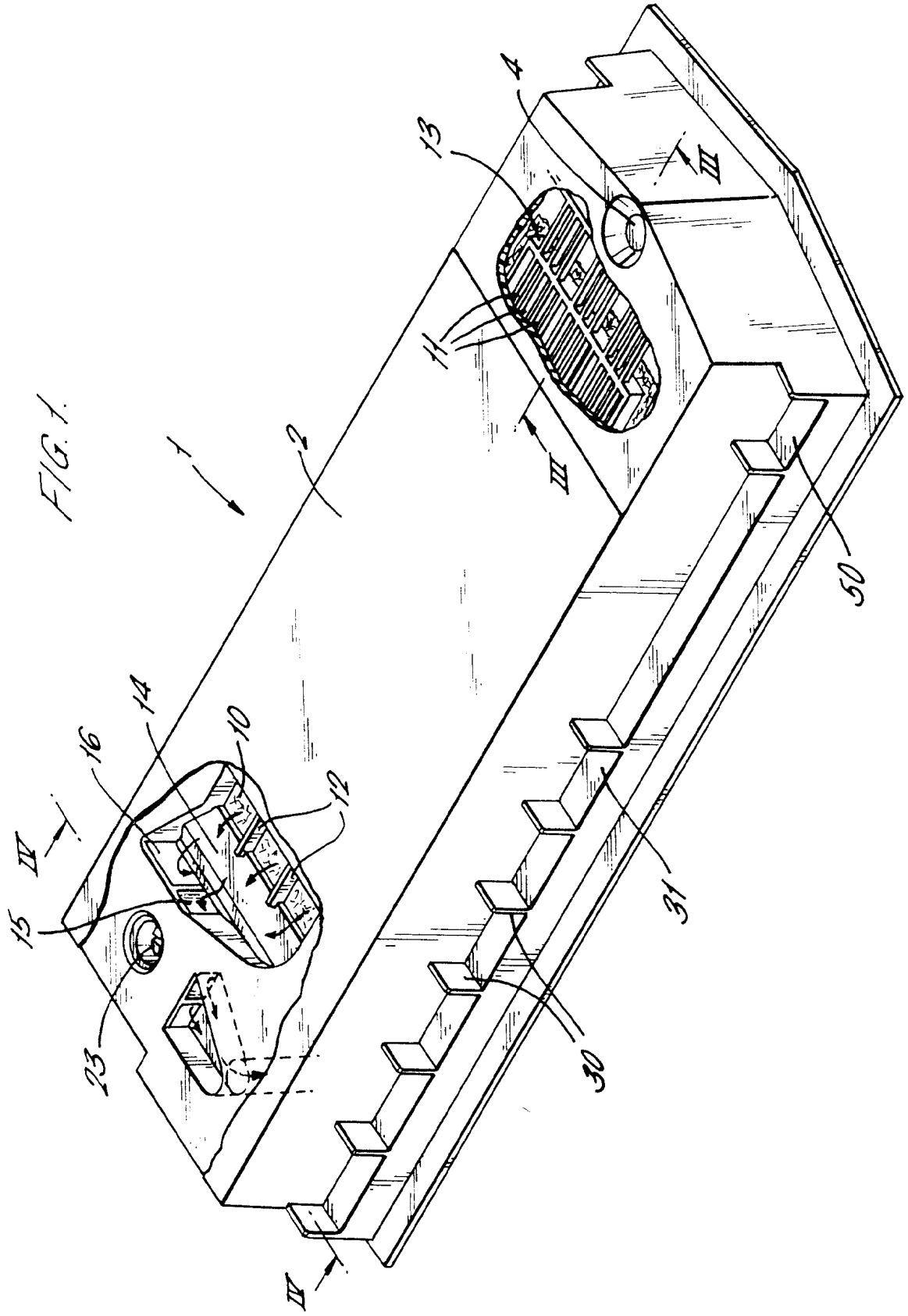
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la boisson tout anhydride carbonique perdu de la solution pendant le passage du fluide aqueux dans la cartouche.

22. Procédé selon l'une quelconque des revendications 17 à 19, suivant lequel la boisson produite est du chocolat ou du café de type expresso battu.

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FIG. 1.



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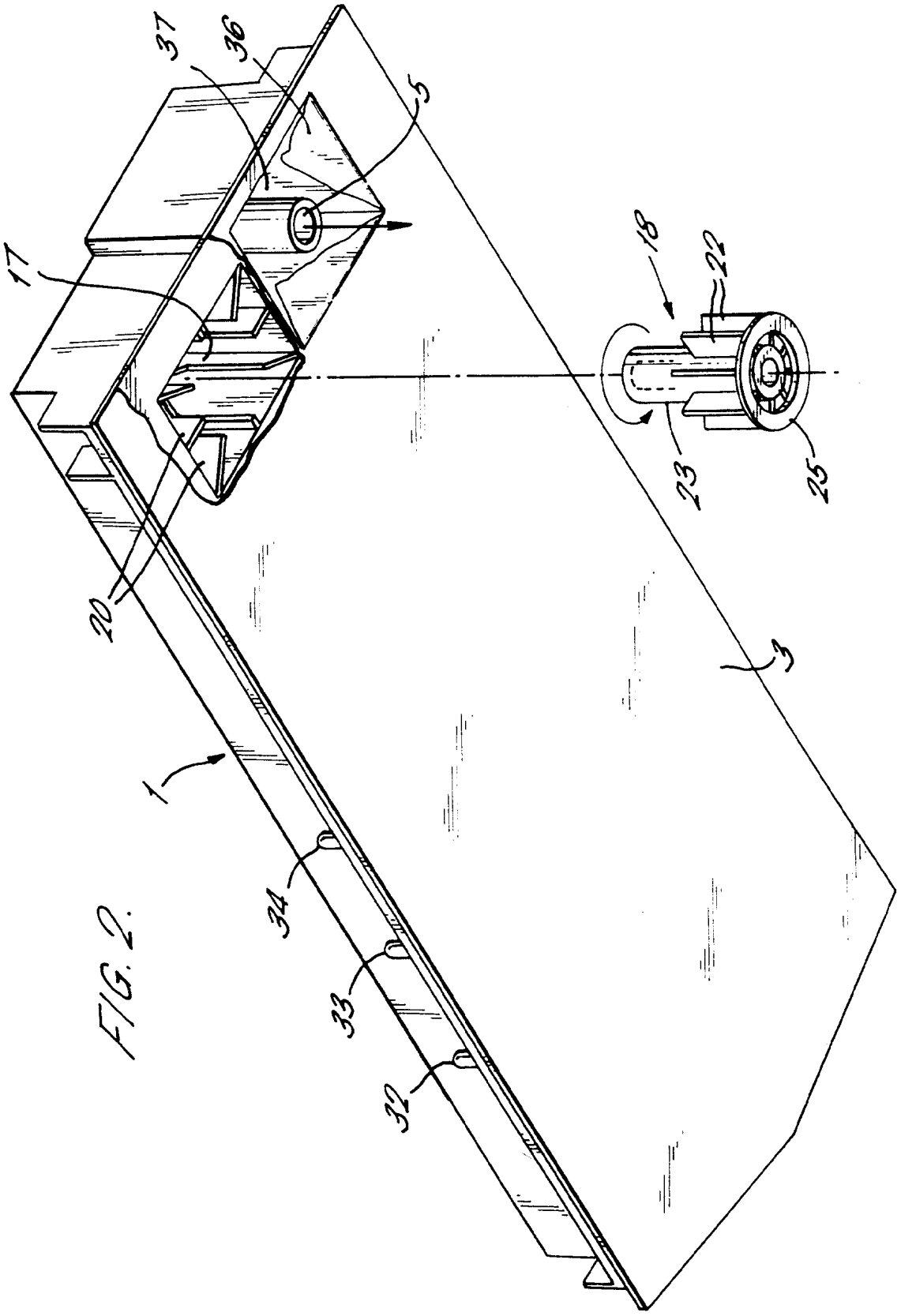


FIG. 2.

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FIG. 3.

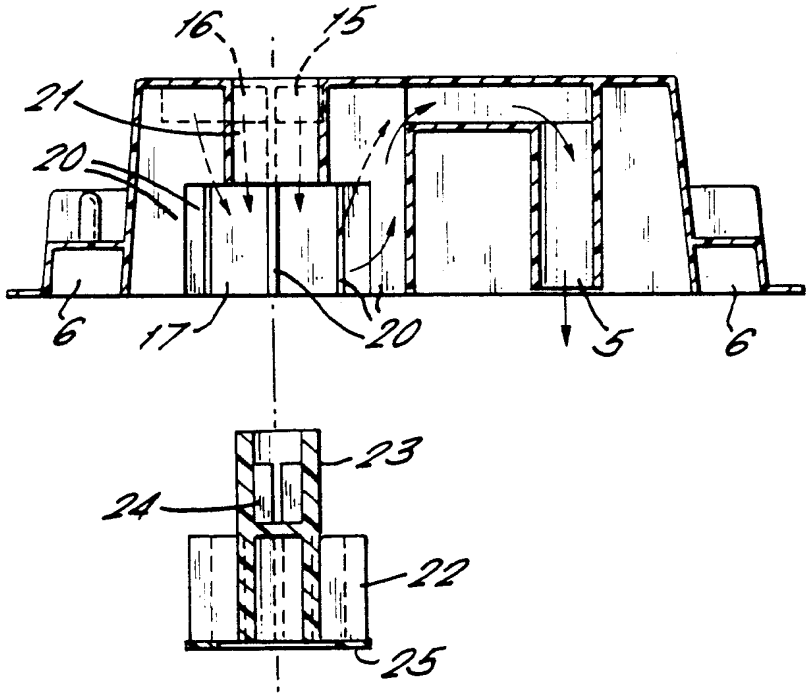
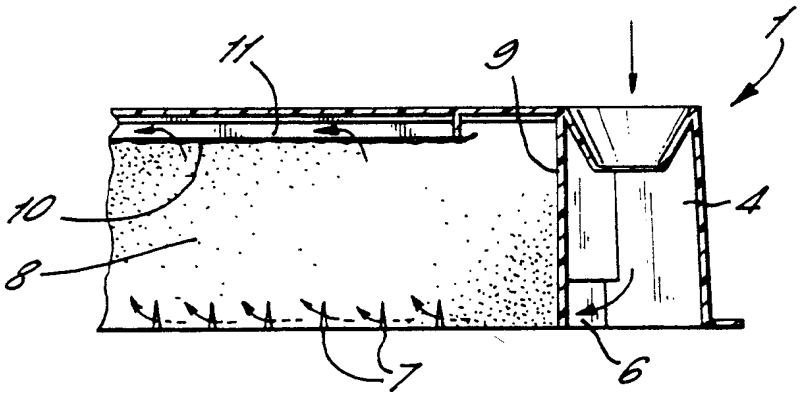
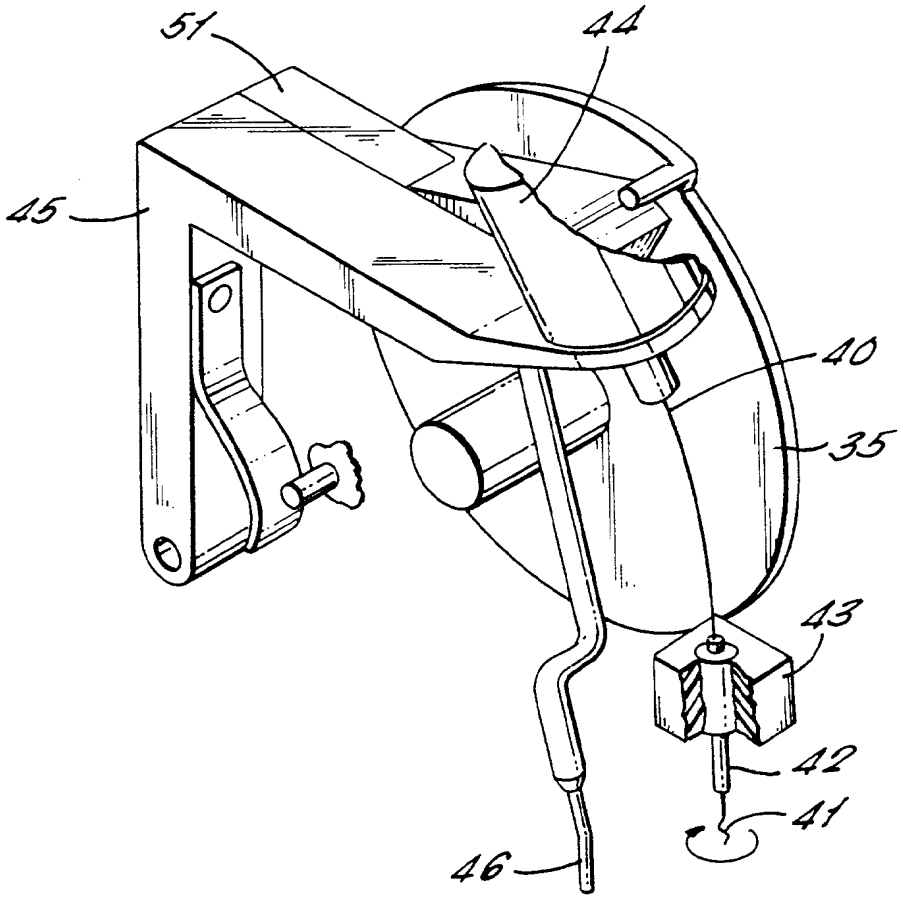


FIG. 4.



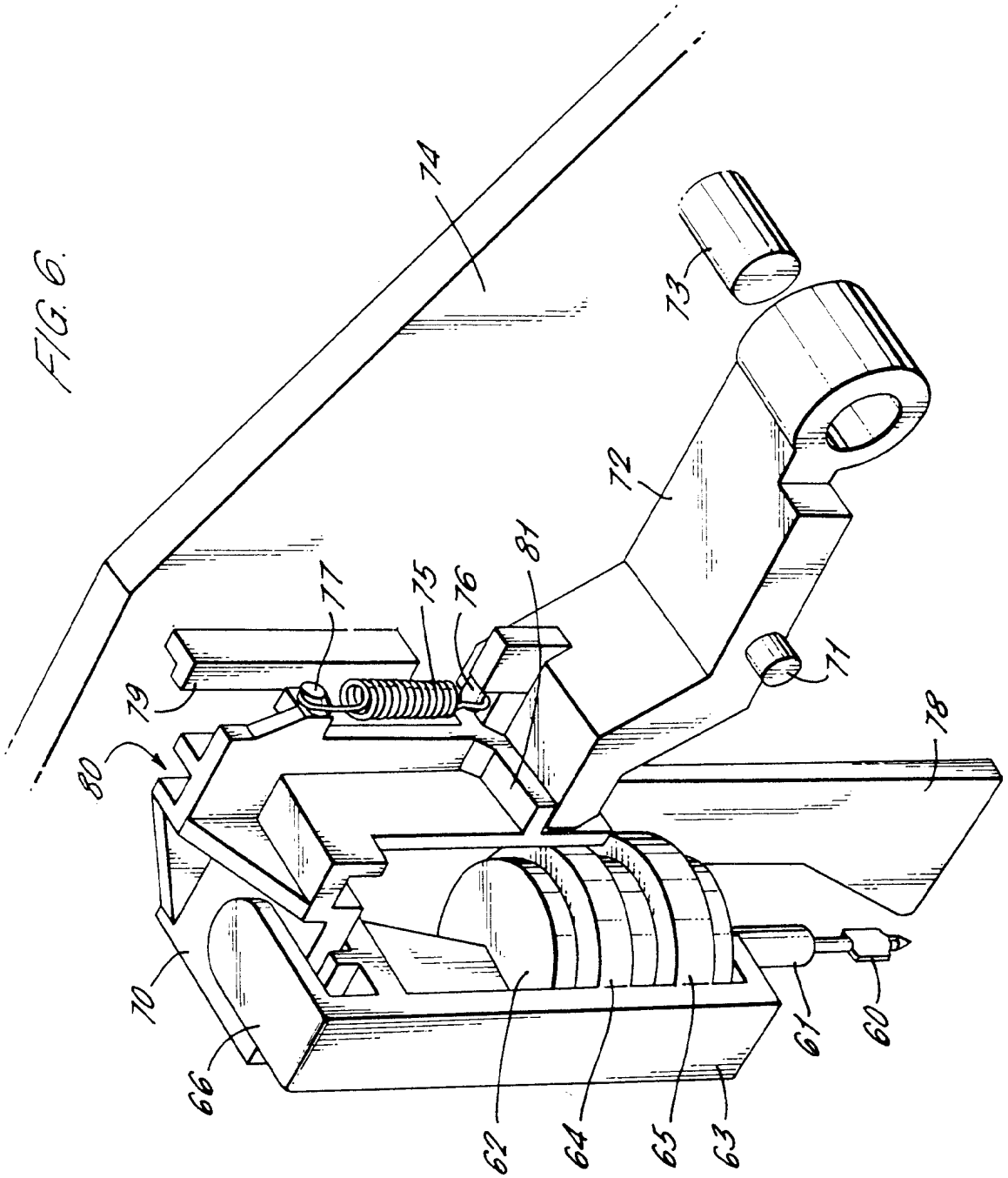
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FIG. 5.



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FIG. 6.



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FIG. 7.

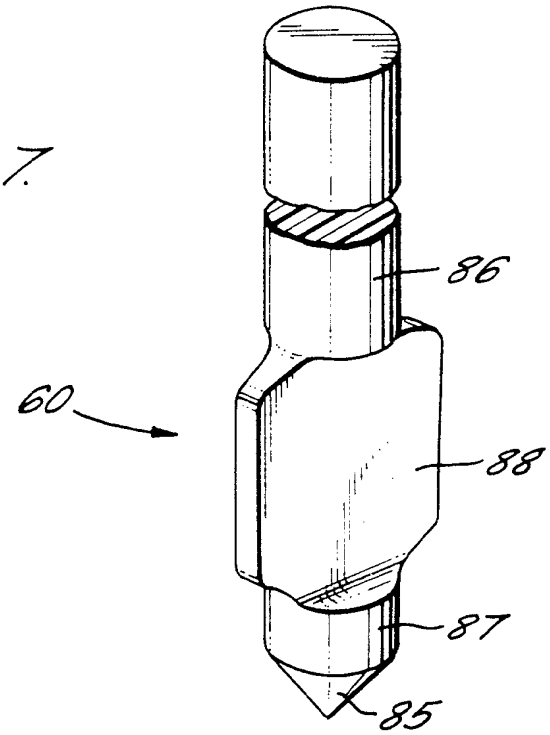
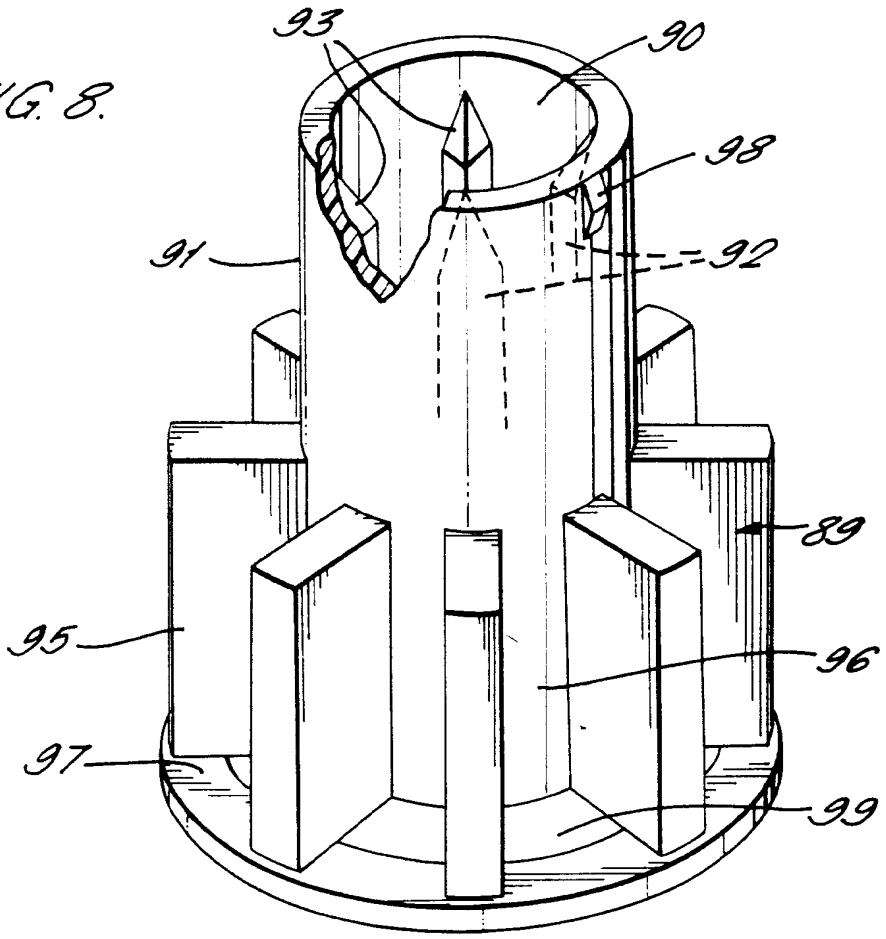


FIG. 8.



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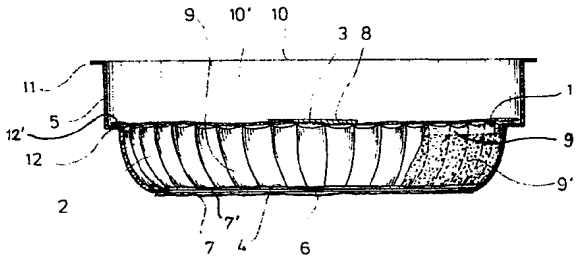
(72) Erfinder:

gleich Anmelder

Prüfungsantrag gem. § 44 PatG ist gestellt

(54) Kaffee-Kompaktfilter

Kaffee-Kompaktfilter, bestehend aus einem oben und unten offenen Filtergehäuse mit je einer darin fest angebrachten oberen und unteren Filterpapierlage, zwischen denen eine bestimmte Menge gemahlenen Kaffees eingebracht ist, wobei zwischen oberer und unterer Filterpapierlage (1 und 4) randseitig entlang der Innenseite des Filtergehäuses (10') ein Filterpapiereinsatz (2) angeordnet ist, der mit der Innenseite des Gehäuses (10') nicht oder nur teilweise in Berührung steht und mit der unteren Filterpapierlage (4) verbunden oder einstückig ist, und Kaffee-Maschine für die Verwendung des Kaffee-Kompaktfilters (10), die eine bewegbar mit dem Gehäuse der Maschine verbundene Aufnahmevorrichtung mit einer Öffnung zur Aufnahme des Kaffee-Kompaktfilters (10) aufweist.



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Patentansprüche:

1. Kaffee-Kompaktfilter, bestehend aus einem oben und unten offenen Filtergehäuse mit je einer darin fest angebrachten oberen und unteren Filterpapierlage, zwischen denen eine bestimmte Menge gemahlenen Kaffees eingebracht ist,
dadurch gekennzeichnet, daß zwischen oberer und unterer Filterpapierlage (1 und 4) randseitig entlang der Innenseite des Filtergehäuses (10') ein Filterpapiereinsatz (2) angeordnet ist, der mit der Innenseite des Gehäuses (10') nicht oder nur teilweise in Berührung steht und mit der unteren Filterpapierlage (4) verbunden oder einstückig ist.

2. Kaffee-Kompaktfilter nach Anspruch 1, dadurch gekennzeichnet, daß der randseitig angeordnete Filterpapiereinsatz (2) aus geriffeltem, gewelltem, zickzack-förmig gefaltetem oder ähnlich geformtem Filterpapier besteht, so daß zwischen dem randseitig angeordneten Filterpapiereinsatz (2) und der Innenseite des Gehäuses (10') ein Ringkanal bzw. mehrere etwa parallele Kanäle (13) mit einer im wesentlichen vertikalen Achse gebildet werden, die nach unten offen sind.

3. Kaffee-Kompaktfilter nach den Ansprüchen 1 und 2, dadurch gekennzeichnet, daß die das Kaffeemehl (9') abdeckende obere Filterpapierlage (1) eine automatische Entlüftung (3) aufweist, die sich unter dem Einfluß von heißem Wasser oder Wasserdampf öffnet.

4. Kaffee-Kompaktfilter nach den Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß die automatische Entlüftung (3) durch wenigstens einen Schnitt, eine Perforation oder ähnliches in der oberen Filterpapierlage (1), die mit wenigstens einem Klebestreifen (8) oder

ähnlichen abgedeckt ist, der sich unter der Einwirkung von heißem Wasser oder Wasserdampf wenigstens teilweise ablöst, gebildet wird.

5. Kaffee-Kompaktfilter nach den Ansprüchen 1 bis 4, dadurch gekennzeichnet, daß das Filtergehäuse 10' einen für die Aufnahme von heißem, zu Einfüllbeginn noch nicht durch die Filterpapierlagen (1 und 4) und den gemahlenen Kaffee (9') gelaufenem Wasser ausreichend hohen Rand (5) oberhalb der oberen Filterpapierlage (1) des Kompaktfilters (10) aufweist.

6. Kaffee-Kompaktfilter nach den Ansprüchen 1 bis 5, dadurch gekennzeichnet, daß die untere Filterpapierlage (4) des Kompaktfilters (10) durch ein darunterliegendes, mit dem Filtergehäuse (10') verbundenes oder einstückiges Trag- und Abstandselement (6) in Form eines Kreuzes, eines Sterns, eines Gitters oder ähnliches unterstützt wird.

7. Kaffee-Kompaktfilter nach den Ansprüchen 1 bis 6, dadurch gekennzeichnet, daß das Filtergehäuse (10') unterhalb des Trag- und Abstandselementes (6) eine weitere Filterlage (7) in Form eines Kunststoffgazefilters, eines Papierfilters oder ähnliches aufweist, die durch das Trag- und Abstandselement (6) von der unteren Filterpapierlage (4) des Kompaktfilters (10) auf Abstand gehalten wird.

8. Kaffee-Maschine für die Verwendung des Kaffee-Kompaktfilters (10) nach den Ansprüchen 1 bis 7, dadurch gekennzeichnet, daß die Maschine (14) eine bewegbar mit dem Gehäuse der Maschine (14) verbundene Aufnahmevorrichtung (15) mit einer Öffnung zur Aufnahme des Kaffee-Kompaktfilters (10) aufweist.

9. Kaffee-Maschine nach Anspruch 8, dadurch gekennzeichnet, daß die Maschine (14) eine Führung (15') zum Einschieben oder Einlegen des Filters (10) aufweist.

10. Kaffee-Maschine nach Anspruch 9, dadurch gekennzeichnet, daß sie unterhalb der Führung (15') eine mit dieser verbundene oder einstückige, etwa trichterförmige Sammel- und Ableitvorrichtung (16) für den aus dem Kaffee-Kompaktfilter (10) austretenden Kaffeesud aufweist.

11. Kaffee-Maschine nach Anspruch 8, dadurch gekennzeichnet, daß die Aufnahmevorrichtung (15) für die Aufnahme des Kaffee-Kompaktfilters (10) in ihrem unteren Bereich, d. h. bei eingelegtem Kompaktfilter (10) unter diesem, eine etwa trichterförmige Sammel- und Ableitvorrichtung (16) für den austretenden Kaffeesud aufweist, die mit der Aufnahmevorrichtung (15) verbunden oder einstückig ist.

12. Kaffee-Maschine nach den Ansprüchen 8 bis 11, dadurch gekennzeichnet, daß die Aufnahmevorrichtung (15) für die Aufnahme des Kaffee-Kompaktfilters (10) eine nur geringfügig größere Höhe als der Kaffee-Kompaktfilter (10) selbst aufweist.

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10 Kaffee-Kompaktfilter

Die Erfindung bezieht sich auf ein Kaffee-Kompaktfilter, bestehend aus einem oben und unten offenen Filtergehäuse mit je einer darin fest angebrachten oberen und unteren 15 Filterpapierlage, zwischen denen eine bestimmte Menge gemahlenen Kaffees eingebracht ist, sowie aus einer Kaffee-Maschine für die Aufnahme des Kaffee-Kompaktfilters.

20 Neben herkömmlichen Filtertüten, die in ein etwa trichterförmiges Filtergefäß eingesetzt und von Hand mit gemahlenem Kaffee gefüllt werden, sind schon seit längerem sogenannte Kaffee-Kompaktfilter gebräuchlich, die aus einem oben und unten offenen Filtergehäuse mit je 25 einer darin fest angebrachten oberen und unteren Filterpapierlage bestehen, zwischen denen eine bestimmte Menge gemahlenen Kaffees eingebracht ist und die als Einsatz in speziellen, dafür geeigneten Kaffeemaschinen verwendet werden und nach einmaligem Gebrauch komplett fortge- 30 worfen werden. Kompaktfilter werden vor allem dort verwendet, wo größere Mengen Kaffeesud in kurzer Zeit erzeugt werden sollen, d. h. vor allem im gastronomischen Bereich.

35 In der Praxis haben derartige Kompaktfilter jedoch einige Nachteile, sowohl aus der Sicht des Verbrauchers als auch des Herstellers, gezeigt.

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Als wirksame Filterfläche steht nur die untere Filterpapierlage zur Verfügung, was zur Folge hat, daß der Filtriervorgang, vor allem bei feiner gemahlenem Kaffee, relativ lange dauert, obwohl gerade auch eine kurze Zubereitungszeit gefordert ist.

Ein weiteres Problem stellt das ungleichmäßige Eindringen des aufgegebenen heißen Wassers in die Kaffeemehlfüllung dar. Bei Aufgabe des heißen Wassers wird zuerst die obere Filterpapierlage durchfeuchtet und dadurch sehr wenig durchlässig für gasförmige Stoffe. Während des weiteren Eindringens des Heißwassers in die Kaffeemehlfüllung werden die zwischen den Kaffeepartikeln verbliebene Luft und der entstehende Wasserdampf verdrängt und sammeln sich in einer Blase unterhalb der oberen Filterpapierlage. Die Folge ist eine unerwünschte Verringerung der Fläche, durch die das Heißwasser in die Kaffeemehlfüllung eintritt und damit sowohl eine Verlangsamung des Filtriervorganges als auch eine Verschlechterung der Auslaugung der Kaffeemehlfüllung. Im schlimmsten Fall kann es sogar zum Überlaufen von heißem Wasser und dadurch zu einer Verbrühungsgefahr für den Benutzer kommen, wenn das heiße Wasser nicht schnell genug durch den Filter abfließen kann.

Nachteilig aus der Sicht des Herstellers ist, daß solche Kompaktfilter, die für einmaligen Gebrauch gedacht sind, mehrmals verwendet werden können, indem für die untere Filterpapierlage handelsübliche Filterpapiere eingelegt werden und Kaffeemehl von Hand aufgegeben wird. Häufig sind derartige Kaffee-Maschinen Teil eines sogenannten "Service-Paketes", d. h. für die Maschine selbst entstehen dem Verbraucher keine Kosten, er ist jedoch verpflichtet, regelmäßig eine bestimmte Mindestmenge an Kaffee-Kompaktfiltern eines bestimmten Herstellers zu kaufen. Der Bedarf, der über diese Mindestmenge hinausgeht, wird aber oft nicht bei dem Hersteller des Kom-

paktfilters gedeckt, sondern in Form von preiswerterem Fremd-Kaffee in handelsüblichen Verpackungsformen gekauft. Hierdurch entstehen dem Kompaktfilter-Hersteller bzw. Lieferanten des "Service-Paketes" nicht zu unterschätzende Umsatzverluste.

Es stellt sich daher die Aufgabe, ein Kaffee-Kompaktfilter sowie eine Kaffee-Maschine für die Verwendung des Kompaktfilters zu schaffen, die die oben genannten Nachteile vermeiden, und einerseits insbesondere eine schnelle Zubereitung, eine gute Auslaugung des Kaffeemehls und eine sichere Handhabung für den Verbraucher bieten und andererseits eine Mehrfachverwendung des Kompaktfilters ausschließen.

Die Lösung dieser Aufgabe gelingt erfindungsgemäß durch ein Kaffee-Kompaktfilter, bestehend aus einem oben und unten offenen Filtergehäuse mit je einer fest darin angebrachten oberen und unteren Filterpapierlage, zwischen denen eine bestimmte Menge gemahlenen Kaffees angebracht ist, dadurch gekennzeichnet, daß zwischen oberer und unterer Filterpapierlage randseitig entlang der Innenseite des Filtergehäuses ein Filterpapiereinsatz angeordnet ist, der mit der Innenseite des Gehäuses nicht oder nur teilweise in Berührung steht.

Durch einen derartigen zusätzlichen Filterpapiereinsatz wird die Fläche, durch die der Kaffeesud austreten kann, wesentlich vergrößert. Dies gilt insbesondere dann, wenn der Einsatz aus geriffeltem, gewelltem, zick-zack-förmig gefaltetem oder ähnlich geformtem Filterpapier besteht. Zwischen der Innenwand des Filtergehäuses und dem Filterpapiereinsatz wird bei einem z. B. glatten Einsatz ein Ringkanal gebildet, bei z. B. gewelltem Einsatz ergibt sich eine Anzahl von etwa parallelen Kanälen mit im wesentlichen vertikalen Achsen, die nach unten offen sind und den austretenden Kaffeesud ableiten. Der rand-

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seitige Filtereinsatz ist, um ein unerwünschtes Austreten von Kaffeemehl zu verhindern, mit der unteren Filterpapierlage verbunden oder einstückig.

Das Problem der Luft- und Dampfblasenbildung im Inneren des Filters wird dadurch gelöst, daß der erfindungsgemäße Kompaktfilter eine automatische Entlüftung aufweist, die sich erst unter dem Einfluß von heißem Wasser oder Wasserdampf öffnet. Sie besteht beispielsweise aus wenigstens einem Schnitt oder einer Perforation in der oberen Filterpapierlage, die mit einem Klebestreifen oder ähnlichem abgedeckt ist, der sich unter der Einwirkung von heißem Wasser oder Dampf wenigstens teilweise ablöst und so die darunter befindlichen Öffnungen freigibt. Durch diese entweichen zunächst die vom eindringenden Wasser aus dem Kaffeemehl verdrängte Luft und der dort entstehende Wasserdampf. Nach dem Entlüftungsvorgang fließt dann das aufgegebene Heißwasser außer durch die obere Filterpapierlage selbst zum Teil auch durch die darin befindlichen Öffnungen in das Kaffeemehl. Dieser so vergrößerte Durchfluß trägt ebenfalls zu einer kurzen Zubereitungszeit bei, während gleichzeitig durch das vorherige Entlüften das Kaffeemehl gleichmäßiger und intensiver ausgelaugt wird, was nach ersten praktischen Erfahrungen mit dem erfindungsgemäßen Kompaktfilter zu einer Kaffeemehlersparnis von etwa 20 % bei gleichbleibender Qualität des Kaffeesuds führt. Auch das Überlaufen des Filters bei Aufgabe von Heißwasser ist durch den verbesserten Durchfluß praktisch ausgeschlossen, zumal das Kompaktfiltergehäuse nach dieser Erfindung einen für die Aufnahme von heißem, zu Einfüllbeginn noch nicht durch die Filterpapierlagen und den gemahlenen Kaffee gelaufenem Wasser ausreichend hohen Rand oberhalb der oberen Filterpapierlage aufweist.

Die Reißfestigkeit von Filterpapier im feuchten Zustand ist relativ gering. Um die Zugspannungen in der unteren

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Filterpapierlage, die das Gewicht von Kaffeemehl und aufgegebenem Wasser aufnehmen muß, gering zu halten, wird diese durch ein darunterliegendes Tragelement, das beispielsweise die Form eines Kreuzes, eines Sterns oder eines Gitters hat und mit dem Filtergehäuse verbunden oder einstückig ist, unterstützt. Ein Einreißen der unteren Filterpapierlage ist so nicht mehr möglich.

Das Tragelement dient gleichzeitig als Abstandselement, das eine unterhalb dieses Trag- und Abstandselementes befindliche weitere Filterlage in Form eines Kunststoffgazefilters, eines Papierfilters oder ähnliches von der unteren Filterpapierlage des Filters zur Sicherung der vollen Durchlässigkeit auf Abstand hält. Durch diese weitere Filterlage werden über die randseitige Filterpapierlage eventuell übergetretene oder durch Beschädigung der unteren Filterpapierlage ausgetretene Kaffeemehlpartikel zurückgehalten, so daß der Kaffeesud sicher fei bleibt von Kaffeemehlanteilen, was sowohl dem Geschmack als auch der Bekömmlichkeit des Getränkes zugute kommt.

Eine Kaffee-Maschine für die Verwendung des erfindungsgemäßen Kaffee-Kompaktfilters weist eine bewegbar mit dem Gehäuse der Maschine verbundene Aufnahmevorrichtung mit einer Öffnung zur Aufnahme des Kaffee-Kompaktfilters auf. Hierdurch wird sowohl ein einfaches Einlegen und Herausnehmen des Kompaktfilters wie auch eine sichere Handhabung gewährleistet, da keine Manipulationen des Benutzers in unmittelbarer Nähe des Heißwasseraustrittes der Maschine erforderlich sind. Die Öffnung in der Aufnahmevorrichtung ist so bemessen und gelegen, daß der Kompaktfilter beispielsweise auf einem vorstehenden Kragen oder einem Vorsprung seines Gehäuses rundum- bzw. allseitig aufliegt.

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Um den aus dem Kompaktfilter austretenden Kaffeesud zu sammeln und in ein darunter befindliches Auffanggefäß zu leiten, weist die Kaffee-Maschine nach der Erfindung eine etwa trichterförmige Sammel- und Ableitvorrichtung auf, die beispielsweise unterhalb der Führung zum Einschieben oder Einlegen des Filters mit der Führung verbunden oder einstückig ist oder mit der Aufnahmevorrichtung in deren unterem Bereich, d. h. bei eingelegtem Kompaktfilter unter diesem, verbunden oder einstückig ist. Mit dieser Sammel- und Ableitvorrichtung wird erreicht, daß der Kaffeesud auch in Auffanggefäße, wie z. B. Glaskannen, mit relativ kleiner Einfüllöffnung eingeleitet wird, ohne daß ein Teil des Kaffeesuds neben die Einfüllöffnung gerät.

Eine Mehrfachverwendung des Kompaktfilters bzw. Verwendung von Fremdprodukten wird durch folgende Merkmale des erfindungsgemäßen Kompaktfilters und der Kaffee-Maschine weitgehend ausgeschlossen:

Filterpapiereinsätze, bestehend aus einer flachen Filterpapierlage mit einem daran anschließenden randseitigen Filterpapierteil, sind nicht im Handel, d. h. der Filterpapiereinsatz kann nicht durch einen mehr oder weniger ähnlichen handelsüblichen Einsatz ersetzt werden. Wird lediglich die untere Filterpapierlage durch einen z. B. handelsüblichen Papierrundfilter ersetzt, kommt es wegen des verringerten Durchflusses infolge verkleinerter Filterfläche zu einem Überlaufen des aufgegebenen Heißwassers aus dem Filtergehäuse, was, wenn es mehrmals geschieht, den Benutzer von dieser Mehrfachverwendung abbringen wird.

Bekannte, im Handel befindliche Kompaktfilter, wie eingangs beschrieben, scheiden ebenfalls für einen Einsatz in der erfindungsgemäßen Kaffeemaschine aus, da diese Filter keinen erhöhten Rand für noch nicht durch Filter-

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papierlagen und Kaffeemehl gelaufenes Wasser aufweisen und auch die Schublade für die Aufnahme des Kompaktfilters keinen entsprechenden Raum für die Wasseraufnahme bietet.

Die Verwendung schließlich von Kompaktfiltern, die eine größere Höhe aufweisen als der erfindungsgemäße Kompaktfilter, ist wegen der begrenzten Höhe der Schublade unterbunden, da die Schublade mit einem solchen höheren Kompaktfilter nicht mehr in die Kaffeemaschine einschiebbar ist.

Die Erfindung wird im folgenden anhand der Zeichnung eines bevorzugten Ausführungsbeispieles des erfindungsgemäßen Kaffee-Kompaktfilters sowie der erfindungsgemäßen Kaffee-Maschine für die Aufnahme des Kompaktfilters näher erläutert. Es zeigen im einzelnen:

Figur 1 einen erfindungsgemäßen Kaffee-Kompaktfilter, teils in Seitenansicht, teils in Vertikalschnitt,

Figur 2 eine Draufsicht auf einen Querschnitt in horizontaler Ebene des Kompaktfilters,

Figur 3 eine Seitenansicht einer Kaffeemaschine für die Aufnahme des Kompaktfilters.

Wie aus den Figuren 1 und 2 zu entnehmen ist, besteht das hier dargestellte Ausführungsbeispiel des Kompaktfilters 10 aus einem Filtergehäuse 10', das einen vorstehenden Kragen 11 im oberen Bereich, einen erhöhten Rand 5 und eine zurückspringende Stufe 12 aufweist. Im Inneren des Filtergehäuses 10' ist auf der durch die zurückspringende Stufe 12 gebildeten Fläche 12' eine obere Filterpapierlage 1 angebracht, was durch Kleben oder Verschweißen oder ähnliches erfolgt. Die obere

Filterpapierlage 1 weist einen Schnitt bzw. eine Perforation 3 auf, die mit einem Klebestreifen 8 abgedeckt ist. Unterhalb der oberen Filterpapierlage 1 befindet sich randseitig angeordnet ein Filterpapiereinsatz 2, der zur Vergrößerung der Filterfläche gewellt oder gefaltet oder ähnlich geformt ist. Unterhalb des Einsatzes 2 liegt die untere Filterpapierlage 4, die mit dem Einsatz 2 verbunden oder einstückig ist. Der Raum 9, der durch obere und untere Filterpapierlage 1 und 4 und den Filterpapiereinsatz 2 gebildet wird, ist wenigstens teilweise mit Kaffeemehl 9' gefüllt. Durch die randseitige Lage des oberflächenvergrößernd geformten Einsatzes 2 in dem Filtergehäuse 10' entstehen Kanäle 13 mit etwa parallelen und vertikalen Achsen. Die untere Filterpapierlage 4 wird von Trag- und Abstandselementen 6 unterstützt, die mit dem Filtergehäuse 10' verbunden oder einstückig sind. Gleichzeitig halten die Trag- und Abstandselemente 6 eine weitere Filterlage 7, vorzugsweise ein Kunststoffgazefilter, von der unteren Filterpapierlage 4 auf Abstand, so daß zwischen beiden ein Raum 7' gebildet wird, in den der durch die Kanäle 13 abgeleitete Kaffeesud vor dem Durchströmen der Filterlage 7 zunächst einströmt und wo eventuell ausgetretene Kaffeemehlpartikel zurückgehalten werden.

Figur 3 zeigt eine Seitenansicht einer Kaffeemaschine 14, die für die Aufnahme des erfindungsgemäßen Kompaktfilters 10 ausgerüstet ist. Eine bewegbare Aufnahmevorrichtung 15, im Ausführungsbeispiel eine Schublade, enthält den Kompaktfilter 10, der eine nur geringfügig kleinere Höhe als die Aufnahmevorrichtung 15 selbst hat. Gestrichelt eingezeichnet ist die Lage der Schublade in herausgezogenem Zustand. Unterhalb des Kompaktfilters 10 bzw. der Aufnahmevorrichtung 15 ist ein trichterförmiges Sammel- und Ableitelement 16 vorhanden, das den aus dem Kompaktfilter 10 austretenden Kaffeesud in ein Auffanggefäß 17 leitet.

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Fig.1

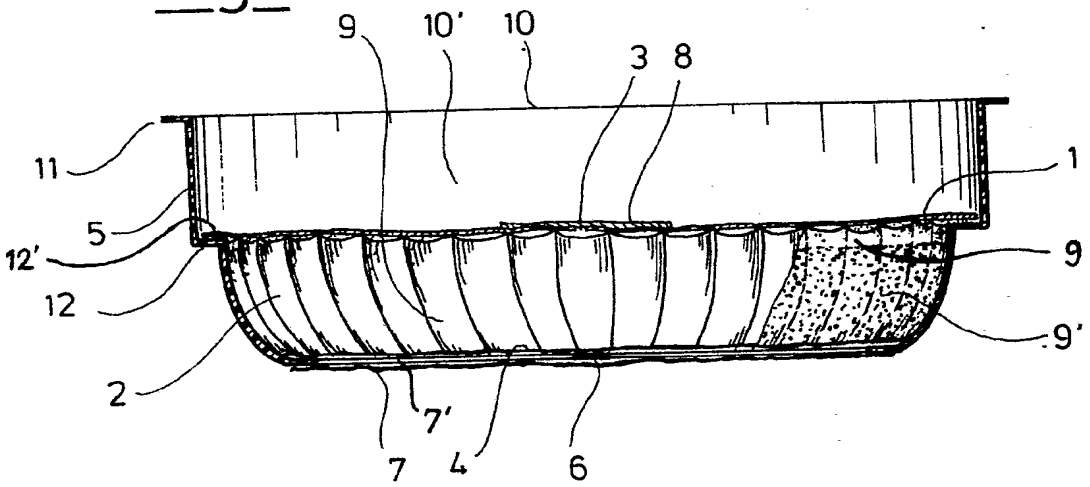
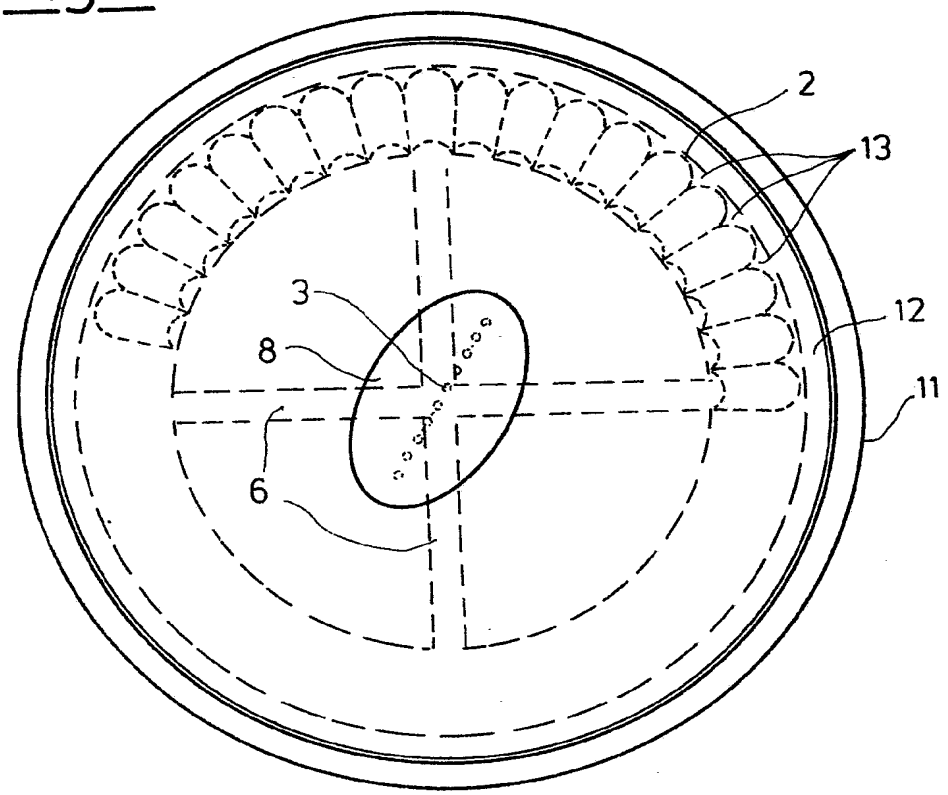


Fig.2



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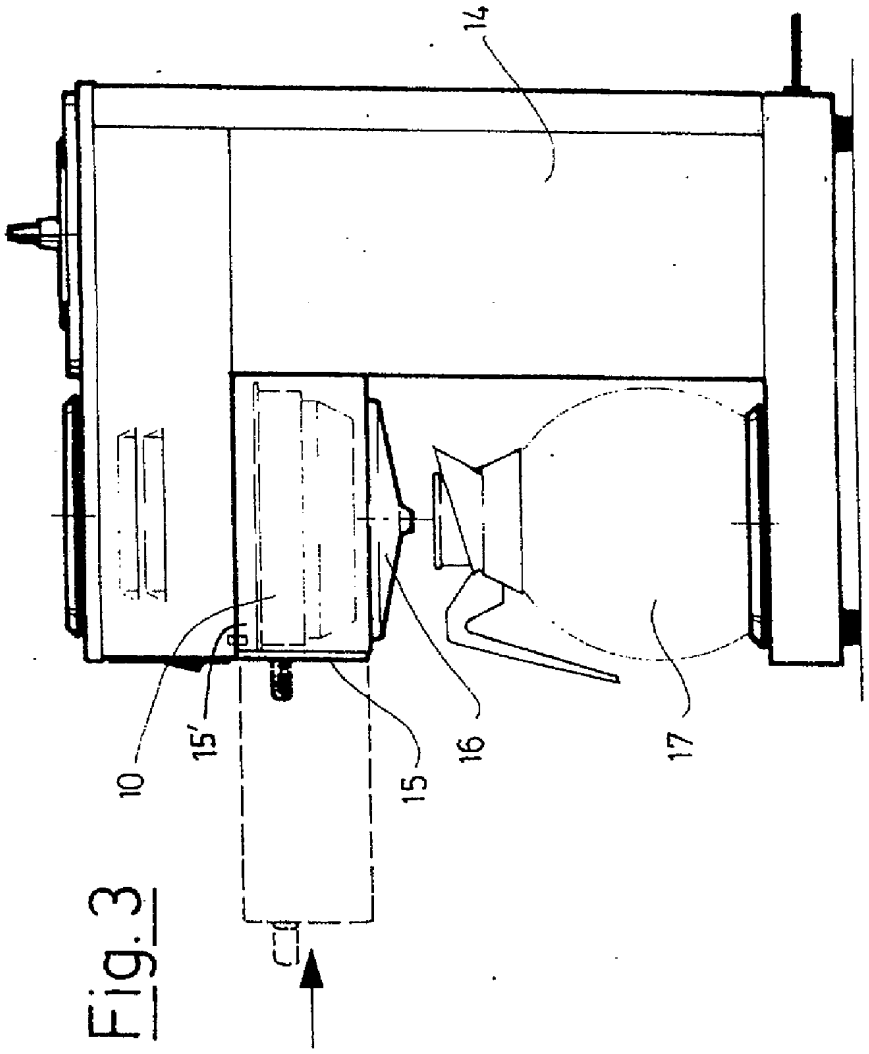


Fig. 3

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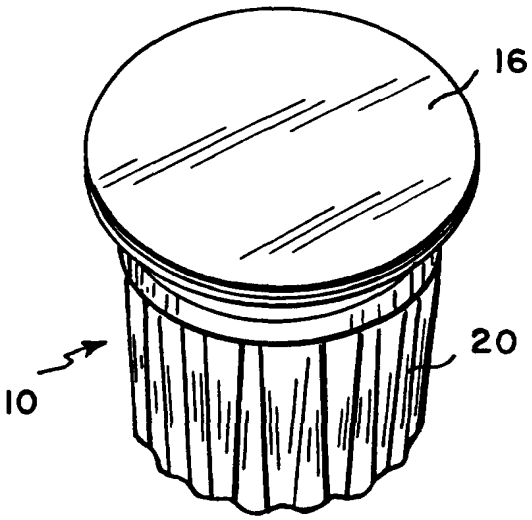
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(54) Title: BEVERAGE FILTER CARTRIDGE



(57) Abstract: A beverage filter cartridge (10) includes a cup-shaped outer container (12) with a bottom (18) and a side wall (20) extending upwardly from the bottom wall (18) to a circular rim (22) surrounding an upper opening (24). The side wall (29) has an upper section (20a) extending downwardly from the rim (22) to an intermediate section, and a tapered lower section (20c) configured to provide a plurality of circumferentially spaced flutes (20e) extending downwardly from the intermediate section to the bottom wall (18). A filter element (14) subdivides the interior of the container (12) into first (A) and second (B) chambers. A beverage medium is stored in the first chamber (A). A cover (16) is joined to the side wall (20) at the rim (22) to close the upper opening (24). The cover (16) is yieldably piercable to accommodate an injection of liquid into the first chamber (A) for combination with the beverage medium to produce a beverage. The filter element (14) is permeable to accommodate a flow of the beverage from the first chamber (A) into the second chamber (B), and the bottom wall (18) is yieldably piercable to accommodate an outflow of the beverage from the second chamber (B) to the exterior of the cartridge.

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BEVERAGE FILTER CARTRIDGE

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority from U.S. Provisional Patent Application Serial No. 60/183,708 filed 02/18/2000 and U.S. Utility Patent Application filed on February 13, 2001 (serial no. unknown), both of which are incorporated herein by reference in their entirety.

FIELD OF THE INVENTION

This invention relates to disposable single serve beverage filter cartridges.

DESCRIPTION OF THE PRIOR ART

A known disposable single serve beverage filter cartridge is disclosed in U.S. Patent Nos. 5,325,765 and 5,840,189 (Sylvan et al.), dated respectively July 5, 1994 and November 24, 1998, the disclosures of which are herein incorporated by reference.

This beverage filter cartridge is comprised basically of an impermeable yieldably-piercable cup-shaped outer container internally subdivided by a permeable cone-shaped filter into first and second chambers. A granular or powdered dry beverage medium, e.g., roasted ground coffee, is stored in the first chamber, and the container is closed by an impermeable yieldably piercable lid.

During a processing cycle, the lid and container bottom are pierced, respectively, by tubular inlet and outlet probes. The inlet probe admits heated liquid under pressure into the first chamber for infusion with the beverage medium, and the resulting brewed beverage passes through the filter into the second chamber from which it exits via the outlet probe for delivery to an underlying cup.

This known beverage filter cartridge has gained rapid and increasingly widespread acceptance, notwithstanding several problems that have persisted since its initial introduction. One such problem stems from a tendency of the container side

wall to buckle under the force exerted by the outlet probe as it pierces the container bottom. This sometimes results in a failure of the outlet probe to achieve bottom penetration, thus aborting the brewing process because the brewed beverage cannot be delivered to the underlying cup. Buckling of the container side wall also can distort the punctured orifice in the container bottom, thus compromising sealing and resulting in leakage of the brewed beverage.

Problems have also been encountered in reliably sealing the rim of the filter component to the interior side wall of the container, as well as in centrally securing the bottom of the filter component to the container bottom. Failure to achieve a proper rim seal can cause the unsealed portion of the filter to collapse under brew pressure, resulting in the brewed beverage being contaminated by beverage medium residue escaping from the collapsed filter. By the same token, contamination of the brewed beverage also can occur if the filter bottom is not centrally secured, resulting in the filter being punctured by the outlet probe as it projects upwardly through the container bottom. Contamination of the brewed beverage also occurs occasionally when a filter element bursts under the pressure exerted by the heated liquid being infused with the beverage medium.

Still another problem stems from heat sealing the upper rim of the filter at or closely adjacent to the upper rim of the container side wall. This increases the unoccupied so called "head space" between the outside of the filter and the surrounding container wall, and also limits the maximum amount of beverage medium that can be stored in the cartridge to that which can be contained within the filter. In some cases, this can compromise the strength of the resulting brewed beverage. Beverage strength can be optimized by filling the filter to its maximum capacity, but this can result in errant granules of the beverage medium spilling onto the container rim. This in turn can disrupt the integrity of the seal between the cover and the container rim.

Among the objectives of the present invention is a strengthening of the container side wall to thereby resist buckling when the container bottom is punctured by the outlet probe of the brewer.

Companion objectives include a beneficial increase in beverage medium storage capacity, improvements in the manner in which the filter component is sealed to and radially supported by the container side wall, as well as improvements in the manner in which the lower end of the filter is positioned and anchored to the cartridge bottom.

SUMMARY OF THE INVENTION

In accordance with the present invention, the container side wall is provided with circumferentially spaced flutes which are strategically positioned to enhance resistance to buckling without interfering with or compromising the integrity of the seal between the side wall and the filter component. The location at which the filter component is joined to the interior side wall of the container is lowered to achieve a beneficial increase in beverage medium storage capacity. This location is defined by a tapered circular ledge against which the tapered filter component is reliably sealed.

The channels formed between the circumferentially spaced flutes serve to efficiently direct the brewed beverage downwardly towards the pierced container bottom, with an accompanying beneficial increase in turbulence in the head space defined between the filter element and container side wall.

In a second embodiment of the invention, the container bottom is configured to provide a downwardly protruding centrally disposed boss defining a reduced diameter interior sump surrounded by an annular planar bottom area. The annular bottom area is available for piercing by the outlet probe. The filter projects downwardly into and is secured within the sump at a location safely out of harms way with respect to the piercing action of the outlet probe. A beneficial decrease in head space is also realized by locating the lower end of the filter in the reduced diameter sump.

In a third embodiment of the present invention, the circumferentially spaced flutes protrude sufficiently inwardly into the container interior to radially contact the filter element at circumferentially spaced locations. This radial contact beneficially guides the filter element into its centrally located position during assembly of the cartridge components, and, during the processing cycle, provides radial support which resists distortion and possible bursting of the filter element.

These and other features, objectives and advantages of the present invention will now be described in greater detail with reference to the accompanying drawings, wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a disposable beverage filter cartridge in

accordance with one embodiment of the present invention;

Figure 2 is an exploded perspective view of the basic components of the beverage filter cartridge shown in Figure 1;

Figure 3 is a side elevational view of the beverage filter cartridge shown in Figure 1;

Figures 4 and 5 are vertical and horizontal sectional views taken, respectively, on lines 4-4 and 5-5 of Figure 3;

Figure 6 is an enlarged sectional view of a rim portion of the filter cartridge as shown in Figure 4;

Figure 7 is an enlarged view of a portion of the side wall of the beverage cartridge;

Figure 8 is a sectional view taken along line 8-8 of Figure 7;

Figure 9 is a bottom perspective view of a disposable filter cartridge in accordance with a second embodiment of the present invention;

Figure 10 is a side elevational view of the filter cartridge shown in Figure 9;

Figure 11 is a bottom view of the filter cartridge shown in Figures 9 and 10;

Figure 12 is an enlarged cross sectional view taken along line 12-12 of Figure 10;

Figure 13 is a perspective view of a disposable beverage filter cartridge in accordance with a third embodiment of the present invention;

Figure 14 is an exploded perspective view of the components of the beverage filter cartridge shown in Figure 13;

Figure 15 is a side elevational view looking in the direction depicted by the arrow "x" in Figure 13;

Figure 16 is another side elevational view looking in the direction depicted by the arrow "Y" in Figure 13;

Figure 17 is an enlarged bottom view of the beverage filter cartridge shown in Figures 13-16;

Figure 18 is an enlarged vertical sectional view taken along line 18-18 of Figure 16;

Figure 19 is a vertical sectional view taken along line 19-19 of Figure 18;

Figure 20 is a horizontal sectional view taken along line 20-20 of Figure 19; and

Figure 21 is an enlarged sectional view of a rim portion of the cartridge as shown in Figures 18 and 19.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

With reference initially to Figures 1-5, a beverage filter cartridge in accordance with a first embodiment of the invention is generally depicted at 10. As shown in Figure 2, the basic components of the beverage filter cartridge include an outer cup-shaped container 12, a generally cone-shaped filter element 14, and a planar circular lid 16.

The cup-shaped container 12 has a bottom 18, and a side wall 20 extending upwardly from the bottom to a circular rim 22 surrounding an upper opening 24. With reference additionally to Figures 6-8, it will be seen that the side wall 20 has an upper section 20a extending downwardly from the rim 22 to an intermediate section defined by an inwardly tapered ledge 20b, and a lower tapered section 20c extending downwardly from ledge 20b to the bottom 18.

The upper wall section 20a is preferably subdivided into upper and lower segments 20a′ and 20a″. Moving down the cup, segment 20a′ is flared outwardly, and segment 20a″ tapers inwardly, with the juncture therebetween defining a stacking shoulder 20d. The bottom 18 is optionally and preferably provided with an upwardly protruding central boss 18a.

The lower tapered wall section 20c is configured to provide a plurality of circumferentially spaced flutes 20e, the upper ends of which terminate beneath the intermediate section defined by ledge 20b, and the lower ends of which terminate as indentations in the bottom wall 18.

It will be seen from Figure 8 that the depths "d" of the flutes 20e gradually increase from a minimum at their upper ends to a maximum at their lower ends. Likewise, as can be seen from Figure 7, the widths "w" of the flutes also gradually increase from a minimum at their upper ends to a maximum at their lower ends.

The cup-shaped container is preferably thermo-formed vacuum molded from an impermeable yieldably piercable heat sealable material having a nominal thickness of 0.031″ and comprising, for example, polyethylene/EVOH/polystyrene supplied by

Curwood Packaging of Oshkosh, Wisconsin, U.S.A.

The filter element 14 is formed of a pliable and permeable heat sealable material such as for example cellulose polypropylene supplied by J. R. Crompton, Ltd of Bury, Lancashire, England. The bottom of the filter element is supported on and secured as by heat sealing to the central boss 18a.

The lid may be cut or blanked from any suitable impermeable heat sealable and yieldably piercable material, such as for example, a metallic/polymer laminate supplied by Winpak Heat Seal Packaging, Inc. of Montreal, Canada.

As can best be seen in Figure 6, the filter element is heat sealed as at 26 to the intermediate wall section defined by tapered ledge 20b. The taper angle of the ledge 20b closely approximates the taper angle of the filter element 14, thereby facilitating the task of securely and reliably heat sealing the two together. The filter element serves to subdivide the interior of the container 12 into first and second chambers A, B. A dry granular or powdered beverage medium "M", typically ground roasted coffee, is stored in chamber A, and the container opening 24 is closed by heat sealing the lid 16 to the rim 22.

At the onset of a processing cycle, the lid 16 and container bottom 18 are pierced, respectively, by tubular inlet and outlet probes 28, 30 (see Figure 3). The inlet probe 28 admits a heated liquid, typically hot water, into chamber A where it infuses and combines with the beverage medium M to produce a beverage. The beverage passes through the filter element 14 into chamber B, from which it exits via outlet probe 30.

The second embodiment illustrated in Figures 9-11 is similar in many respects to the above-described first embodiment. Similar features of the second embodiment have been identified with similar reference numerals in a two hundred series. Thus, for example, reference numeral 10 identifies the filter cartridge of the first embodiment, and reference numeral 210 identifies the filter cartridge of the second embodiment.

In the second embodiment, the container bottom 218 is configured to provide a downwardly protruding centrally disposed reduced diameter boss 218a defining an interior sump 218b surrounded by an annular substantially planar bottom area. The bottom of the conical filter element is received in and secured to the bottom of the sump as at 218c.

The third embodiment illustrated in Figures 13-21 is also similar in many respects to the first embodiment. Again, similar features have been identified with similar reference numerals, but in a three hundred series.

The major difference between the first and third embodiments is that the latter has fewer and much deeper flutes 320e. As can be best seen in Figure 19, the deeper flutes 320e contact and provide radial support for the filter element 314.

In light of the foregoing, it will now be appreciated by those skilled in the art that the present invention offers significant advantages over the known beverage filter cartridge described in the previously referenced patents. For example, the circumferentially spaced flutes 20e, 220e and 320e strengthen the container side wall against buckling when the bottom is pierced by the outlet probe 30. The deeper flutes 320e of the third embodiment offer the added advantage of radially supporting the filter element, which can be particularly beneficial during the processing cycle, when the filter element is being stressed by the infusion of pressurized heated liquid into the beverage medium.

In all embodiments, the downwardly diverging and gradually deepening of the flutes serves to promote downward flow of the brewed beverage in chamber B while beneficially encouraging turbulence. The upwardly protruding bosses 18a, 318a on the container bottoms of the first and third embodiments provide readily accessible support platforms for the bottoms of the filter elements. Securing the bottoms of the filter elements to the bosses 18a, 218a insures that the filter elements will not be punctured by the outlet probe 30.

The small diameter sump 218b defined by the downwardly protruding boss 218a of the second embodiment receives the lower end of the filter component in a confined space which beneficially decreases head space and further assists in positively locating and safeguarding the filter from damaging contact with the outlet probe.

The tapered ledges 20b, 220b, 320b of all embodiments provide distinct and readily accessible lands to which the filter elements may be reliably joined by heat sealing. The upper ends of the flutes 20e, 220e, 320e terminate below the ledges 20b, 220b, 320b, thereby insuring that the ledges are not interrupted by discontinuities that would be detrimental to the critical seal of the filter elements to the container side walls.

The upper container sections 20a, 220a, 320a above the filters provide

beneficial increases in available storage capacity for the beverage medium. This increased storage capacity makes it unnecessary to fill the interior chamber A to its maximum capacity, thereby safeguarding the container rim from contamination by errant granules of the beverage medium.

Although the outer container and cover have been described as being formed from impermeable materials, it will be understood by those skilled in the art that, alternatively, permeable materials may be employed for one or both of these components. Where permeable materials are employed, the completed cartridges will preferably be subsequently enclosed, either individually or in batches, with impermeable wrappings. Materials for such wrappings are well known, and include for example EVOH films, aluminum foil, etc.

Although the present invention has been described with reference to several embodiments, various changes, modifications and additions may be made without departing from the spirit and scope of the appended claims.

We claim:

1. A beverage filter cartridge comprising:

a cup-shaped outer container having a bottom and a side wall extending from said bottom wall to a circular rim surrounding an upper opening, said side wall having an upper section extending downwardly from said rim to an intermediate section, and having a tapered lower section extending downwardly from said intermediate section to said bottom wall, said tapered lower section being configured to provide a plurality of circumferentially spaced flutes;

a filter element received in said container, said filter element being joined to said side wall and being configured and positioned to subdivide the interior of said container into first and second chambers;

a beverage medium stored in said first chamber; and

a cover joined to said side wall at said rim and closing said upper opening, said cover being yieldably piercable to accommodate an injection of liquid into said first chamber for combination with said beverage medium to produce a beverage, said filter element being permeable to accommodate a flow of said beverage from said first chamber into said second chamber, and said bottom wall being yieldably piercable to accommodate an outflow of said beverage from said second chamber to the exterior of said cartridge.

2. The beverage filter cartridge of claim 1 wherein said flutes extend downwardly from upper ends terminating beneath said intermediate section to lower ends at said bottom wall.

3. The beverage filter cartridge of claim 2 wherein the lower ends of said flutes define indentations in said bottom wall.

4. The beverage filter cartridge of claims 2 or 3 wherein the depths of said flutes gradually increase from a minimum at said upper ends to a maximum at said lower ends.

5. The beverage filter cartridge of claims 2 or 3 wherein the widths of said flutes gradually increase from a minimum at said upper ends to a maximum at said lower ends.

6. The beverage filter cartridge of claim 1 wherein said filter element is joined to said side wall at said intermediate section.

7. The beverage filter cartridge of claim 1 wherein said intermediate section is defined by a ledge joining said upper section to said lower section, and wherein said filter element is joined to said side wall at said ledge.

8. The beverage filter cartridge of claim 7 wherein said ledge tapers inwardly from said upper section to said lower section, and wherein the taper angle of said intermediate section is greater than the taper angle of said lower section.

9. The beverage filter cartridge of claim 1 wherein said upper section has an upper segment extending downwardly from said circular rim and a lower segment extending upwardly from said intermediate section, said upper segment being flared outwardly and said lower segment being tapered inwardly, with the juncture of said upper and lower segments defining an exterior stacking shoulder.

10. The beverage filter cartridge of claim 1 wherein said bottom wall is provided with an upwardly protruding centrally disposed boss, a lower end of said filter element being supported on said boss.

11. The beverage filter cartridge of claim 10 wherein the lower end of said filter is secured to said boss.

12. The beverage filter cartridge of claim 1 wherein said filter element is in contact with and radially supported by said flutes.

13. The beverage filter cartridge of claim 1 wherein said bottom is provided with a downwardly protruding centrally disposed boss defining an interior sump, and wherein the lower end of said filter element is received in said sump.

14. The beverage filter cartridge of claim 13 wherein said filter element is secured to the bottom of said sump.

15. The beverage filter cartridge of claim 1 wherein said outer container is impermeable.

16. The beverage filter cartridge of claims 1 or 15 wherein said cover is impermeable.

17. A beverage filter cartridge comprising:

a cup-shaped outer container having a bottom and a side wall extending from said bottom wall to a circular rim surrounding an upper opening, said side wall having an upper section extending downwardly from said rim to an intermediate section, and having a tapered lower section extending downwardly from said intermediate section to said bottom wall, said tapered section being configured to provide a plurality of circumferentially spaced flutes;

a filter element received in said container, said filter element being in contact with and radially supported by said flutes and being joined to said side wall at a location subdividing the interior of said container into first and second chambers;

a beverage medium stored in said first chamber; and

a cover joined to said side wall at said rim and closing said upper opening, said cover being yieldably piercable to accommodate an injection of liquid into said first chamber for combination with said beverage medium to produce a beverage, said filter being permeable to accommodate a flow of said beverage from said first chamber into said second chamber, and said bottom wall being yieldably piercable to accommodate an outflow of said beverage from said second chamber to the exterior of said cartridge.

18. A beverage filter cartridge comprising:

a cup-shaped container having a bottom and a side wall extending from said bottom wall to a circular rim surrounding an upper opening, said side wall having an upper section extending downwardly from said rim to an intermediate section, and having a tapered lower section extending downwardly from said intermediate section to said bottom wall, said tapered section being configured to provide a plurality of circumferentially spaced flutes, said bottom being provided with a downwardly protruding centrally disposed boss defining an interior sump;

a conical filter element received in said container, the bottom of said filter element protruding downwardly into and being secured within said sump, said filter element being joined to said side wall and being configured and positioned to subdivide the interior of said container into first and second chambers;

a beverage medium stored in said first chamber; and

a cover joined to said side wall at said rim and closing said upper opening, said cover being yieldably piercable to accommodate an injection of liquid into said first chamber for combination with said beverage medium to produce a beverage, said filter being permeable to accommodate a flow of said beverage from said first chamber into

said second chamber, and said bottom wall being yieldably piercable to accommodate an outflow of said beverage from said second chamber to the exterior of said cartridge.

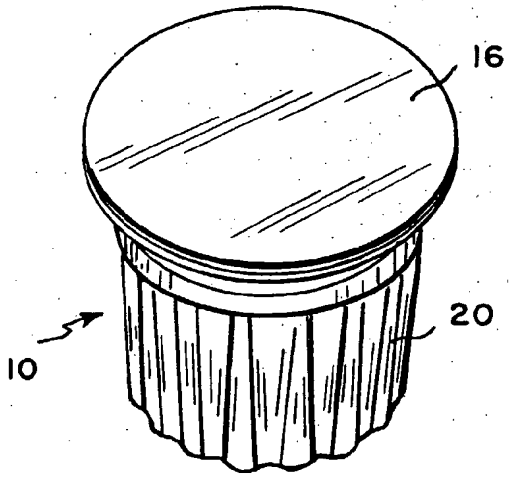


FIG. 1

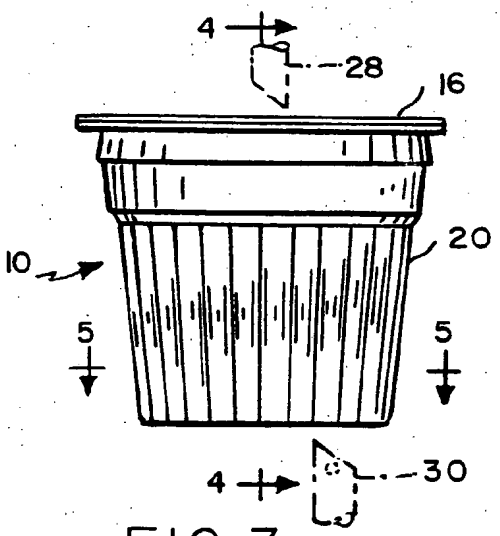


FIG. 3

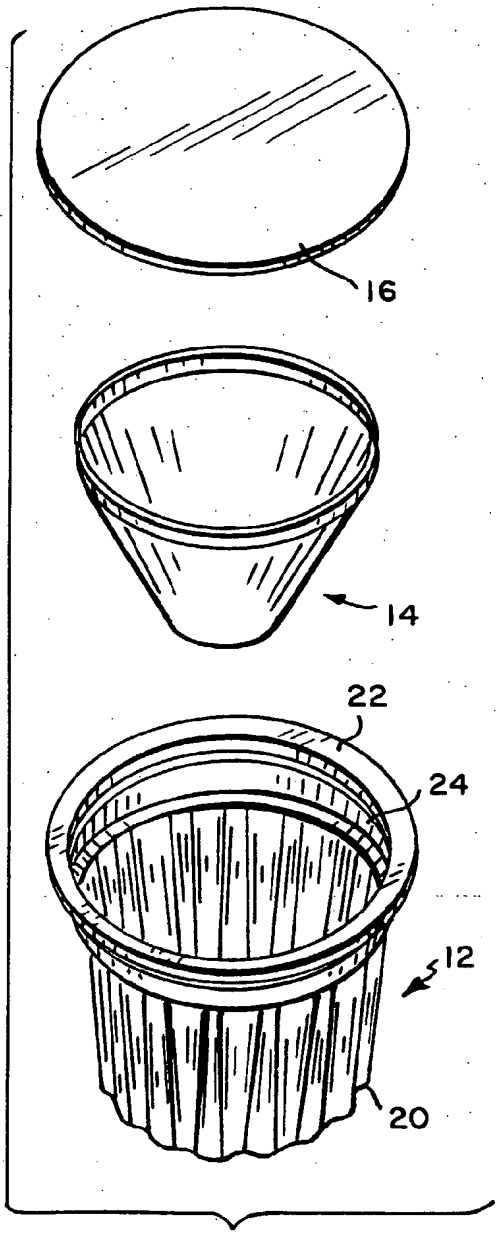


FIG. 2

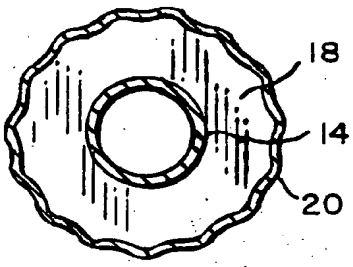


FIG. 5

K-FEE SYSTEM GMBH, EX2009, page 5751
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

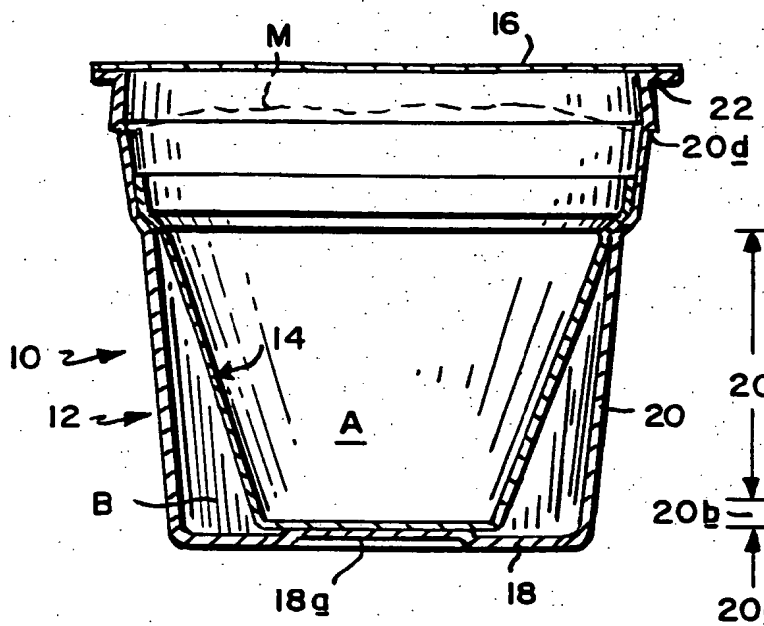


FIG. 4

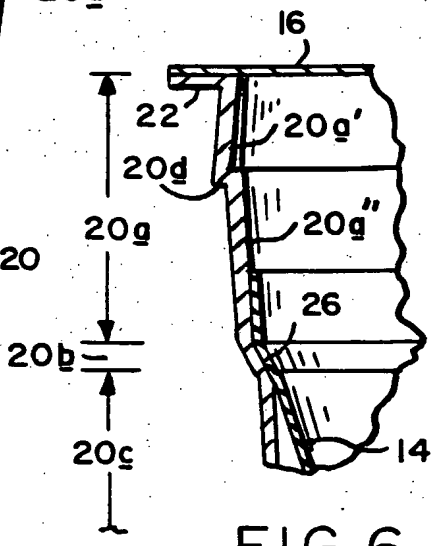


FIG. 6

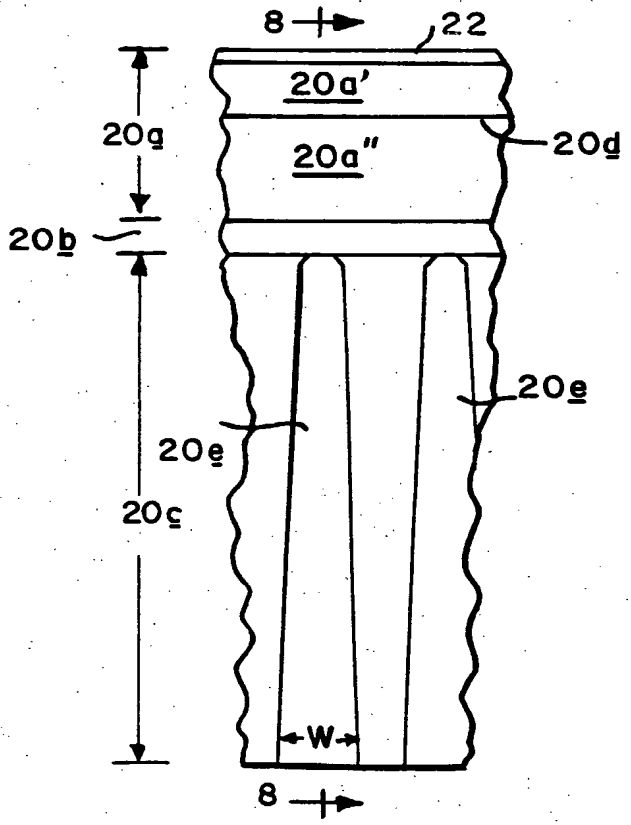


FIG. 7

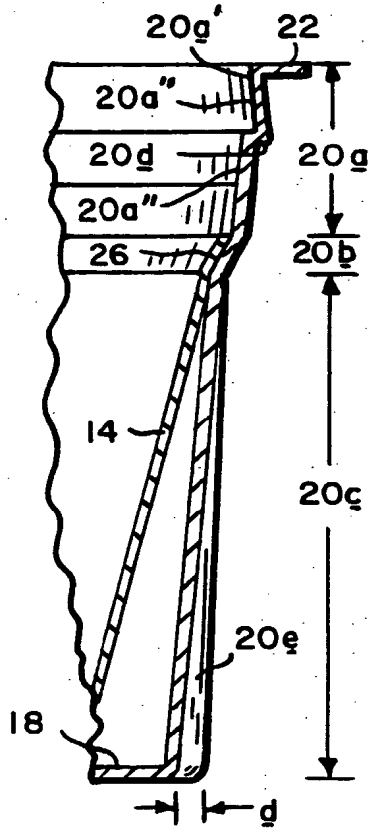


FIG. 8

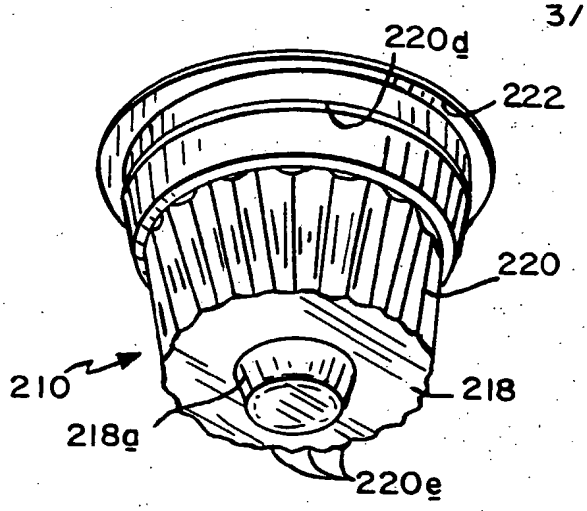


FIG. 9

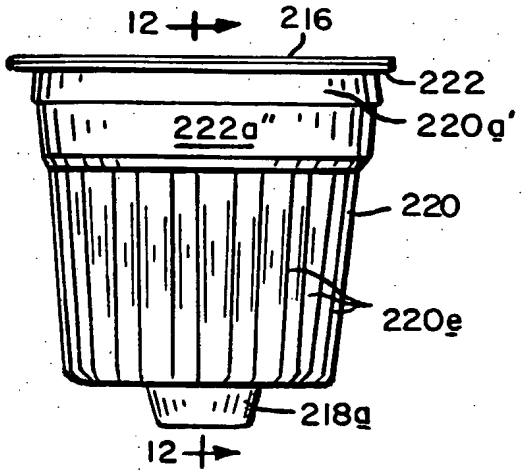


FIG. 10

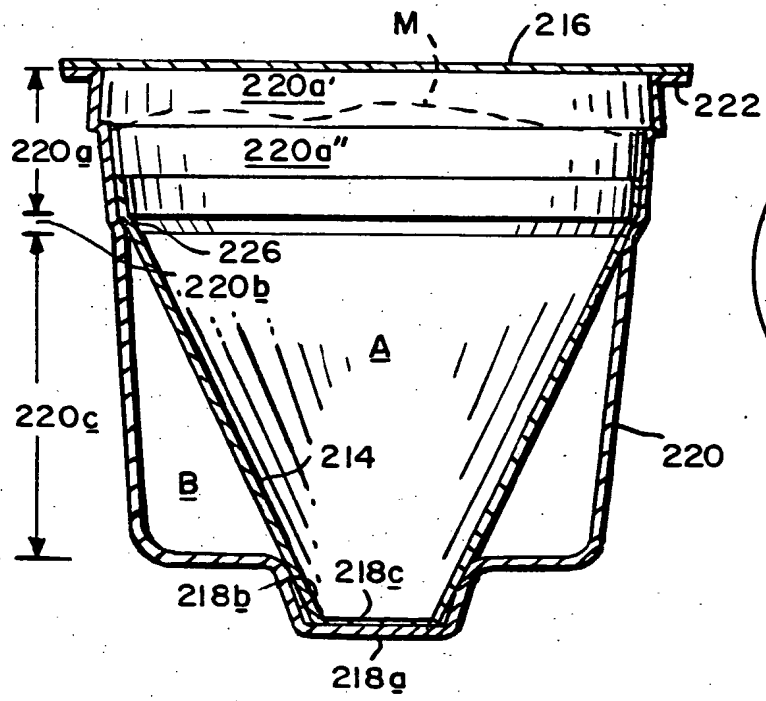


FIG. 12

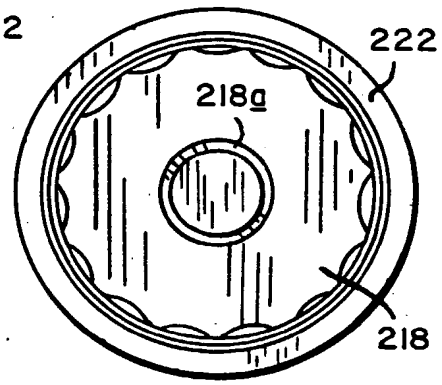


FIG. 11

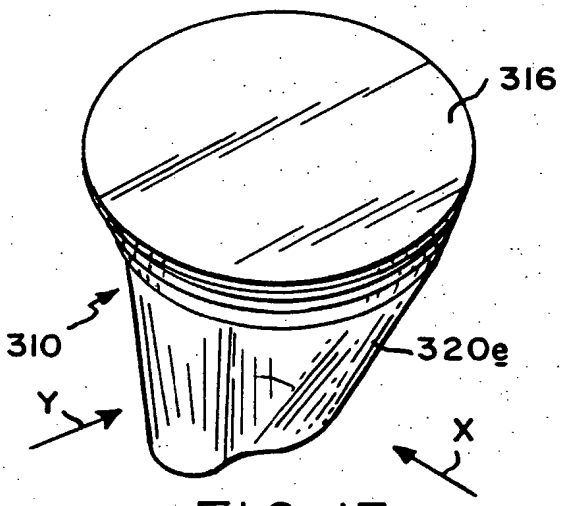


FIG. 13

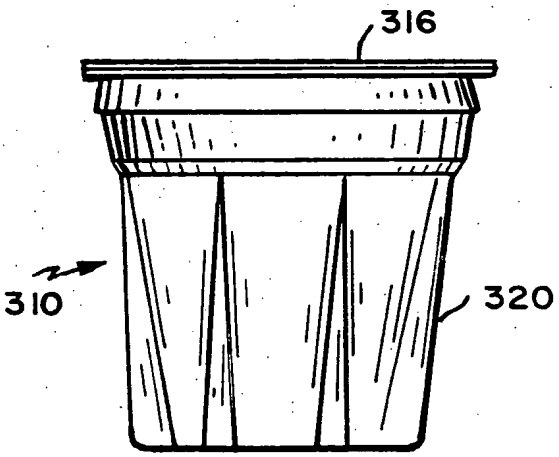


FIG. 15

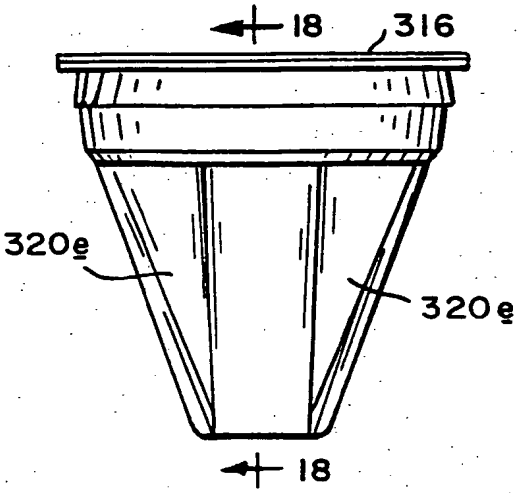


FIG. 16

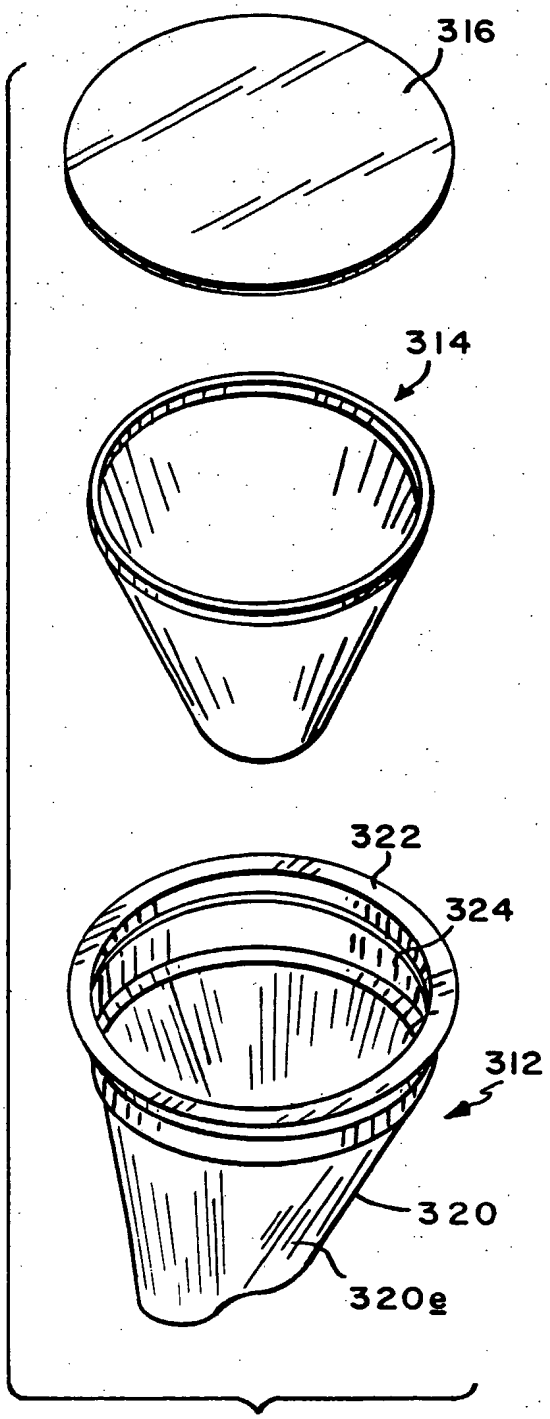


FIG. 14

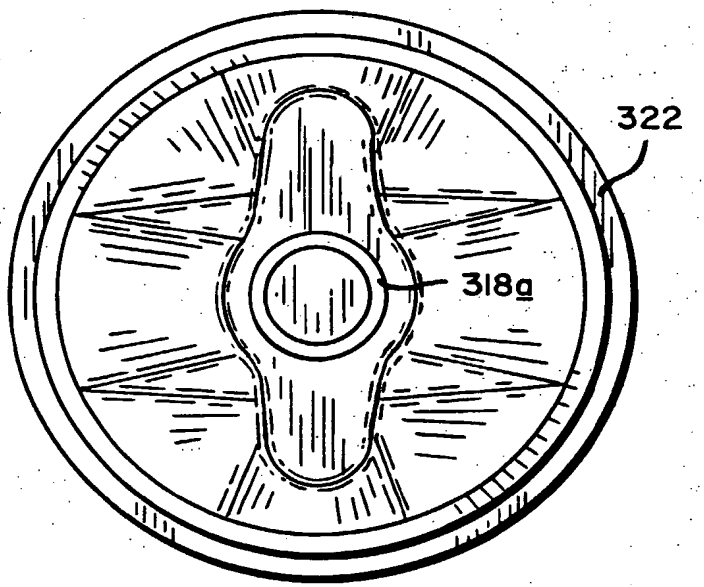


FIG. 17

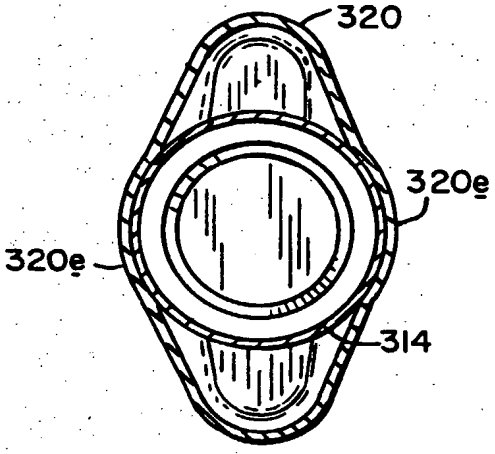


FIG. 20

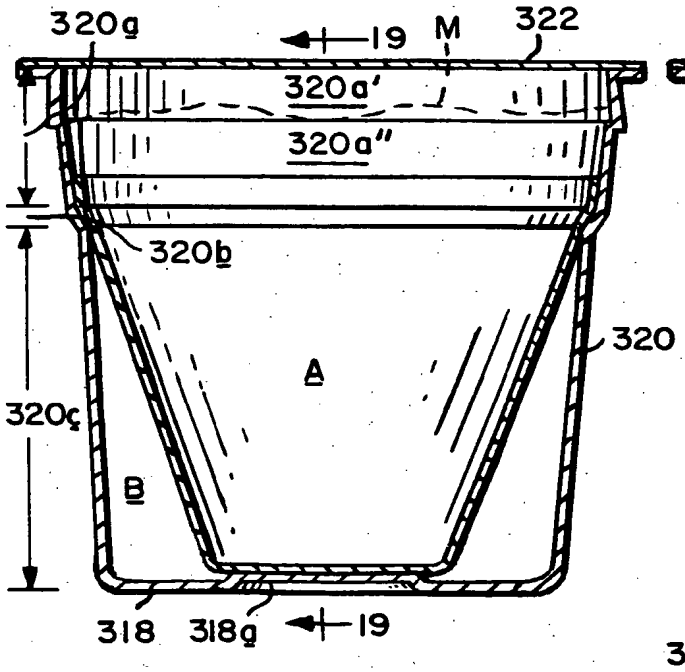


FIG. 18

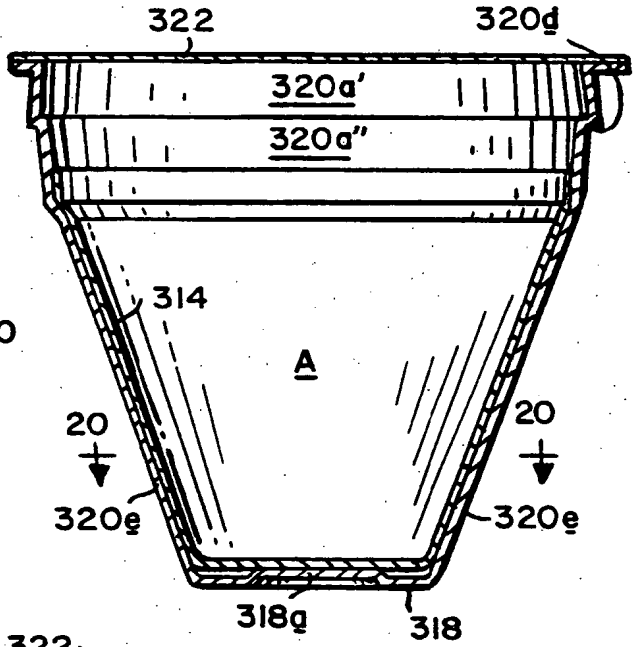


FIG. 19

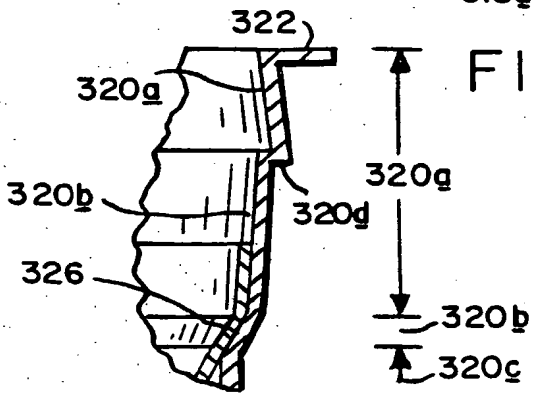


FIG. 21

INTERNATIONAL SEARCH REPORT

tional Application No
PCT/US 01/04881

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65D81/00

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 B65D

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.
Y	US 5 840 189 A (SYLVAN JOHN E ET AL) 24 November 1998 (1998-11-24) cited in the application	1,6,7, 15-17
A	column 2, line 66 -column 3, line 58; claims 1-5; figures 1,2,5	10,18
Y	DE 15 36 372 A (WEBER, W.) 15 January 1970 (1970-01-15)	1,6,7, 15-17
A	page 3, line 17-21 page 6	12

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

☒ 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
18 July 2001	30/07/2001

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	Novelli, B

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

tional Application No
PCT/US 01/04881

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5840189 A	24-11-1998	US 5325765 A	05-07-1994
DE 1536372 A	15-01-1970	CH 448878 A	15-12-1967

Form PCT/ISA/210 (patent family annex) (July 1992)

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 772 398 A1

(12) EUROPEAN PATENT APPLICATION

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11.04.2007 Bulletin 2007/15

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B65D 85/804 *(2006.01)*

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(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: **Cense d'Almez S.A.**
1325 Corroy le Grand (BE)

(72) Inventor: **Van Belleghem, Luc**
1332, Genval (BE)

(74) Representative: **Quintelier, Claude et al**
Gevers & Vander Haeghen
Holidaystraat 5
1831 Diegem (BE)

(54) Cartridge for use with a device for preparing an infused beverage

(57) The invention relates to a cartridge containing infusible substance for use in a device for preparing infused beverage. The cartridge comprises a bottom part provided with a filter adapted to let liquid pass through and a top part (38) provided with an opening. Side walls are joining the bottom and top parts. The bottom part forms a recess arranged toward the inside of the cartridge, the surface of the recess comprising an actuating surface for actuating a mechanism of the device.

EP 1 772 398 A1

Printed by Jouve, 75001 PARIS (FR)

K-FEE SYSTEM GMBH, EX2009, page 5758
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

Description

Field of the invention

[0001] The invention relates to a cartridge containing infusible substances for use in a device for preparing infused beverage. The cartridge comprises a bottom part provided with a filter adapted to let liquid pass through and a top part provided with an opening. Side walls are joining the bottom and top parts.

[0002] As a matter of example, the infusible substance can alternatively be tea leaves, various different herbs and spices, herbal tea, flower petals, leaves, seeds, roots, powder, coffee or other materials capable of being infused.

Description of prior art

[0003] Such cartridges are known in the art.

[0004] For instance, Japanese patent application JP 2001-120436 discloses a tea preparation device comprising an infusion tank which can be filled with hot water, and a holder which can communicate with the tank through a communication aperture. A passage communicates with the tank for pouring out the infused tea. A cartridge is used and contains tea leaves. The cartridge has a removable top seal.

[0005] In use, the tea leaf cartridge is inserted in the holder. The cartridge top seal is removed when the holder is inserted in the device. The opened cartridge in the holder is moved under the tank. Then, while the opening is turned toward the interior of the tank, the tea leaves contained in the cartridge are able to move and float freely into the infusion tank, once water is introduced in the tank and holder. The infusion then takes place. A stirring mechanism comprising a rod partially immerged in the infusion tank can be operated to stir the water while infusing.

[0006] A drainage hole in the holder and the passage are arranged to discharge the infused tea from the tank to a discharge container and the cartridge is entirely or partially formed as a filter. That is, once the infusion is completed, the tank is emptied and the tea leaves return in the cartridge and settle there.

[0007] The disclosed device provides easy setting up and preparation of a liquid infusion in a traditional way during which tea leaves are allowed to float freely in the liquid, and it also provides easy handling of the used infusible substance, such as tea leaves, in the cartridge itself forming a filter.

[0008] The device disclosed in the prior art presents a security problem in the sense that a user may start the device, even if no cartridge has been introduced in the machine. If it is the case, the infusion container must be emptied. Either the infusion container needs to be removed and emptied manually. Or water needs to be evacuated in the discharge container. In that case, infusion already contained in the discharge container is diluted, impairing its taste and flavour.

[0009] Another drawback of the device comes from the fact that the liquid infusion is stored in a discharge container. Because the liquid infusion stored in the discharge container continues infusing, its taste and flavour is impaired.

[0010] It has also been found that not all tea leaves contained in the cartridge are able to move and float freely into the infusion tank. Some leaves tend to remain within the cartridge preventing the liquid from infusing properly.

Summary of the invention

[0011] It is an object of the invention to provide a cartridge for infusible substances for use in a device for preparing infused beverage according to which the functioning of the device is safe.

[0012] To this end, the bottom part of the cartridge forms a recess arranged toward the inside of the cartridge, the surface of the recess comprising an actuating surface for actuating a mechanism of the device.

[0013] The cartridge is mainly but not necessarily adapted for being slot in the following device for preparing infusion beverage. The device includes an infusion container for containing liquid and comprising an opening to allow liquid to flow out of the container. The device includes a receptacle defining a cavity for receiving a cartridge containing infusible substances. The infusion container and the receptacle are operable in relation to each other to be arranged in a position wherein the infusion container and the cavity communicate through the opening. Infusible substances contained in the cartridge are immersed once liquid is poured into the infusion container to the cavity; the infusible substances are able to move and float freely in the infusion chamber. The infusion takes place.

[0014] The device further comprises an openable and closable passage communicating with the cavity. Once the infusion is completed, the passage is opened and the infused liquid flows from the infusion container to the passage through the cavity and the filter of the cartridge. The infused liquid may be poured directly in a cup.

If no cartridge is inserted in the device, at least one mechanism of the device is not actuated. The functioning of the device may be paused or stopped. Such security mechanism prevents a user to operate the device when no cartridge is introduced.

[0015] It is an object of the invention to provide a cartridge for infusible substances for use in a device for preparing infused beverage according to which all substances contained in the cartridge are efficiently used for preparing the beverage.

[0016] To this end, the recess is provided with at least an opening for letting gas pass through.

[0017] The device for preparing infused beverage may comprise an injecting means for injecting gas in the infusion container. The recess of the cartridge constitutes a space or compartment into which the means for inject-

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ing gas, such as an injection nozzle, may be located. The injecting means injects gas in the cartridge through the opening of the recess.

[0018] In use, when the cartridge is slot within a device for preparing infused beverage, the injection means is inserted in the recess. Gas is injected in the infusion container through the cartridge. The infusible substances are pushed out of the cartridge to float within the infusion container. The infusible substances are prevented from remaining within the cartridge while the infusion takes place.

[0019] Preferably, the opening is disposed in the recess to face an opening of the injection means through which gas is injected. The size of the opening of the recess is substantially equal to that of the injection opening. The gas is properly injected in the infusion container through the cartridge. It avoids gas pockets from developing in the device around the cartridge; such gas pockets could damage the cartridge or create tensions within the device.

[0020] It is known to the skilled person that tea infusion takes place in three stages. Firstly the caffeine contained in tea leaves is diffused to the liquid, then all aromas giving the infusion its flavour and finally the tea leaves release their acid tannins. If the tea leaves are infused too long or at a wrong temperature, the effect of either the first or the second stage are annihilated, the tannins destroying either the caffeine or the aromas.

[0021] The infusion takes place around the tea leaves and water located immediately around the leaves becomes rapidly saturated. The infusion process slows down and the three stages of the process are partially or not properly performed; Water around the leaves is highly concentrated in caffeine and poorly concentrated in aromas.

[0022] To prevent such an effect, gas may be injected within the infusion container through the cartridge, while the infusion takes place to stir the liquid and homogenize the infusion.

[0023] The introduction of oxygen further provides the advantage of improving the quality of infused tea beverage. It is known that water when heated up looses oxygen, which has effect on the taste of the tea. Oxygenating the liquid while it infuses restores a normal oxygen concentration to water and ensures a high quality taste for the infused tea.

[0024] In another embodiment, openings for letting a gas pass through, arranged in the side walls of the cartridge may be used as well. Openings in the recess have been found to be more efficient for pushing infusible substances out of the cartridge and for uniformly agitating and oxygenating the liquid during infusion.

[0025] In one embodiment, the recess has a substantially cylindrical or frustroconical form defining recess side walls and a recess top. The at least one opening of the recess is provided through the recess side walls, or/and through the recess top.

[0026] Preferably, the recess has a circular bottom section with a diameter comprised between 2 and 15 millimetres, or more particularly between 2 and 6 millimetres. Such a range consists of an optimal compromise between a recess large enough to provide sufficient space for the injection means of the device and a recess small enough to provide a sufficient surface for liquid to flow out of the cartridge through the filter.

[0027] It is an object of the invention to provide a cartridge for infusible substances for use in a device for preparing infused beverage which may be firmly maintain in the device. To this end, the top part of the cartridge comprises a lip surrounding the opening of the top part. The lip may be trapped in a gripping mechanism of the device. It is important that the cartridge is correctly and firmly hold within the cavity to insure that the actuating surface of the recess the injection means of the device remains located in the recess of the cartridge. Failure to do so could result to gas pockets developing and creating unnecessary tensions within the device.

Preferably, the cartridge has a substantially cylindrical or frustroconical form. A cartridge of such a form can easily be slot and steadily maintained within a cavity of a complementary shape. Cartridge of different forms, for instance semi-spherical forms may not fit so properly within a cavity and may slide in one direction or another.

A cartridge of such a form is also easy to manufacture, whether the cartridge is made of plastic material and moulded or made of metal and stamped by application of a mould, form, or die. Preferably, the angle formed by the side walls and the bottom part is comprised between 90 degrees and 100 degrees, or more particularly between 93 degrees and 97 degrees.

[0028] In one embodiment, the filter consists of a sheet made of aluminium perforated. Food contact approved aluminium may be used. Alternatively, the inner surface of the filter may be covered with a food contact approved coating layer able to resist to temperatures at least up to 100°C during several minutes. Alternatively, the filter consists of at least a sheet made of wool or of any natural or synthetic material adapted to infusion and filtering.

[0029] Preferably the cartridge is made of aluminium. Food contact approved aluminium may be used. Alternatively, the inner surface of the cartridge may be covered with a food contact approved coating layer able to resist to temperatures at least up to 100°C during several minutes.

[0030] It is a further object of the invention to provide a cartridge containing infusible substances which may be easily manipulated. To this end, the opening of the top part of the cartridge is provided with and closed by a sheet, arranged toward the outside of the cartridge with respect of the opening.

The opening of the cartridge is closed, its content being securely enclosed. The sheet may be automatically cut in the device for preparing infused beverage.

[0031] It is a further object of the invention to provide a cartridge which contents is protected from humidity, air and light. To this end, the bottom part of the cartridge is

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further provided with and closed by a removable sheet, arranged toward the outside of the cartridge with respect of the filter.

The content of the cartridge is protected from air, light and humidity. The removable sheet may be removed manually just before the cartridge is to be used; the flavour and aromas of the infusible substance may be preserved until then. The infusible substance may also be vacuum-packed.

[0032] According to one embodiment, the cartridge includes automatic readable means adapted to be read or detect by a detecting or reading means. The readable means may comprise and/or inform on preparation parameters for indicating how to infuse the infusible substance of the cartridge at best.

[0033] Advantageously, the preparation parameters may consist of the infusion temperature and/or the infusion duration and/or when the gas injection takes place, how long it lasts, etc.

Short description of the drawings

[0034] These and further aspects of the invention will be explained in greater detail by way of example only and with reference to the accompanying drawings in which:

Fig.1a shows a perspective top view of a cartridge according to one embodiment for use in a device for preparing infused beverages;

Fig.1b shows a perspective bottom view of a cartridge according to one embodiment;

Fig.1c shows a perspective side view of a cartridge according to one embodiment;

Fig.1d shows a perspective side view of the bottom part of a cartridge according to one embodiment;

Fig.1e shows a cross-sectional side view of the cartridge according to one embodiment;

Fig.1f shows a cross-sectional side view of the cartridge according to another embodiment;

Fig.2 shows a perspective front view of a device for preparing infused beverages in which a cartridge according to the invention is used;

Fig.3 shows a detailed perspective side view of the device;

Fig.4 shows a perspective front view of the inside of the device for preparing infused beverages;

Fig.5 shows a perspective back view of the inside of the device for preparing infused;

Fig.6 shows a perspective side view of the inside of the device for preparing infused;

Fig.7 shows a perspective top view of a receptacle of the device for receiving cartridge;

Fig.8 shows a schematic section of a receptacle of another device for receiving a cartridge;

Fig.9a-e shows a mechanism for opening a cartridge located inside the device.

Fig.10a-c shows a mechanism for withdrawing a cartridge according to the invention from a device for preparing infused beverage;

[0035] The figures are not drawn to scale. Generally, identical components are denoted by the same reference numerals in the figures.

Detailed description of preferred embodiments

[0036] A cartridge 12 according to the invention is explained in respect with **figures 1a, 1b, 1c, 1d, 1e.** The cartridge 12 comprises a bottom part 42 provided with a filter 44 adapted to let liquid pass through, a top part 38 provided with an opening 35 and side walls 45 joining the bottom and top parts 42, 38 . It defines an inner volume 40 to contain infusible substances 12. The volume 40 is calculated so to receive enough infusible substances 12 for preparing a standard cup of infused beverages. Infusible substances when soaked tend to swell. The volume 40 is also calculated to contain all the swollen infusible substances once infused.

[0037] The cartridge 12 is cone-shaped, truncated at the level of the bottom part 42. In one embodiment, the section of the top and bottom part 38, 42 is circular or oval. The section of the opening 35 is circular or oval. The angle α formed by the side walls 45 and the bottom part 42 is between 90 and 100 degrees and preferably comprised between 93 and 97 degrees. In another embodiment, the cartridge 12 is cylindrical.

[0038] Such a shape allows creating an inner volume 40 big enough to contain enough infusible substances for preparing a standard cup of beverage. Such shape allows the cartridge 12 to be steadily inserted within the cavity 16. It is also perfectly suitable to ensure a perfect fit between the cartridge 12 and the cavity 16.

[0039] The side walls of the cartridge 12 are air- and waterproof and opaque to be impermeable to water, air and light. The cartridge 12 is preferably made of aluminium. Food contact approved aluminium may be used. Alternatively, the inner surface of the cartridge 12 may be covered with a food contact approved coating layer able to resist to temperatures at least up to 100°C during several minutes.

[0040] Preferably, the filter 44 is as part of the cartridge 12 and consists of a perforated sheet made of aluminium. Food contact approved aluminium may be used. Alternatively, the inner surface of the filter 44 may be covered with a food contact approved coating layer.

[0041] Alternatively, the filter 44 may consist of at least a sheet made of wool or of any natural or synthetic material adapted to infusion and filtering. It is attached in a conventional manner to the bottom part 42, preferably on the inner walls of the cartridge 12.

[0042] The top part 38 comprises a lip 39 surrounding the opening 35 at least partly. The lip 39 rests upon the

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rim of the receptacle 10. The opening 35 is closed and covered by a sheet 50 (not represented) arranged towards the outside of the cartridge. Preferably the sheet 50 is made of aluminium and is heat-sealed to the lip 39 in a conventional manner.

[0043] In one embodiment, the top part 38 may be covered by a filter (not represented) arranged towards the outside of the cartridge 12. The sheet 50 covers the filter. The filter consists of an extensible or deformable sheet made of wool or of any natural or synthetic material adapted to infusion and filtering. When a cartridge 12 comprising such filter is immersed in water, the filter spreads in water out of the cartridge; the filter creates a space in water where infusible substances 14 contained in the cartridge 12 are able to float. Such filter prevents from infusible substances 14 from scattering everywhere in the infusion container 6 in particular and in the device in general.

[0044] The bottom part 42 is recovered by a removable sheet 36, arranged towards the outside of the cartridge 12 with respect to the filter 44. The removable sheet 36 may be heat-sealed or glued to the cartridge 12 in a conventional manner. It is made of aluminium or of any other food approved material. The removable sheet 36 comprises a prehension means (not shown), so a user can grasp and remove it from the cartridge 12.

[0045] The sheets 36 and 50 hermetically close and vacuum-pack the inner contents 40 of the cartridge 12. The infusible substances 12 are protected from air and humidity. Both sheets 36, 50 and cartridge 12 are preferably made of an opaque material to protect its contents 14 for light as well.

[0046] The cartridge 12 may comprise marks or any automatic readable means comprising or indicating infusion parameters. The marks or readable means may be located either on the outside surface of the side walls 45 or on the lip 39 or on the sheet 50.

[0047] In one embodiment, the bottom part 42 includes a recess 46 arranged toward the inside of the cartridge 12. The recess 46 is frustrocone-shaped, the larger section of the recess 46 being at the level of the bottom part 42. The larger section of the recess 46 has a diameter comprised between 2 and 15 millimetres, or more particularly between 2 and 6 millimetres.

[0048] The recess 46 comprises openings 48 for letting gas pass through. In one embodiment, four openings 48 are located on the side walls 52 and one on the top part 54 of the recess 46. As a matter of example, the four openings 48 on the side walls are arranged symmetrically with respect of the axis of the recess 48.

[0049] **Figure 2** shows a perspective front view of a device for preparing infused beverages which uses cartridges according to the invention.

[0050] The device 2 comprises a removal reservoir 66 containing liquid and two infusion containers 6 for containing liquid 4. The infusion container 6 is designed to simultaneously contain air and enough water for a normal cup of beverage. Alternatively, the infusion container 6 is designed to contain several cups of beverage.

[0051] The infusion container 6 is disposed on a platform 68 connected to the device 2 via a supporting arm 69. A removable holding cap 70 is clipped on top of the container 6. An opening (not represented) is located on top of the container 6 and is closed by the holding cap 70. A pair of arc-shaped arms 71 connects the holding cap 70 to the platform 68. The container 6 is securely held between the platform 68 and the holding cap 70. The supporting arm 69, the holding cap 70, the pair of arms 71 enclose various conduits for gas and liquid to flow between the infusion container 6 and other internal elements of the device 2.

[0052] An opening 8 (not represented) is provided at the bottom of the container 6 to allow liquid 4 to flow out of the container 6.

[0053] The platform 68 comprises a spout 19, through which the infused beverage is poured out of the device 2. The spout 19 opens above a cup support 64. The cup support 64 is adapted to hold a cup or any similar container to collect the infused beverage poured from the spout 19 directly.

[0054] The device 2 may be adapted to prepare simultaneously one, two or more infused beverages at a time. The device 2 comprises a corresponding number of infusion containers 6 and accompanying parts.

[0055] Referring now to **figure 3**, the platform 68 comprises a receptacle 10 for receiving a cartridge 12 containing infusible substances 14. In this particular embodiment, the receptacle 10 consists of a drawer. The drawer 10 is operable between at least a first position and a second position. The drawer 10 slides from a closed position in the platform 68 to an opened position out of the platform 68. The drawer comprises a cavity 16 into which a cartridge 12 (not represented) containing infusible substances may be inserted. The drawer 10 may slide either automatically or manually. When the drawer 10 is closed in the platform 68, the cavity 16 of the drawer 10 communicates with the bottom opening 8 of the infusion container 6, so that the infusion container 6 and the cavity 16 form an infusion chamber.

[0056] The cavity 16 of the drawer 10 is connected to a passage 18 (not represented) located in the platform 68. An actuated valve allows closing and opening the passage 18. When the passage 18 is opened, liquid flows out of the infusion container 6 through the cavity 16 to the passage 18. When the passage 18 is closed, the infusion chamber formed by the cavity 16 and the infusion container 6 is closed. The passage 18 is connected to the spout 19 as well as to a conduit for waste water described below through actuated valves. Liquid flowing into the passage may be directed either to the conduit for waste water or to the spout 19.

[0057] The device 2 for preparing infused beverage is now described in respect with **figures 4, 5, 6**.

[0058] The device 2 comprises a support 72 for the reservoir 66. The support 72 comprises an opening where the valve-cap of the reservoir 66 is plugged, giving

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access to the water contained in the reservoir 66.

[0059] The support 72 is connected to a conduit 65a, creating a flow path for water from the reservoir 66. The conduit 65a is connected to a series of conduits 65b, via a system of actuated valves, to transfer water to respective infusion container 6. The conduit 65b is located within one of the pair of arms 71. A sprinkler 63 with several outlets 61 is disposed at one extremity of the conduit 65b. The sprinkler 63 is located within the holding cap 70 and is plugged into an opening located at the top of the infusion container 6. A pump 67 is used for the transfer of water from the conduit 65a to the conduits 65b.

[0060] The device 2 further comprises a heating chamber 59 to heat water. The device comprises an air or gas inlet pipe 28 located within the arm 69 and the platform 68. The gas inlet pipe 28 is adapted to deliver pressurised gas. The pump 67 is used for ejecting pressurised gas into one of the inlet pipe extremity. The pump 67 is actuated to control the pressure of the gas at the inlet.

[0061] The device 2 further comprises a conduit 23 to collect waste water from the infusion container 6. The conduit 23, connected at one extremity to a waste container (not represented) located within the device 2 and travels within the arm 69 and the platform 68. Its other extremity is located within the platform 68.

[0062] The device 2 further comprises a conduit 24 to collect used cartridges from the receptacle 10. The conduit 24 is located in the arm 70 and opens above the waste container.

[0063] In a manner known, the device 2 further comprises a sensor to detect the presence of a cup on one of the cup holder 64, a set of control knobs 3 for the user to operate the device 2, an operating means comprising a processing means to electronically control and operate all mechanisms of the device 2. The processing means includes a printed circuitry 25 and memory to store data for use by the processing means.

[0064] The receptacle 10 of the device 2 is now explained in respect with **figure 7**.

[0065] The receptacle 10 consist of a drawer comprising a front panel 105, a tray 107. The drawer 10 slides along two side panels 104a and 104b located inside the platform 68. A multiple runner mechanism 101,102,103 is disposed on the top edge of both side panels 104a, 104b.

[0066] The tray 107, removably linked to the side panels 104a, 104b through the multiple runner mechanism, slides along the side panels 103, 104. A mechanism located in the platform 68 is provided to rise up and support the tray 107 away from the side panels 104a, 104b. The tray 107 is formed by two panels 107a and 107b hinged to each other through a hinge 108. The hinge 108 is disposed perpendicular to the sliding direction of the tray 107.

[0067] The tray 107 comprises a cavity 16 adapted to receive a cartridge 12. The cavity 16 comprises partial side walls 110 connected to the first panel 107a of the tray 107 and a partial bottom part 111 connected to the side walls 110. The partial side walls and bottom part 110 and 111 are disposed towards the front panel 105 and underneath the first panel 107a only. The partial side walls 110 and the partial bottom part 111 form a partial cone or cylinder, truncated at the level of the bottom part 111. The dimensions of said partial cone are slightly larger than those of the cartridge 12, so that the cartridge 12 perfectly fit into the cavity 16.

[0068] A protruding nozzle 112, preferably cylindrical or frustrocone-shaped, is located on the bottom part 111 towards the inside of the cavity 16. The dimensions of protruding nozzle 112 are such that the recess 46 of a cartridge 12 inserted in the cavity 16 perfectly fits the protruding nozzle 112. The protruding nozzle 112 comprises openings 113 injecting gas towards the inside of the cavity 12. The openings 113 are disposed in the protruding nozzle 112 in such way that the openings in the recess of a cartridge 12 inserted in the cavity face the injection opening 113. In one embodiment, four openings 113 are located on the side walls of the nozzle 112 and one on its top part 54.

[0069] The protruding nozzle 112 is connected to a conduit 29 (not represented) located within the bottom part 111 of the cavity 16. Alternatively, the conduit 29 may be located on the surface of the bottom part 111 either towards the inside of the cavity 16 or the outside of the cavity 16. The conduit 29 is connected to gas inlet pipe 28.

[0070] In another embodiment, the protruding nozzle 112 may be located on the partial side walls 110 of the cavity 16.

[0071] A recess 109 is disposed on the top surface of the tray 107 around the top edges of cavity 16. The section of the recess 109 is slightly larger than that of the lip 39 of cartridges 12 so that the lip 39 of a cartridge 12 received in the cavity 16 perfectly slots the recess 109.

[0072] A mechanism to automatically open a cartridge according to the invention, while the drawer 10 slides into the platform 68, is now described with reference to **figures 9a to 9e**.

[0073] The device 2 comprises a pair of parallel arc-shaped bars 33 between which a flat blade 31 is attached. The blade 31 is fixely attached tangent to the cylindrical surface formed between the arc-shaped bars 33. The blade 31 is preferably a semi-circular or semi-oval blade, its straight side being connected to the arc-shaped bars 33 through rods 31a. The small and long diameters of the blade 31 are slightly smaller than these of the opening 35 of the cartridge 12.

[0074] The arc-shaped bars 33 rotate around the infusion container 6 through the platform 68 and within the pair of arc-shaped arms 71. The sliding movement of the drawer 10 in the platform 68 is linked to the movement of the arc-shaped bars 33.

[0075] The arc-shaped bars 33 are positioned tangent to the sliding direction of the receptacle 10. The arc-shaped bars 33 are located tangent to the tray 107 of the drawer 10 and on each side of the top part of cavity 16

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of the drawer 10.

[0076] Figure 9a shows the position of the blade 31 in relation to the cartridge 12, when the drawer 10 starts sliding into the platform 68. The arc-shaped bars 33 rotate and soon the lip 29 of the cartridge 12 is trapped between the arc-shaped bars 33 and the recess 109 of the tray 107. The edge of the blade 31 touches and pierces the first sheet 50 inside the opening 35 of the cartridge 12 close to the opening edge. Figure 9b to 9d shows the position of the blade 31 in relation to the cartridge 12, while the drawer 10 keeps on sliding into the platform 68. The arc-shaped bars 33 keep on rotating; the blade 31 follows a circular movement in and out of the cartridge 12 cutting the sheet 50 close to the edge of the opening 35. It is important that the cartridge 12 is remained blocked in the cavity 12 between the arc-shaped bars 33 and the recess 109 of the tray 107, so that the blade 31 may perform a proper and efficient cut of the sheet 50.

[0077] Figure 9e shows the position of the blade 31 in relation to the cartridge 12, when the drawer 10 reaches its final position in the platform 68. When the blade 31 moves out of the cartridge 12, it pushes away of the cartridge 12 the part of the sheet 31 it just cut out. The cut out part remains partially attached to the sheet 31. The whole opening 35 is accessible.

[0078] In another embodiment, the cut out part of the sheet 50 is entirely separated from the sheet 50 and is dragged away by the blade 31, when the blade 31 moves out of the cartridge 12. The cut out part falls by gravity onto the ejection chute 106 and is collected within the second waste container 78.

[0079] The blade 31 could be of any shape adapted to the section of the opening 35. The dimensions of the blade need to be smaller than these of the opening 35, to allow the blade 31 to slide in and out of the cartridge 12 via the opening 35 and to cut the sheet 50.

[0080] Once the drawer 10 is closed within the platform 68 and once the top sheet 50 of the cartridge 12 has been cut out, the tray 107 is raised up away from the side panels 104a, 104b. The lip 39 of the cartridge 12 located in the recess 109 of the tray 107 is brought into contact with the bottom opening 8 of the infusion container 6. A gasket 84 disposed on the edge of the bottom opening 8 ensures a hermetic connection between the infusion container 6 and the lip 39. The cartridge 12 is firmly maintained blocked within the cavity 16.

[0081] The dimensions of the opening 8 of the infusion container 6 are equal or larger than those of the section of the cavity 16 on the tray 107 to surround the opening 35 of the cartridge 12. The dimensions of the opening 8 of the infusion container 6 are smaller than those of the section of the recess 109 of the tray 107.

[0082] The device 2 further comprises a movable snapping insert 81 (not represented) located in the platform 68. The movement of the insert 81 is controlled by the operating means of the device 2. The insert 81 is operated to be brought to contact with the cavity 16 of the tray 107. The insert 81 is adapted to fit exactly together with the edge of the side walls 110 of the cavity 16 and with the bottom part 111 of the cavity 16. The insert 81 is also adapted to fit together with the bottom surface of the tray 107. A gasket 83 (not represented) may be disposed on each part of the insert 81 adapted to contact the cavity 16. The insert 81 is connected to the passage 18.

Once the drawer 10 is closed within the platform 68 and once the tray 107 has been brought to contact with the bottom opening 8 of the infusion container 6, the insert 81 is operated and brought to contact with the cavity 16, so the cavity 6 and the insert 81 fit exactly together. The gasket 83 ensures that the surfaces of contact between the insert 81, the cavity 16 and the tray 107 are hermetic. The infusion container 6, the tray 107 the cavity 16 and the insert 81 form a hermetic infusion chamber closed by the passage 18.

[0083] A mechanism for ejecting from the cavity of the drawer 10 a cartridge according to the invention is now explained in respect with **figures 10a to 10c.**

[0084] Figure 10a shows the drawer 10 closed within the platform 68 in the first position. Fig. 10b shows the tray 107 in an intermediate position, sliding on the side panel 104a, 104b towards the inside of the platform 68. Fig. 10c shows the tray 107 sliding further towards the inside of the platform 68 in a third position, where the tray 107 folds up around the hinge 108. The second panel 107b slides out of the third runner 103 and falls on the ejection chute 106. The cavity 16 comprising partial side walls 110 along the first panel 107a only, the cartridge 12 is not held within the cavity 16 anymore. The cartridge 12 is released from the cavity 16; it falls on the ejection chute 106 and slides down toward the ejection conduit 24 in the arm 69. While the cartridge 12 falls down on the ejection chute 106, the cut out part of the sheet 50 is pushed back toward the sheet 50 and partially closes the opening 35 of the cartridge 12. The infusible substances 14 are maintained within the cartridge 12.

[0085] The ejection mechanism to withdrawn the cartridge 12 allows to eject the cartridge smoothly. It prevents the infused substances 14 contained in the cartridge 12 from falling out of the cartridge 12. Some infused substances may still fall out of the cartridge 12 when it is dropped onto the ejection chute 108. They are collected on the ejection chute 108 in any case.

[0086] The drawer 10 and the insert 81 of another device in which the cartridge 12 according to the invention is used are now explained in respect with **figure 8**. A mechanism for detecting a cartridge 12 in the cavity 16 is also presented.

[0087] The drawer 10 comprises a tray 107 with a cavity 16 adapted to receive a cartridge 12. The cavity 16 comprises side walls 110 connected to the tray 107. The side walls 110 form a partial cone or cylinder, truncated at the bottom part. When a cartridge 12 is inserted in the cavity 16b, it is maintained in the cavity 16 through its lip resting upon the upper surface of tray 107; the side walls 45 of the cartridge 12 lay upon the side walls 110 of the

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cavity 16.

[0088] The device 2 further comprises a movable insert 81 located in the platform 68. The movement of the insert 81 is controlled by the operating means of the device 2. The insert 81 is operated to be brought to contact with the cavity of the tray 107. The insert 81 adapted to fit exactly together with the edges 114 of the side walls 110 of the cavity 16. A gasket 83 may be disposed either on the insert 81 or on the edges 114 of the side walls 110 to ensure a hermetic contact between the cavity 16 and the insert 81. The insert 81 is connected to the passage 18.

[0089] A protruding nozzle 112, preferably cylindrical or frustrocone-shaped, is located in the insert 81 towards the inside of the cavity 16. The protruding nozzle 112, provided with openings 113 for the ejection of gas, is connected to a conduit 29 located within the insert 81; the conduit 29 is connected to the inlet pipe 28.

[0090] The insert 81 comprises a detector to detect whether a cartridge 12 is slot in the cavity 16 or not. The detector comprises an actuating push-button 82, located around the protruding nozzle 112 and connected to the circuitry 25 of the device 2. The push-button 82 is able to slide up and down along the protruding nozzle 112. When pushed down, it actuates part of the functioning of the device 2. The push-button 82 is cone-shaped, truncated at the level of its top part. The diameter of the bottom section (at the level of the bottom part 42) of the recess 46 of a cartridge 12 is larger than that of the top section of the push-button 82. Preferably the angle of the cone of the recess 46 is substantially identical to that of the cone of the push-button 82.

[0091] Once the drawer 10 is closed within the platform 68 and once the tray 107 has been brought to contact with the bottom opening 8 of the infusion container 6, the insert 81 is operated to be brought to contact with the cavity 16, so the cavity 6 and the insert 81 fit exactly together. The cartridge 12 is firmly maintained in the cavity 16, its lip 39 between grasped between the upper surface of the tray 107 and the edge of the opening 8 of the infusion container 6. While the insert 81 is raised up, the protruding nozzle 112 and the push-button 82 move into the recess 46 of the cartridge 12. The outside side surface of the push-button 82 is brought into contact with the side surface of the recess 46.

[0092] The push-button 82 keeps on moving into the recess 46, sliding along the surface of the recess 46 until the push-button 82 is blocked between the surface of the recess 46 and the protruding nozzle 112. As the insert 81 keeps on sliding up, the push-button 82 is pressed down by the surface of the recess 46 of the cartridge 12; the push-button creates a new connection in the circuitry 25 for the actuation of a process in the device 2. Once the insert 81 is brought into contact to the edges 114 of the cavity 16, the protruding nozzle 112 is located inside the recess 46 of the cartridge 12, so that the openings 113 of the protruding nozzle 112 face the openings 48 of the recess 46.

[0093] Once the cartridge 12 is removed from the cavity 12 whether automatically or manually, it releases the push-button 82. Similarly, the release of the push-button 82 may control at least a step in the functioning of the device 2.

[0094] A cartridge according to another embodiment of the invention is now explained with respect to **figure 7F**. The bottom part 42 of the cartridge comprises a recess 46a towards the inside of the cartridge 12. The recess 46a consists of a first truncated cone 46a1, its larger section being at the level of the bottom part 42 of the cartridge 12 and of a second truncated cone or cylinder 46a2 "stacked" upon the first cone 46a1. The intersection between the first and second cone 46a1 and 46a2 constitutes an actuating surface 46b. The recess 46a2 comprises openings 48 for letting gas pass through.

[0095] The diameter of the bottom section of the recess 46a1 is larger than that of the top section of the push-button 82. Preferably the angle of the cone of the recess 46a1 is substantially identical to that of the cone of the push-button 82.

[0096] In use, when the insert 81 is raised up, the protruding nozzle 112 and the push-button 82 of the insert 81 move into the recess 46a1 of the cartridge 12. The outside side surface of the push-button 82 is brought into contact with the side surface of the recess 46a1. The push-button 82 slides along the surface of the recess 46a1 until being blocked by the actuating surface 46b. As the insert 81 keeps on sliding up, the push-button 82 is pressed down by the surface 46b; the push-button creates a new connection in the circuitry 25 for the actuation of a process in the device 2. Once the insert 81 is brought into contact to the edges 114 of the cavity 16, the protruding nozzle 112 is located inside the recess 46a2 of the cartridge 12, so that the openings 113 of the protruding nozzle 112 face the openings 48 of the recess 46a.

[0097] While various embodiments of the present invention have been described in detail, it is apparent that modifications and adaptations of those embodiments will occur to those skilled in the art. It is to be expressly understood, however, that such modifications and adaptations are within the scope of the present invention.

Claims

1. Cartridge (12) for containing infusible substance (14) for use in a device for preparing an infused beverage (4), including:

   a bottom part (42) provided with a filter (44) adapted to let liquid (4) pass through;
   a top part (38) provided with an opening (35);
   side walls (45) joining the bottom (42) and top (38) parts;

   characterized in that
   the bottom part (42) forms a recess (46) arranged

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toward the inside of the cartridge (12), the surface of the recess (46) comprising an actuating surface for actuating a mechanism of the device.

2. Cartridge (12) according to claim 1, wherein the recess (46) is provided with at least an opening (48) for letting gas pass through.

3. Cartridge (12) according to any of the preceding claims, wherein the opening of the top part (38) is provided with and closed by a extendable and/or deformable filter arranged toward the outside of the cartridge (12) with respect of the opening (35).

4. Cartridge (12) according to any of the preceding claims, wherein the opening of the top part (38) is provided with and closed by a sheet (36), arranged toward the outside of the cartridge (12) with respect of the opening (35).

5. Cartridge (12) according to any of the preceding claims, wherein the bottom part (42) is provided with and closed by a removable sheet (50), arranged toward the outside of the cartridge (12) with respect of the filter (44).

6. Cartridge (12) according to any of the preceding claims, wherein the recess (46) has a substantially cylindrical or frustroconical form defining recess side walls (52) and a recess top (54), and wherein the at least one opening (48) of the recess (46) is provided through the recess side walls (52), or/and through the recess top (54).

7. Cartridge (12) according to claim 6, wherein the bottom section of the recess (46) has a diameter comprised between 2 and 15 millimetres, or more particularly between 2 and 6 millimetres.

8. Cartridge (12) according to anyone of the preceding claims, having a substantially cylindrical or frustroconical form.

9. Cartridge (12) according to claim 8, wherein the angle (α) formed by the side walls (45) and the bottom part is comprised between 90 degrees and 100 degrees, or more particularly between 93 degrees and 97 degrees.

10. Cartridge (12) according to any of the claims 1 to 9, made of food contact approved aluminium or aluminium having its inner surface covered with a food contact approved coating and able to resist to temperatures at least up to 100°C during several minutes.

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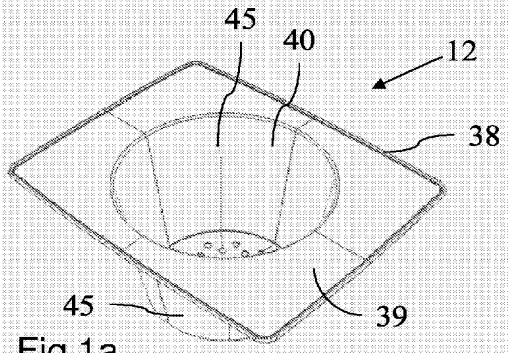


Fig 1a

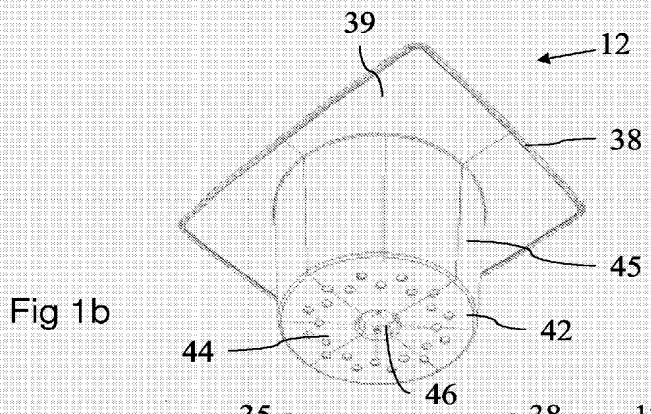


Fig 1b

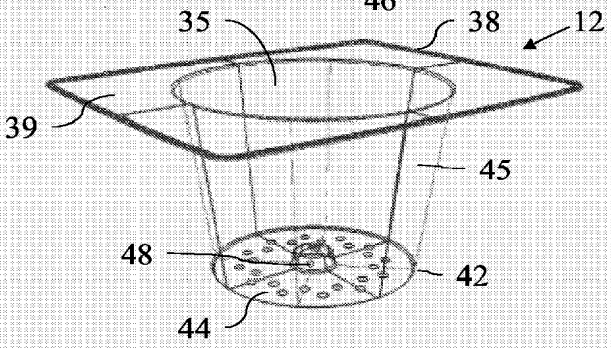


Fig 1c

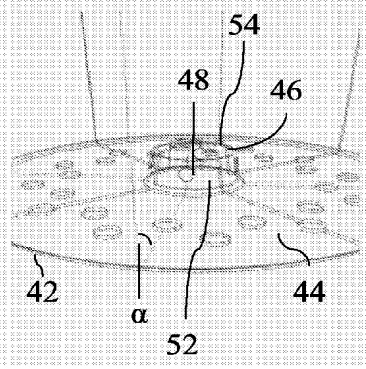


Fig 1d

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FIG 1E

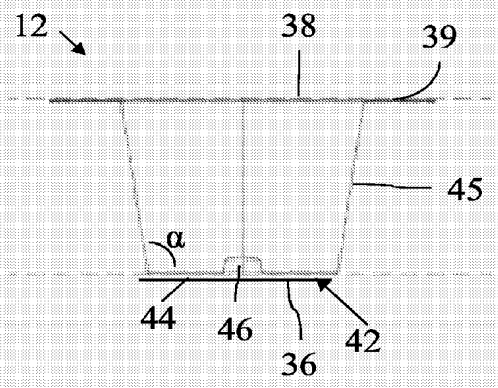
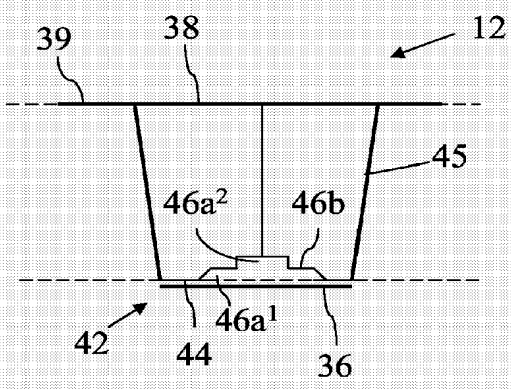
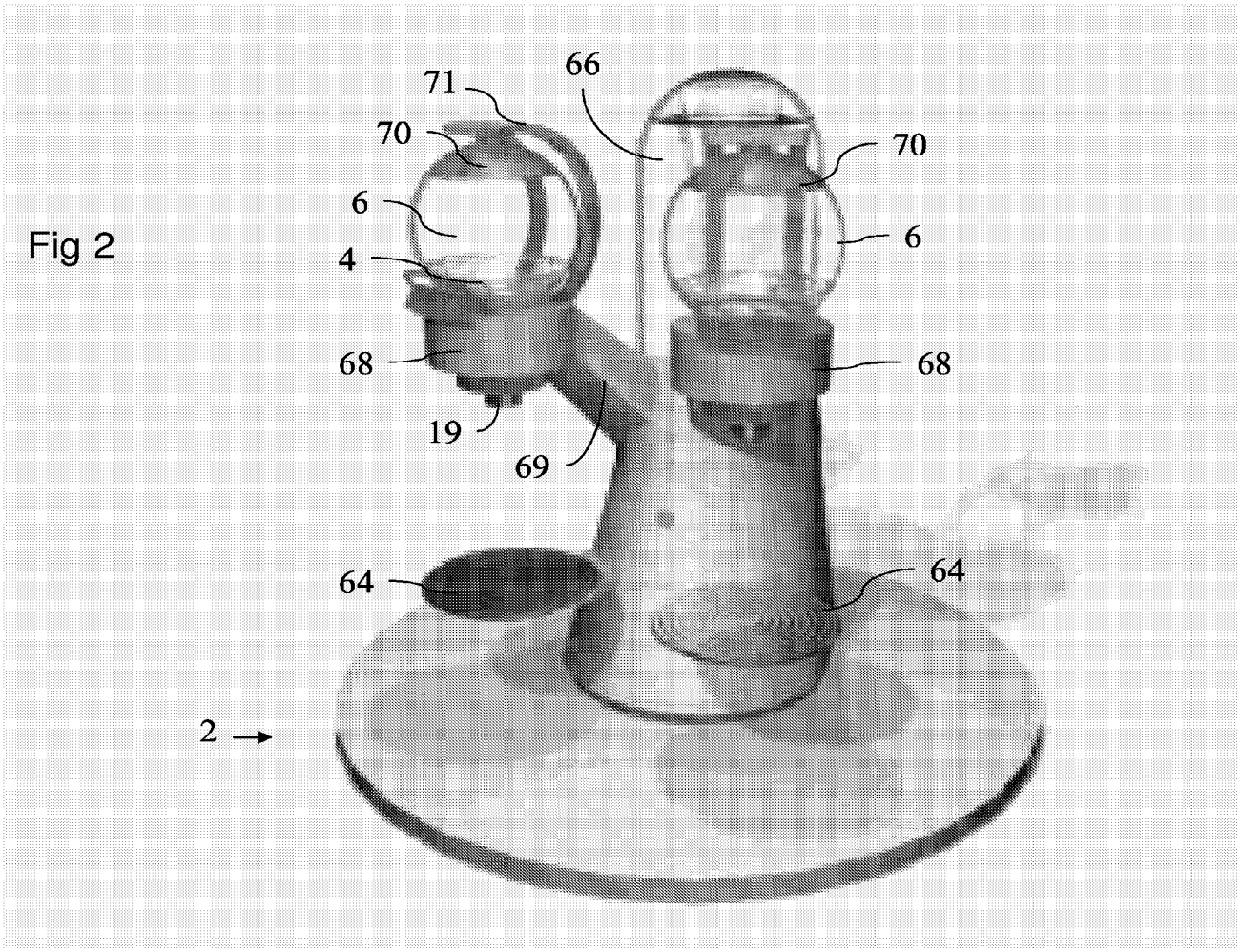


FIG 1F



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Fig 2



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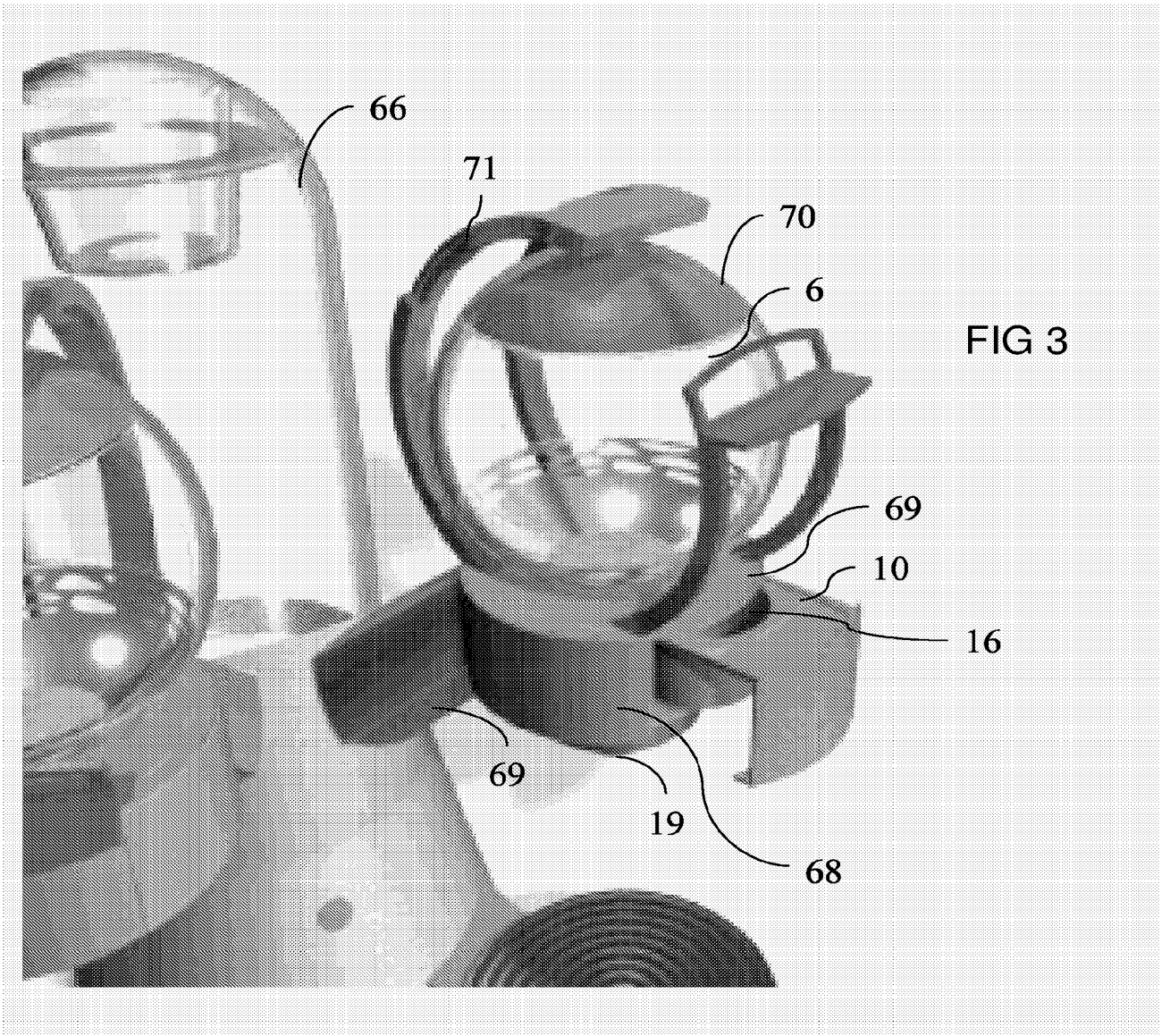
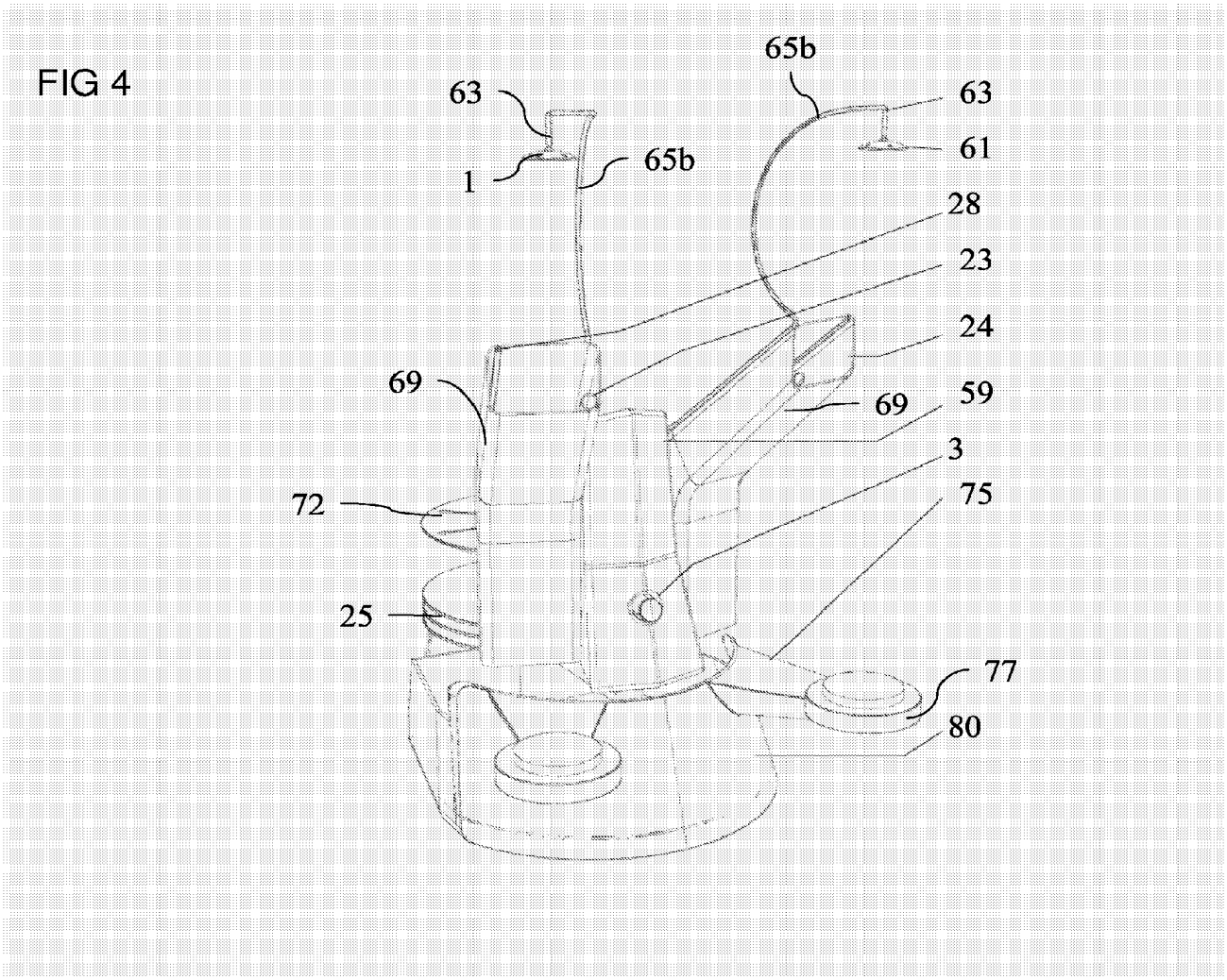


FIG 3

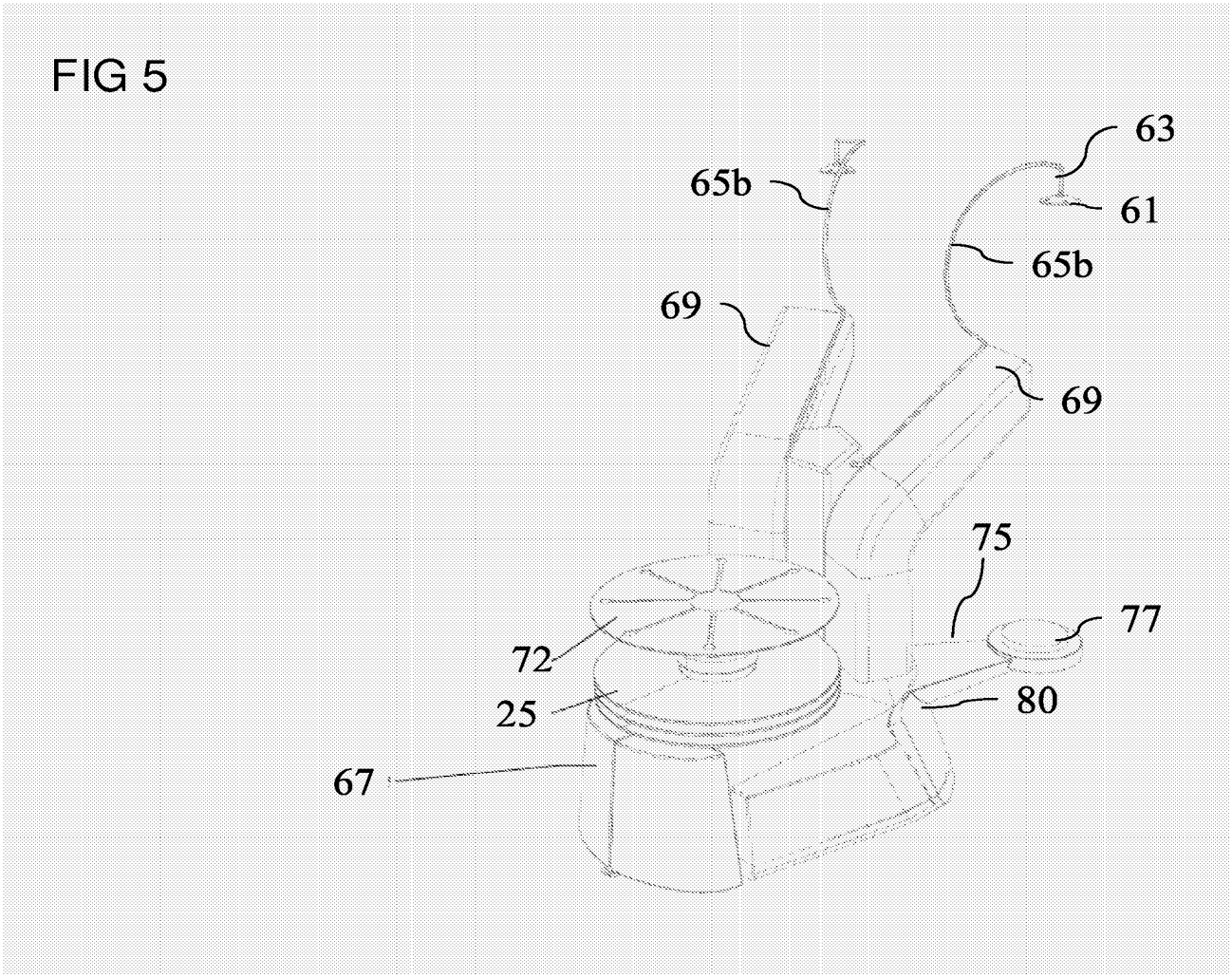
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FIG 4



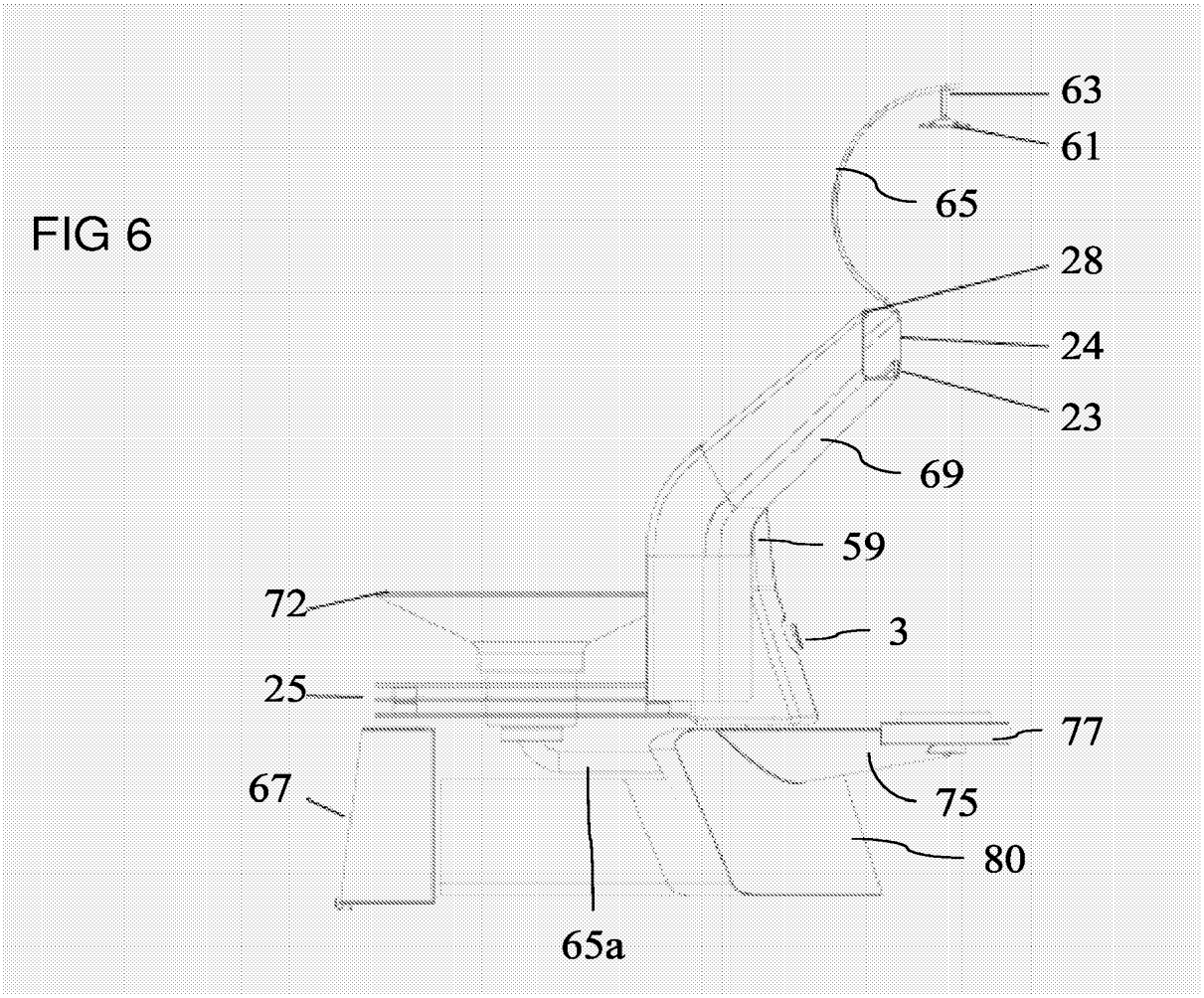
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FIG 5



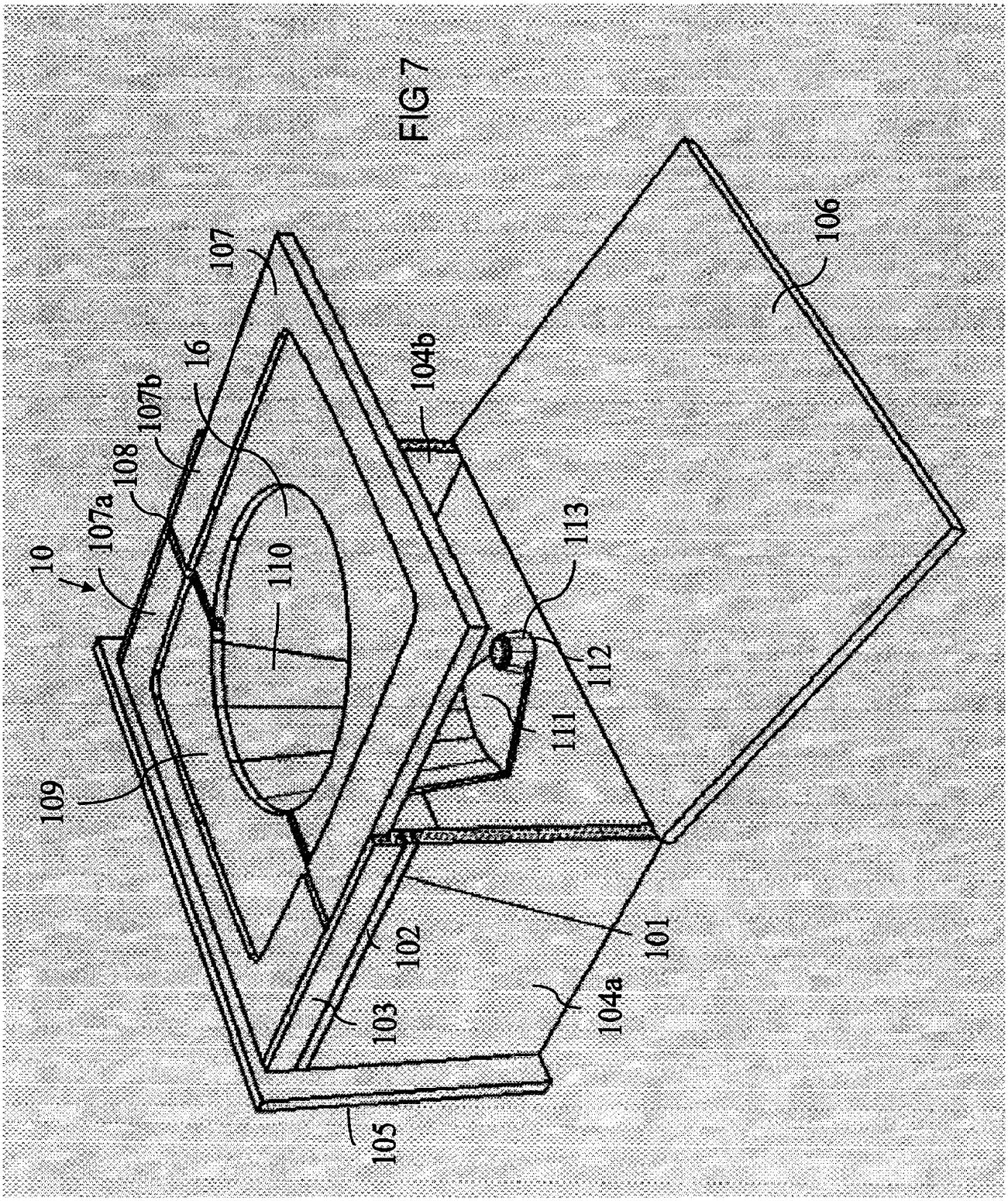
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FIG 6



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FIG 7



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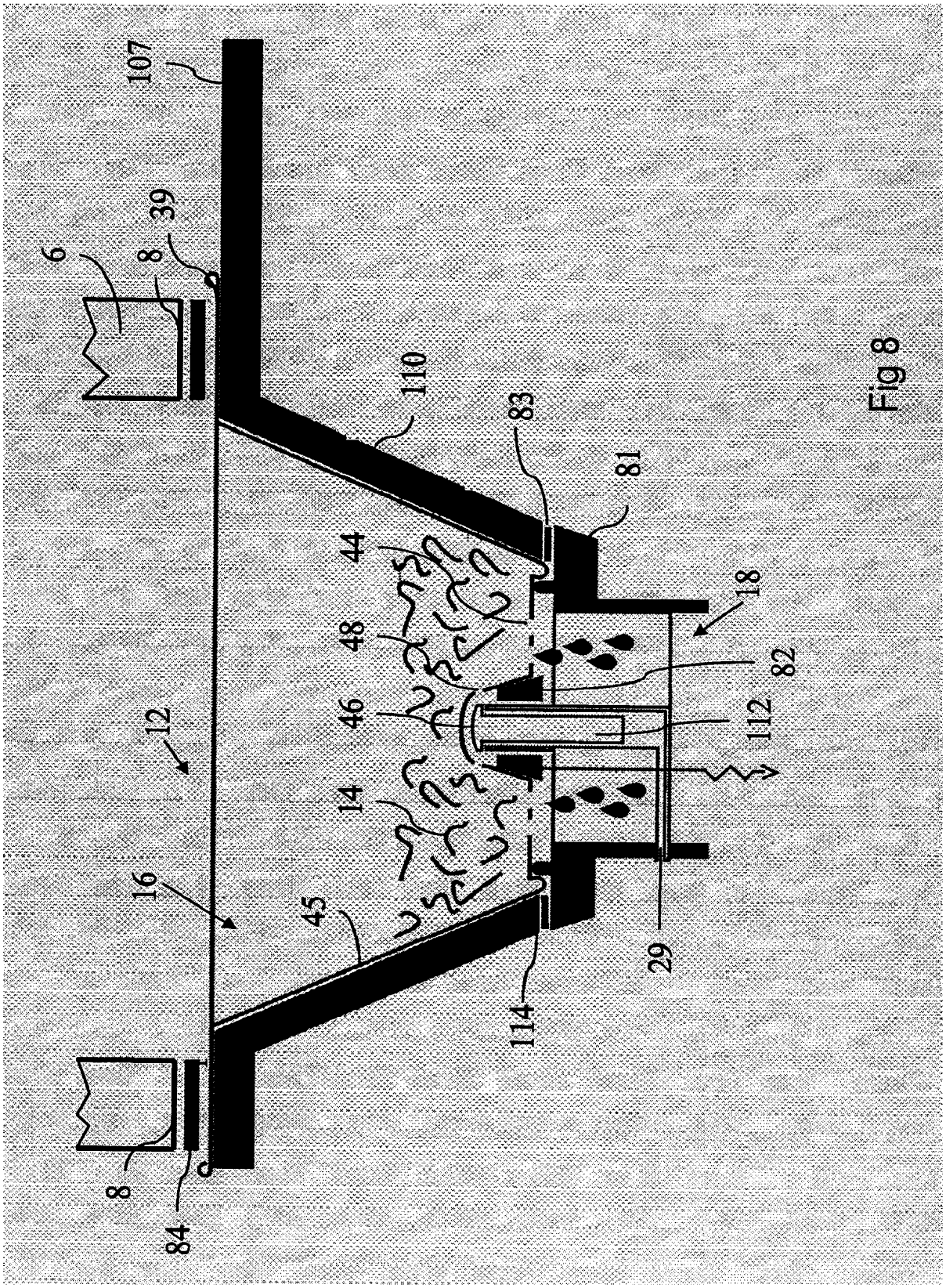


Fig 8

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Fig 9A

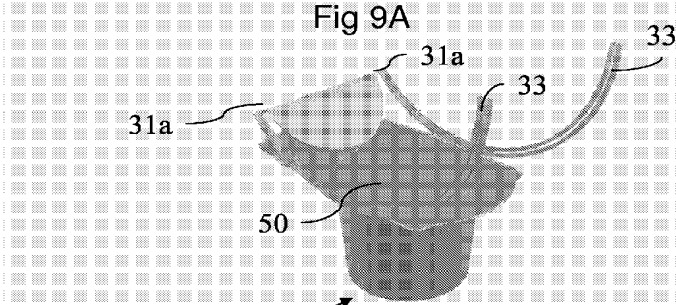
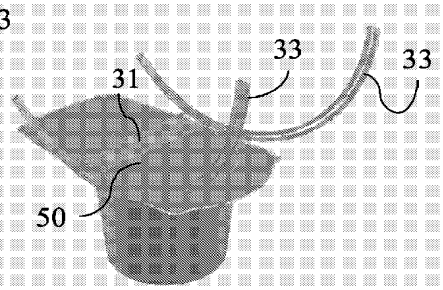


Fig 9B



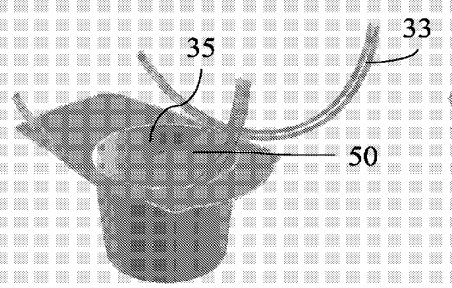


Fig 9C

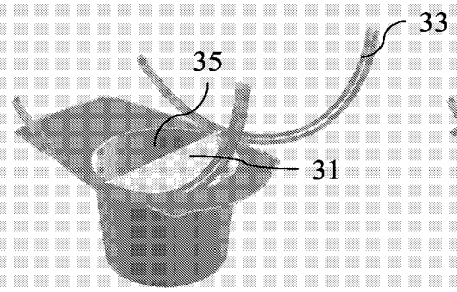


Fig 9D

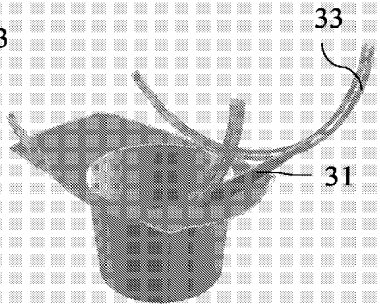


Fig 9E

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FIG 10A

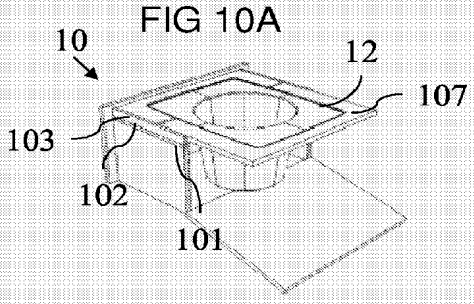
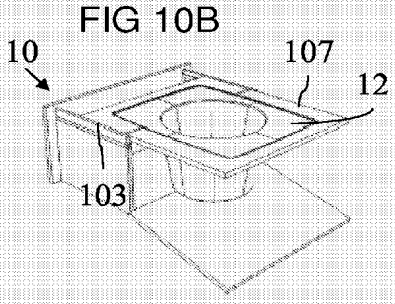


FIG 10B



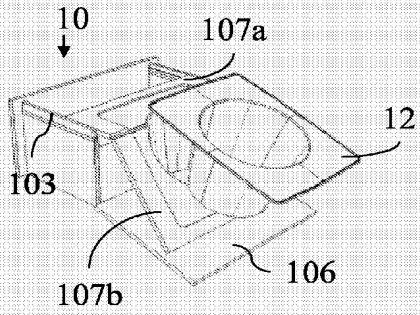


FIG 10C

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 10 9370

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 2005/150390 A1 (SCHIFFERLE RENE) 14 July 2005 (2005-07-14) * paragraphs [0017] - [0020]; figures 1,2 *	1,3-10	B65D85/804
X	US 2 778 739 A (RODTH JOSEPH J) 22 January 1957 (1957-01-22) * column 2, lines 9-66; figures 1,2 *	1,2,4,6, 8	
X	EP 1 344 724 A (HALE, ROBERT) 17 September 2003 (2003-09-17) * paragraphs [0048], [0049]; figures 18,19 *	1,4,6,8	
X	US 4 550 024 A (LE GRANSE ET AL) 29 October 1985 (1985-10-29) * column 3, line 57 - column 4, line 15; figure 1 *	1,3,4, 6-9	
			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	13 February 2006	Cazacu, C

CATEGORY OF CITED DOCUMENTS

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13-02-2006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005150390 A1	14-07-2005	AU 2005200115 A1	28-07-2005
		BR 0500074 A	06-09-2005
		CA 2492304 A1	14-07-2005
		CN 1640350 A	20-07-2005
		DE 102004002005 A1	11-08-2005
		EP 1555219 A1	20-07-2005
		JP 2005199071 A	28-07-2005
		SG 113573 A1	29-08-2005
		ZA 200500320 A	19-07-2005
US 2778739 A	22-01-1957	NONE	
EP 1344724 A	17-09-2003	NONE	
US 4550024 A	29-10-1985	CA 1219139 A1	17-03-1987
		DE 3462324 D1	12-03-1987
		DK 23584 A	21-07-1984
		EP 0114717 A2	01-08-1984
		ES 277007 U	01-08-1984
		NL 8300213 A	16-08-1984

EPO FORM P0459

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Patent documents cited in the description

- JP 2001120436 A **[0004]**

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(25) Filing Language: English

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60/238,802 6 October 2000 (06.10.2000) US

(71) Applicant: **BOYD COFFEE COMPANY** [US/US]; 19730 NE Sandy Boulevard, Portland, OR 97220 (US).

(72) Inventors: **BOYD, David, D.**; 5215 SE 32nd Avenue, Portland, OR 97202 (US). **JOHNSON, Michael, W.**; 26 Crescent Drive, St. Helens, OR 97501 (US).

(74) Agents: **KOLISCH, Pierre, J.** et al.; Kolisch, Hartwell, Dickinson, McCormack, & Heuser, 520 S.W. Yamhill Street, Portland, OR 97204 (US).

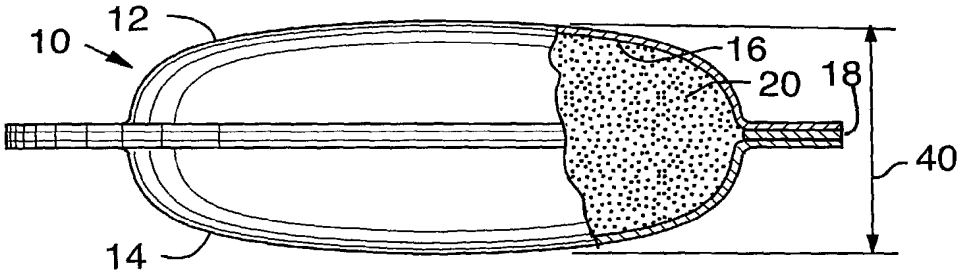
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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: ENCODED COFFEE PACKET



(57) Abstract: A brewing packet (10) is provided for use in the preparation of hot or cold beverages. The brewing packet envelops a brewing ingredient (20) chosen according to the tastes of a beverage drinker. The packet includes a machine interpretable feature (30) that contains encoded data capable of being read by a beverage producing device (100). Furthermore, the data on the packet is capable of directing the beverage producing device to employ a specific brewing operation suited for the particular brewing packet. This allows for producing the optimal beverage from the brewing ingredient. The packet may be utilized with a variety of brewing ingredients to produce a variety of beverages. Similarly, the packet may be configured to produce single or multiple servings of a beverage.

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ENCODED COFFEE PACKET

Cross Reference to Related Application

This application claims priority from Provisional Patent Application Serial No. 60/238,802, filed October 6, 2000 for ENCODED COFFEE PACKET. The full contents of that provisional patent application are incorporated by reference.

Field of the Invention

The present invention relates generally to coffee machines, and more particularly, to an encoded coffee packet for use in a coffee machine to direct the coffee brewing process.

Background of the Invention

Automated coffee machines have long been used for brewing coffee, both in large-scale commercial settings and in smaller business and home settings. These machines typically operate on the principle of placing a quantity of ground coffee into a filter, and passing hot water through the ground coffee to produce a coffee beverage.

In recent years, such machines have brewed coffee using pre-measured, pre-packaged quantities of ground coffee, typically in the form of packets which may be inserted into the coffee machine at the time of brewing, or selected from an onboard coffee packet supply. These packets, also known as pods or cartridges, simplify the task of cleaning the machine and replacing used coffee grounds, and ensure more consistent coffee quality and taste.

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Despite these advantages, however, coffee machines which employ such pre-measured coffee packets typically do not consider variations in individual taste, or the particular characteristics of the packaged coffee grounds. The use of such packets also has heretofore been reserved for espresso coffee making machines, which typically employ consistent size, shape and grind characteristics. Accordingly, applicants have developed a system whereby coffee packets may be encoded with data for use in directing the coffee brewing process to accommodate individual tastes and the particular characteristics of the ground coffee used.

Summary of the Invention

A brewing packet is provided for use in the preparation of hot or cold beverages. The brewing packet envelops a brewing ingredient chosen according to the tastes of a beverage drinker. The packet includes a machine interpretable feature that contains encoded data capable of being read by a beverage producing device. Furthermore, the data on the packet may be capable of directing the beverage producing device to employ a specific brewing operation suited for the particular brewing packet. This allows for producing the optimal beverage from the brewing ingredient. The packet may be utilized with a variety of brewing ingredients to produce a variety of beverages. Similarly, the packet may be configured to produce single or multiple servings of a beverage.

Brief Description of the Drawings

Fig. 1 is a side view of a packet according to an embodiment of the present invention with a section cut away to reveal the contents of the packet.

Fig. 2 is an isometric view of the packet depicted in Fig. 1.

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Fig. 2a is a fragmentary view of the packet shown in Figs. 1 and 2, illustrating an optical bar code encoding configuration.

Fig. 2b is a fragmentary view of an alternative embodiment packet, illustrating encoded data in the form of a shape.

Fig. 2c is a fragmentary view of an alternative embodiment packet, illustrating encoded data in the form of a text string.

Fig. 2d is a fragmentary view of an alternative embodiment packet, illustrating encoded data in the form of a glyph.

Fig. 2e is a fragmentary view of an alternative embodiment packet, illustrating encoded data in the form of a digital watermark.

Fig. 2f is a fragmentary view of an alternative embodiment packet, illustrating encoded data in the form of notches.

Fig. 2g is a fragmentary view of an alternative embodiment packet, illustrating encoded data in the form of grooves.

Fig. 2h is a fragmentary view of an alternative embodiment packet, illustrating encoded data in the form of holes.

Fig. 3 is a schematic representation of a coffee machine constructed in accordance with an embodiment of the present invention, the coffee machine being configured to receive and decipher an encoded packet.

Fig. 4 is a flowchart of a method according to the present invention.

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Detailed Description of the Invention

Although the present invention may be used in virtually any brewing machine, it is described herein for use in the context of machines such as those disclosed in U.S. Patent No. 5,974,949 to Weber et al. and U.S. Patent No. 6,035,762 to Ruckstuhl. Those patents disclose machines for brewing espresso using espresso espresso packets in the form of filter capsules which are received through a funnel into a brewing chamber where water is passed through the filter capsule to produce an espresso beverage. The subject matter of each of these patents is incorporated herein by this reference.

The invention also may be practiced in connection with espresso machines such as those disclosed in U.S. Patent Nos. 4,253,385, 4,254,694, 4,353,293, 4,429,623, 4,484,515, 4,555,894 and 4,852,333, all to Illy. These patents disclose various aspects of espresso machines which include brewing chambers configured to receive pre-fabricated espresso packets through which water is passed to produce an espresso drink. The subject matter of each of these patents also is incorporated herein by this reference.

While the aforementioned machines generally are described for use in connection with espresso packets which contain a single serving of espresso, it will be appreciated that the present invention considers application of the relevant principles to machines which employ coffee packets for use in brewing multiple cups, which employ coffee packets of various size and shape, which employ various filter media and which contain coffee of various varieties, roasts, and grinds. Furthermore, the packet and methodology described herein may also

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produce other types of beverages such as tea, cider, and/or any beverage which is produced by mixing various ingredients. The packet and methodology is not limited to hot beverages and may be used to produce cold beverages.

As indicated above, a variety of factors beyond the grind of the coffee play a part in the taste of coffee, including factors such as freshness, brew temperature, brew duration, amount of water used, etc. These factors may be dependent on the characteristics of the coffee itself, or may be determined by the tastes of the coffee drinker, even absent an understanding of the effects of changes in the brew operation.

With the foregoing in mind, it will be appreciated that it would be desirable to automatically customize the brew operation based on particular characteristics of the packet, the characteristics of the coffee, and/or the tastes of the user, whether or not the user is aware of what changes in the brew operation will lead to the desired taste. The present invention provides a vehicle for such customization in the form of an encoded packet configured to provide the brewing machine with data useful in directing the brewing operation in accordance with packet or packet content characteristics and/or the user's tastes.

Focusing now particularly on the invented encoded coffee packet, it will be appreciated that such packet typically takes the form of a coffee-filled packet configured for placement in a fluid path of a coffee machine whereby hot water (or steam) flows through the packet to produce a coffee beverage. An exemplary packet is depicted in Figs. 1-3, such packet being indicated generally at 10.

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In accordance with the present invention, packet 10 is of somewhat conventional construction, including a filter with a first filter portion 12 and a second filter portion 14 which collectively define a cavity 16 containing ground coffee 20. The filter is selected to permit flow of water therethrough, but to restrict flow of the ground coffee therethrough, other than in the form of a coffee beverage.

Typically, the filter takes the form of opposing, water-permeable paper sheets, as indicated, but the filter may be formed of stainless steel, or some other filter material configured to define a cavity for containment of coffee grounds while water and brewed coffee beverage pass therethrough. It is desirable, however, that the filter impart no undesirable taste characteristics to the resulting coffee beverage.

As indicated above, opposing filter portions 12 and 14 are secured together about their respective perimeters to form cavity 16. In the depicted embodiment, the filter portions are secured to an orbicular gasket 18. The gasket is deformable to allow for an optimum seal. In an alternative embodiment, the packet may be integrally formed from a continuous filter in which no gasket is required. Although the depicted packet is circular, it will be appreciated that the cavity may take virtually any shape capable of containing coffee grounds. The size and bed depth 40 of the packet is determined by the quantity of coffee grounds, the density of coffee grounds, and the desired coffee beverage taste.

As shown in Fig. 2, packet 10 includes a machine interpretable feature 30 which directs operation of the coffee machine in accordance with predefined brewing directives. In the first depicted embodiment, the machine

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interpretable feature is a barcode 31 as depicted in Fig. 2 and 2a. It will be understood that the machine interpretable feature may be any machine readable feature associated with packet 10.

Examples of alternative embodiments are depicted in Figs. 2b through 2h. In Fig. 2b the feature is geometric shape 32. The shape may be raised or lowered and may, or may not incorporate color, or some other machine-interpretably characteristic. Fig. 2c shows text string 33. The text string may consist of alpha-numeric characters and may be of various lengths including a single character. Fig. 2d shows glyph 34. The glyph may be any symbolic figure including a symbol used as a trademark. A digital watermark 35 is depicted in Fig. 2e. Fig. 2f shows notches 36. The notches may be localized to a particular area of the packet or may span its entire perimeter in singular or repetitive fashion. Grooves 37 are depicted in Fig. 2g. One or more grooves may be incorporated to create a texture. Fig. 2h shows holes. One or more holes may be used, which holes may be, of various shapes and sizes. The above-noted machine interpretable features; or other machine interpretable features, may similarly may be employed in combination or alone, such features being selected for their ability to store brewing directives and packet and/or ingredient-characteristic data, and for their cost of manufacture, aesthetic appearance, and ability to carry machine interpretal features which are capable of being successfully detected, read, and interpreted.

Machine interpretable feature 30, it will be appreciated, is capable of storing a significant amount of data, including specific brewing directives and/or packaging or ingredient characteristics. Examples of the types of brewing directives

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stored in machine interpretable feature 30 may include, for example, contact time, contact pattern, fluid volume, fluid temperature, fluid pressure, and/or fluid pass-through rate. The above brewing directives are all well known in the coffee brewing industry to affect the taste and quality of the coffee beverage. Examples of ingredient characteristics which may be stored in machine interpretable feature 30 include grind, blend, roast, quantity, bed depth, freshness, and expiration date. These examples are meant to be exemplary, not limiting in scope.

Fig. 3 schematically depicts a coffee machine 100 designed to utilize packet 10. In the depicted embodiment, packet 10 is positioned between input fluid path 110 and output fluid path 112. Gasket 18 helps form a seal between chamber 114, defining the input fluid path, and chamber 116, defining the output fluid path. Gasket 18 also helps secure packet 10 in place. In other embodiments, packet 10 is held in place by gravity, water pressure, friction, adhesion, magnetism, or other suitable mechanisms. As depicted, water passes into packet 10 along input fluid path 110, passing through filter portion 12. The water contacts ground coffee within packet 10, producing a coffee beverage. The coffee beverage then flows through packet 10 and out through filter portion 14. Thereafter, the coffee beverage continues along output fluid path 112 and into beverage receptacle 120. In one embodiment, water is stored in a reservoir (not shown) within coffee machine 100 and heated before entering input fluid path 110. Alternatively, water is externally heated before entering input fluid path 110, or not heated at all. Beverage receptacle 120 may be dimensioned to accommodate multiple servings of

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the brewed coffee beverage, or may be dimensioned to receive a single serving of brewed coffee.

Coffee machine 100 includes a sensor 130 designed to read machine interpretable feature 30 of packet 10. Sensor 130 is in turn operatively connected to a processor 140 which controls coffee machine 100. Machine interpretable feature 30 may store data which is read by sensor 130 and passed to processor 140. Processor 140 may then direct the brewing operation in accordance with its interpretation of the data derived from machine interpretable feature 30. For example, processor 140 may direct coffee machine 100 to brew using a pre-selected contact time, contact pattern, fluid quantity, fluid temperature, fluid pressure, and/or fluid pass-through rate expressed in machine interpretable feature 30. Alternatively, the processor may itself make determinations of contact time, contact pattern, fluid quantity, fluid temperature, fluid pressure, and/or fluid pass-through rate based on information contained in machine interpretable feature 30. The processor may also, based on information contained in machine interpretable feature 30, direct the coffee machine to add water, milk, cream, sugar, or any suitable condiment to the coffee beverage.

As alluded to above, machine interpretable feature 30 need not store data specifically including brewing directives and ingredient characteristics. Instead machine interpretable feature 30 may act as an identifier so that brewing directives and ingredient characteristics may be looked up from data storage 150 within (or external to) coffee machine 100. Sensor 130 thus may read machine interpretable feature 30 and processor 140 may match the machine interpretable feature with

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predefined brewing operation instructions stored in such memory. Processor 140 may then direct the brewing operation based on brewing operation instructions. In one embodiment, the brewing operation instructions are matched to a machine interpretable feature using a look-up table in which brewing operation instructions correspond in a one-to-one ratio with each known ingredient variety, packet size, packet construction, user preference, etc. It will be appreciated, however, that other arrangements for matching machine interpretable feature 30 with brewing directives similarly may be used.

Referring now to Fig. 4, a method of operation for the present invention is illustrated at 200. At 202, a brewing packet encoded with packet-characteristic data is placed into a brewing device. At 204, the packet-characteristic data is read by a sensor. At 206, the packet-characteristic data is interpreted by a processor. Finally, at 208, brewing is directed in accordance with the packet-characteristic data read by the sensor and interpreted by the processor.

Because the processor may be employed to effect the aforementioned predefined brewing directives based on the machine interpretable feature associated with each packet. The brewing operation may be made consistent based on consistent machine interpretable features from packet to packet. Similarly, the brewing operation may be altered in accordance with desired brewing characteristics each time the packet is replaced. Particular brew characteristics thus may be controlled simply by selection of a packet with the desired encoded brewing directives (whether or not such directives are known to the coffee machine operator). Control of the brewing process thus may be handed off to the brewing

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professionals who produce the packets, rather than relying on untrained machine operators. This may be done without sacrificing variety in brew operation based on differing characteristics of the packet contents or consumer tastes.

For example, a person desiring weaker coffee may purchase packets designated such in order to direct the machine to add water to the brewed coffee beverage in accordance with proper brewing procedure. This avoids problems associated with ill-advised attempts to dilute coffee by decreasing the quantity of coffee used, a change which may result in a corresponding change in bed depth, and thus in an undesirable change in coffee taste.

The encoded packets also may be used to track brewing information which may be useful in ensuring satisfaction with the brewed coffee beverage. For example, the packet may include an encoded date for use in tracking freshness of the coffee grounds contained within the packet. Upon determining that the packet is stale, the processor may direct the machine to note such staleness, thus avoiding an unsatisfactory beverage. Similarly, the packet may contain encoded data related to the coffee blend contained within the packet, such data being stored in memory to provide a history of coffee blends. The encoded packet also may contain encoded data defining the source of the packet so as to prohibit use of counterfeit packets, or packets from unauthorized suppliers.

While the invention has been disclosed in its preferred form, the specific embodiments thereof as disclosed and illustrated herein are not to be considered in a limiting sense as numerous variations are possible. The subject matter of the invention is regarded to include all novel and non-obvious

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combinations and subcombinations of the various elements, features, functions and/or properties disclosed herein. No single feature, function, element or property of the disclosed embodiments is essential. The following claims define certain combinations and subcombinations which are regarded as novel and non-obvious. Other combinations and subcombinations of features, functions, elements and/or properties may be claimed through amendment of the present claims or presentation of new claims in this or a related application. Such claims are also regarded as included within the subject matter of applicant's invention irrespective of whether they are broader, narrower, or equal in scope to the original claims.

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WE CLAIM:

1. A brewing packet comprising:

a filter defining a cavity;

a brewing ingredient within the cavity; and

a machine-interpretable feature associated with the filter, wherein the feature includes encoded data regarding the brewing packet.

2. The packet of claim 1, wherein the machine-interpretable feature is located on the filter.

3. The packet of claim 1, wherein the filter defines an annular flange, the machine-interpretable feature being located on the annular flange.

4. The packet of claim 1, wherein the filter includes a first filter portion, a second filter portion, and a gasket which seals the first filter portion to the second filter portion.

5. The packet of claim 1, wherein the machine-interpretable feature is optically detectable.

6. The packet of claim 5, wherein the machine-interpretable feature includes one or more of a color, a shape, a glyph, a text string, a barcode, and a digital watermark.

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7. The packet of claim 1, wherein the machine-interpretable feature is electromagnetically detectable.

8. The packet of claim 7, wherein the machine-interpretable feature includes a magnetic data storage medium.

9. The packet of claim 1, wherein the machine-interpretable feature is mechanically detectable.

10. The packet of claim 9, wherein the machine-interpretable feature includes one or more of notches, grooves, holes, bumps, and textures.

11. The packet of claim 1, wherein the encoded data includes at least one predefined brewing directive.

12. The packet of claim 11, wherein the predefined brewing directive is one or more of contact time, contact pattern, fluid quantity, fluid temperature, fluid pressure, or fluid pass-through rate.

13. The packet of claim 1, wherein the encoded data defines at least one characteristic of the brewing ingredient.

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14. The packet of claim 13, wherein the characteristic is one or more of grind, blend, roast, quantity, bed depth, freshness, and expiration date.

15. A beverage producing device comprising:

a fluid path configured to direct fluid through an ingredient enveloping beverage packet into a beverage receptacle;

a sensor configured to detect encoded data stored on the beverage packet; and

a processor configured to interpret the encoded data and to direct production of a beverage according to the encoded data.

16. A method of automatically directing beverage-brewing comprising:

placing a brewing packet encoded with packet-characteristic data into a beverage-brewing device;

reading the packet-characteristic data;

interpreting the packet-characteristic data; and

directing beverage-brewing in accordance with interpreted packet-characteristic data.

17. The method of claim 16, wherein reading the packet-characteristic data includes detecting an optically recognizable feature containing the data.

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18. The method of claim 16, wherein reading the packet-characteristic data includes detecting an electromagnetically recognizable feature containing the data.

19. The method of claim 16, wherein reading the packet-characteristic data includes detecting a mechanically recognizable feature containing the data.

20. The method of claim 16, wherein directing beverage-brewing includes setting at least one predefined brewing directive.

21. The method of claim 16, wherein directing beverage-brewing selectively includes aborting the brewing process.

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22. A multiple beverage coffee-brewing packet comprising:

a first substantially rounded filter portion;

a second substantially rounded filter portion operatively connected to the first substantially rounded filter portion by an orbicular gasket to collectively define a cavity, the first and second substantially rounded filter portions being at least partially constructed of water-permeable material; and

a coffee-brewing ingredient within the cavity, wherein the coffee-brewing ingredient is proportioned to produce multiple servings of drip coffee.

23. The coffee-brewing packet of claim 22, wherein a coffee-brewing operation is directed by a machine interpretable feature associated with the coffee-brewing packet.

24. The coffee-brewing packet of claim 23, wherein the machine interpretable feature is the dimension of the orbicular gasket.

25. The coffee-brewing packet of claim 23, wherein the machine interpretable feature is a barcode located on the coffee-brewing packet.

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FIG. 1

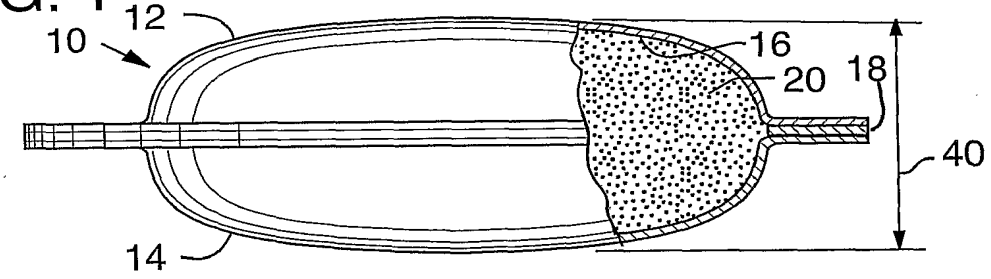


FIG. 2

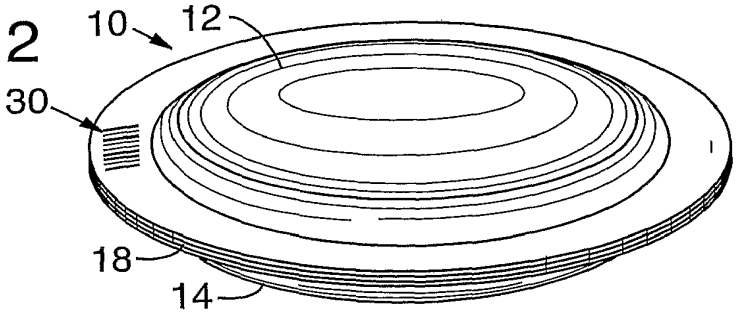


FIG. 2a

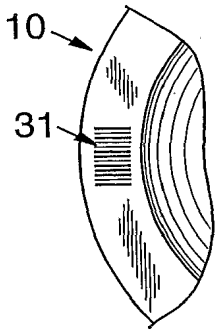


FIG. 2b

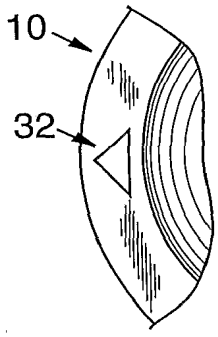


FIG. 2c

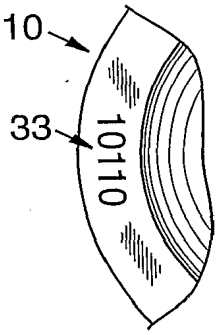


FIG. 2d

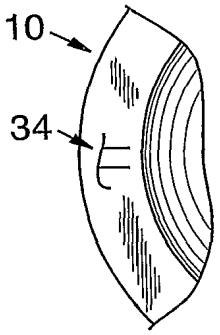


FIG. 2e

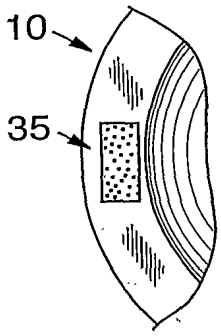


FIG. 2f

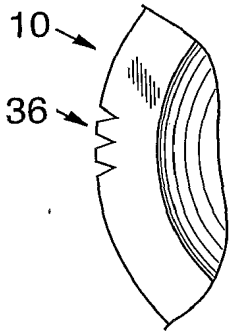


FIG. 2g

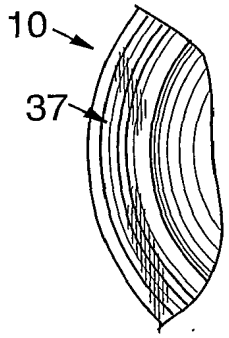


FIG. 2h

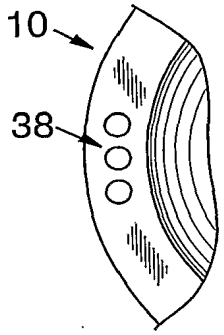
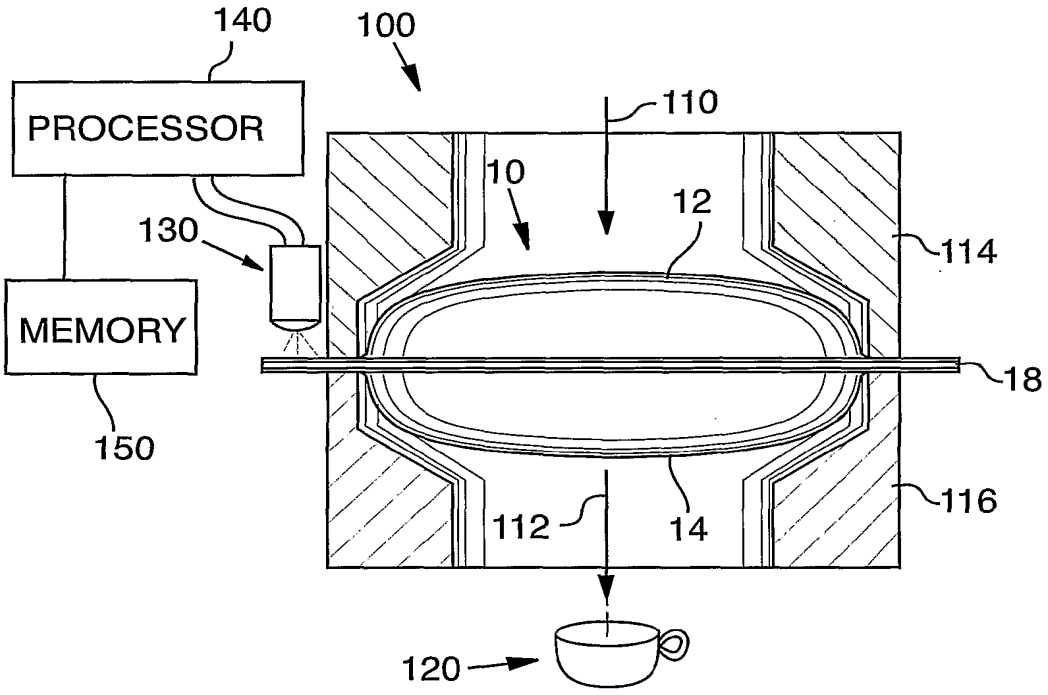


FIG.3



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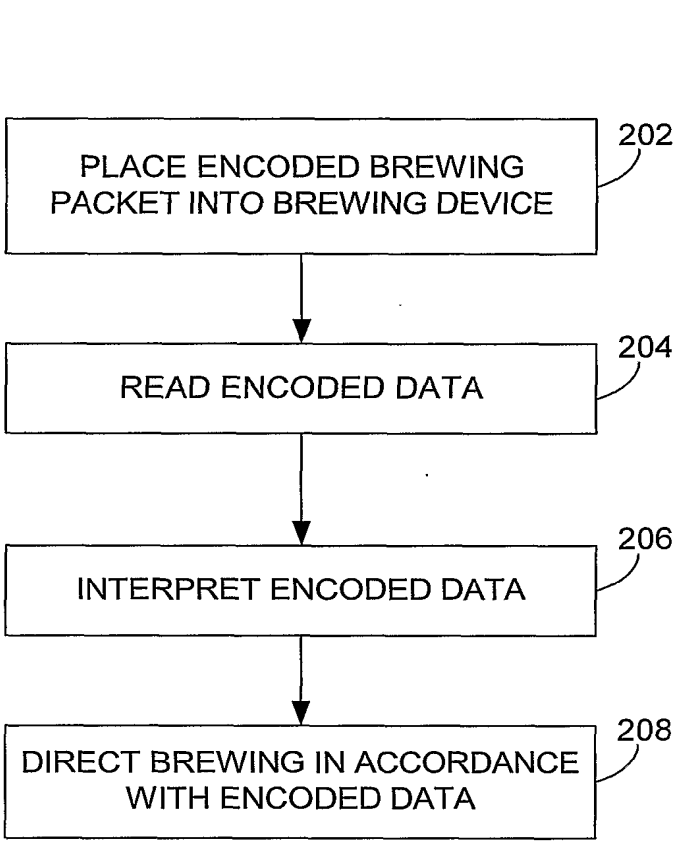

200
PLACE ENCODED BREWING PACKET INTO BREWING DEVICE
202
READ ENCODED DATA
204
INTERPRET ENCODED DATA
206
DIRECT BREWING IN ACCORDANCE WITH ENCODED DATA
208

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/31348

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :A47J 31/00; B65B 29/02
US CL :99/295, 285; 426/78, 81
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)

U.S. : 99/295, 285, 323, 279; 426/78, 81, 79, 82; 210/85

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 5,974,950 A (KING) 02 November 1999, see entire document.	1-6, 11, 13-17, 20, 21 --- 7-10, 18, 19
A	US 5,798,037 A (PEACOCK) 25 August 1998, see entire document.	1

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"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
"A"	document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier document published on or after the international filing date	"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
"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)	"&"	document member of the same patent family
"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		

Date of the actual completion of the international search 04 JANUARY 2002	Date of mailing of the international search report 16 JAN 2002
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer REGINALD L. ALEXANDER Telephone No. (703) 308-0651

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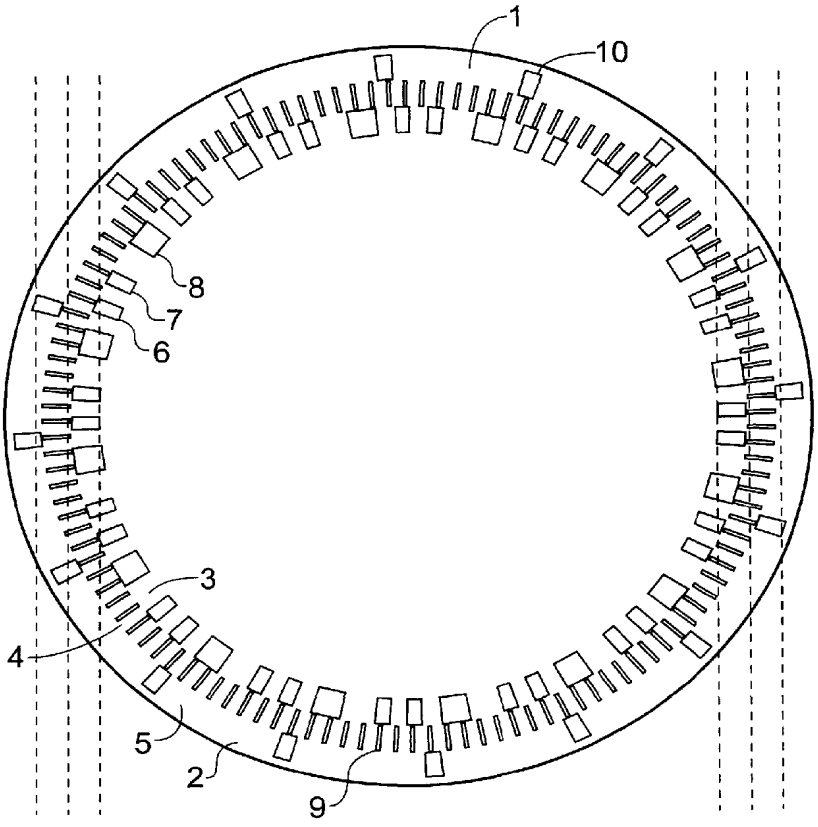
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Published:
— *with international search report*

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.

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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.

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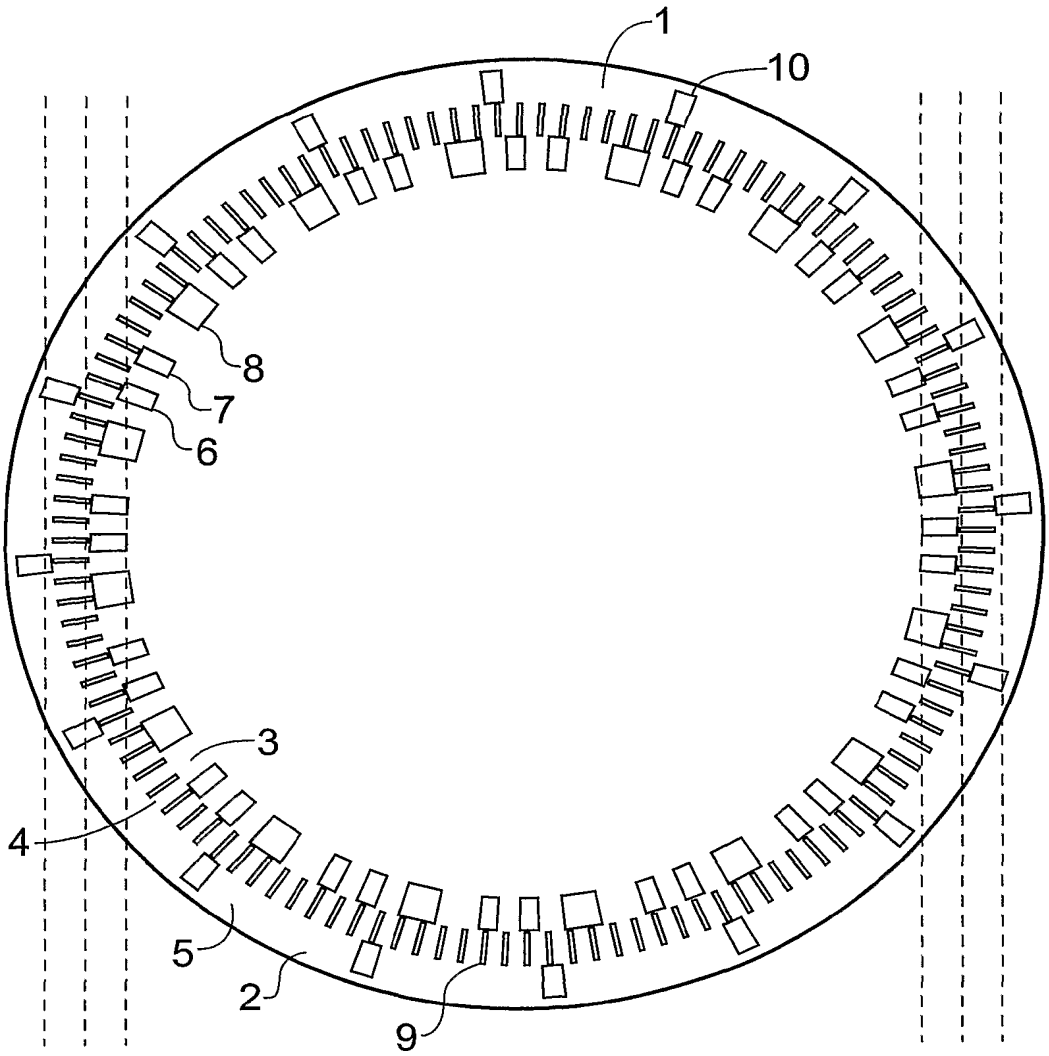


Fig. 1

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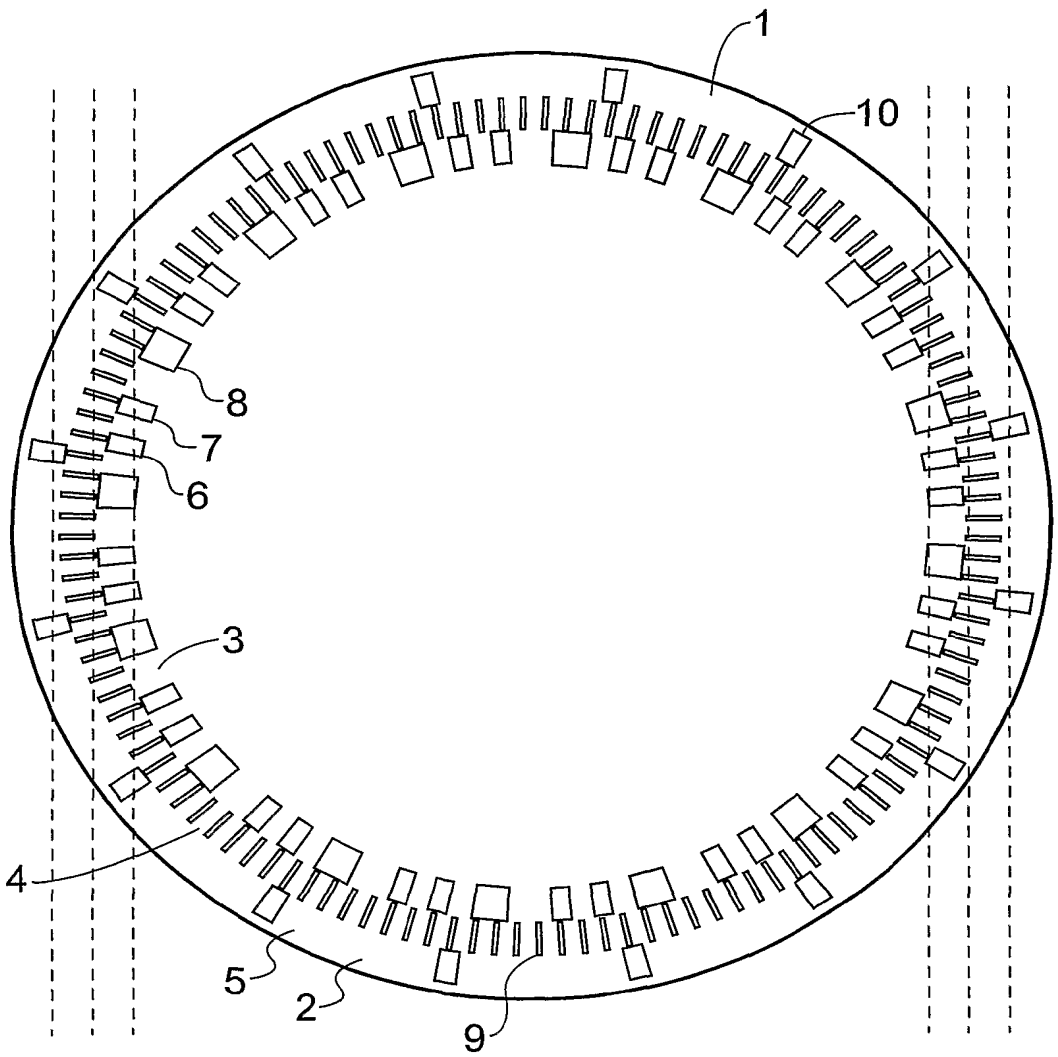


Fig. 2

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IPR2023-00502, U.S. PATENT 10,994,923

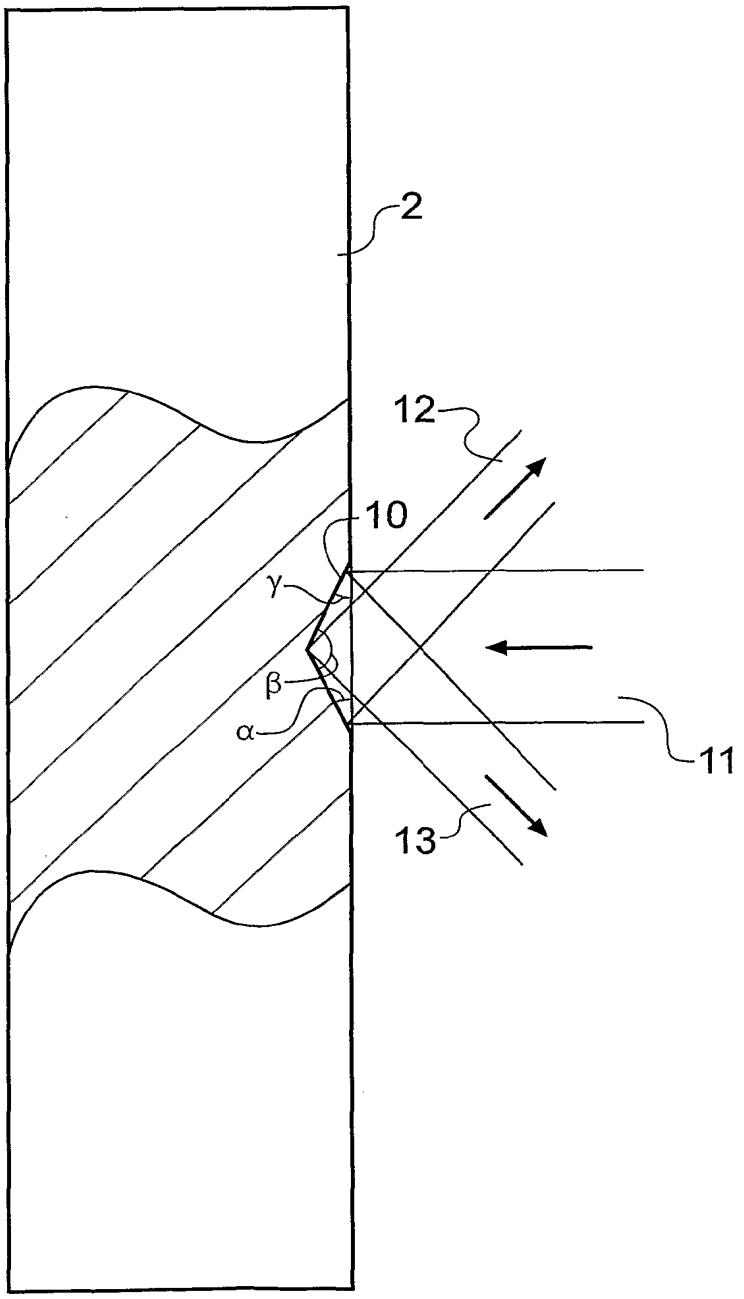


Fig. 3

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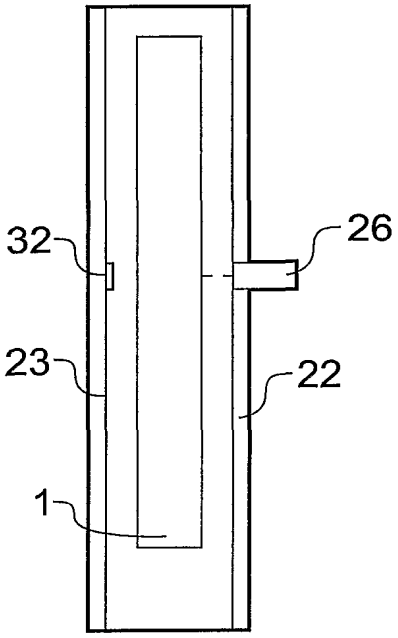


Fig. 4

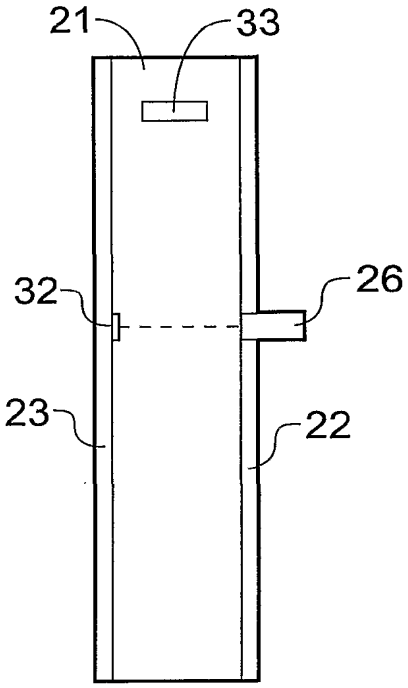


Fig. 5

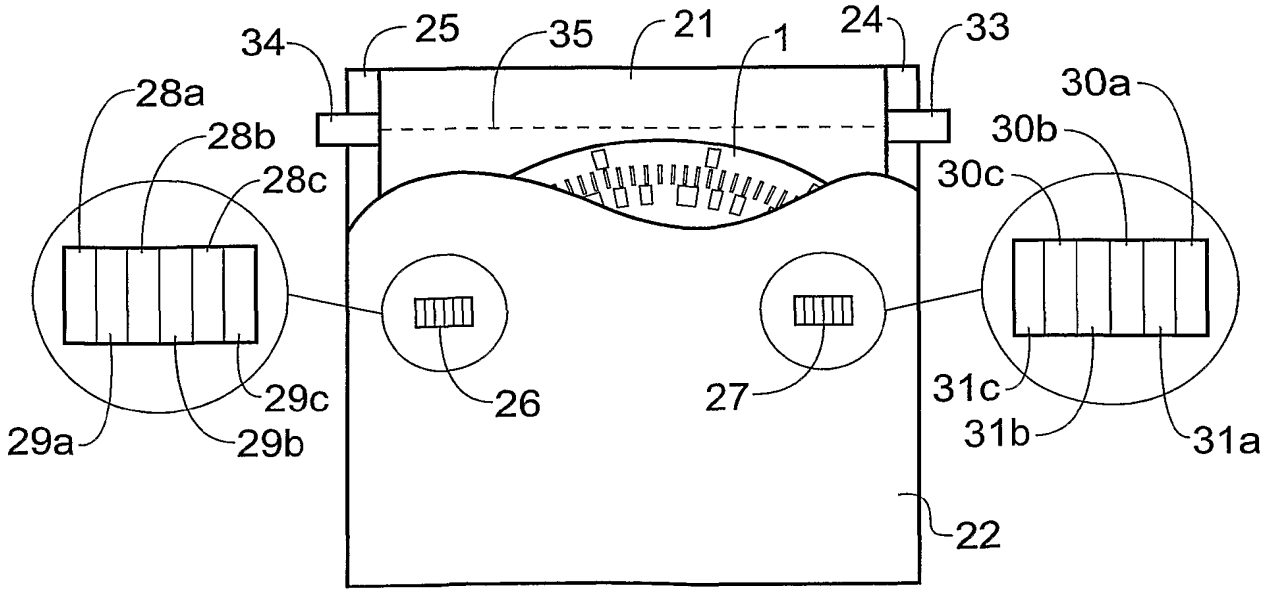


Fig. 6

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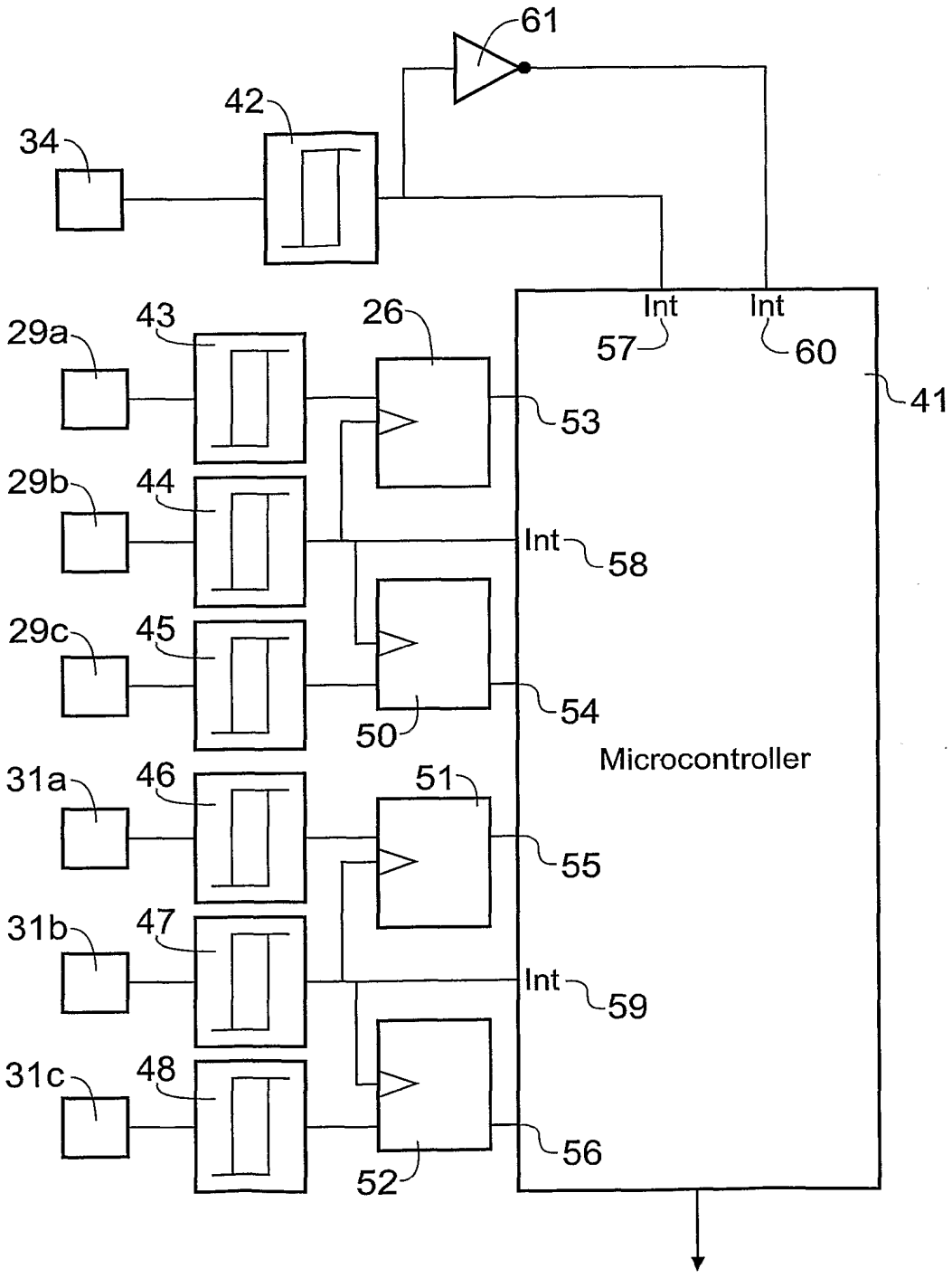


Fig. 7

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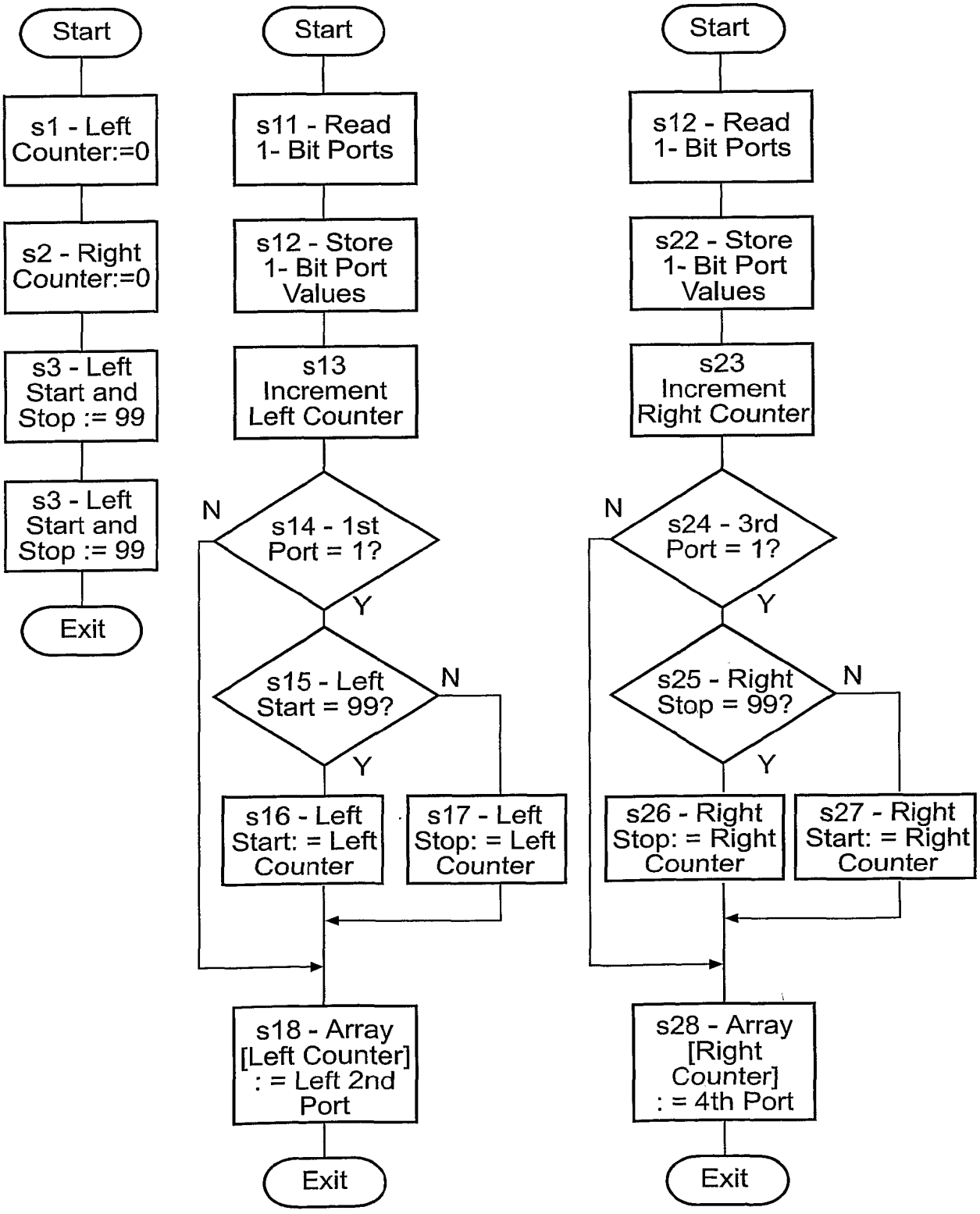
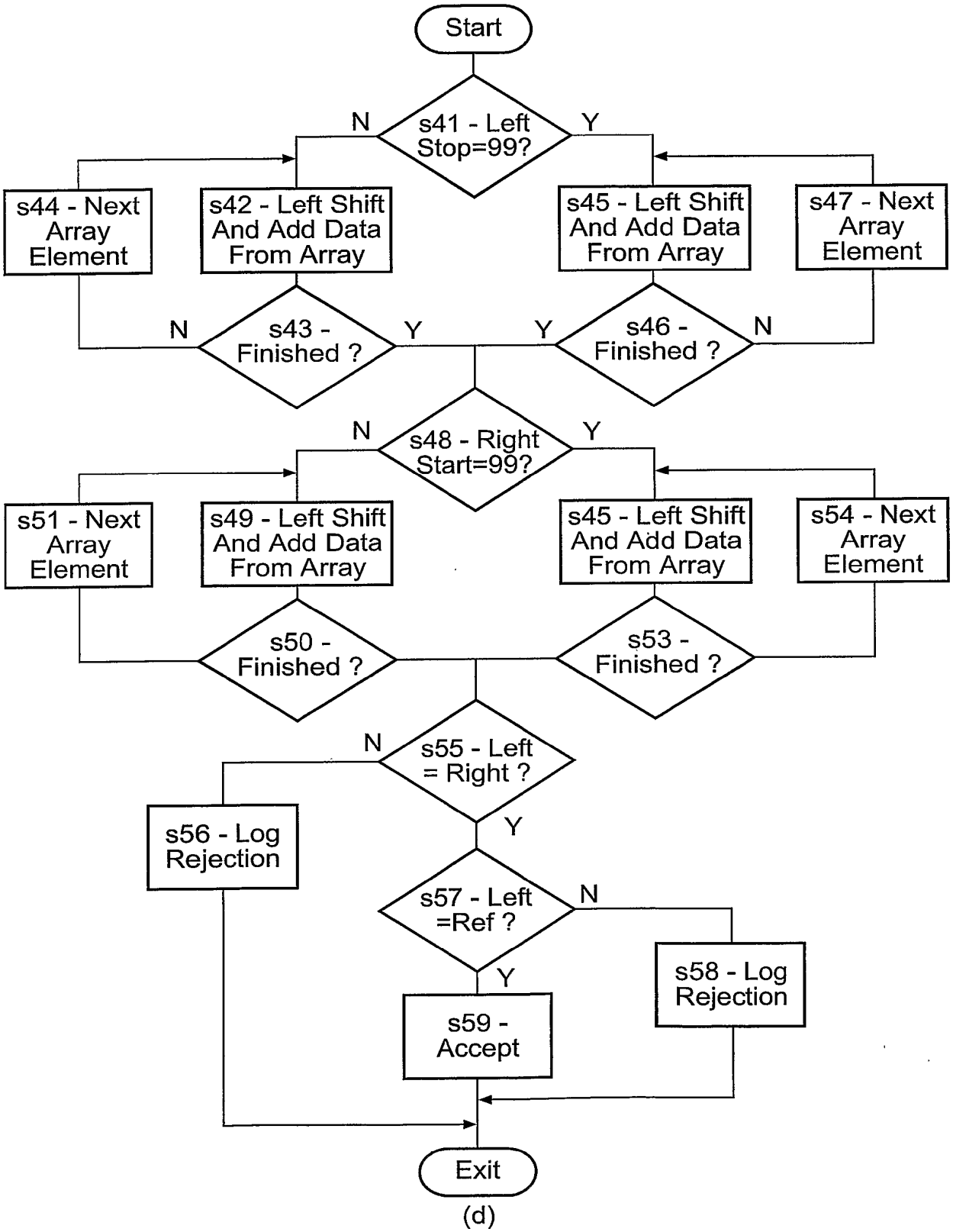


Fig. 8

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(d)

Fig. 8 (continued)

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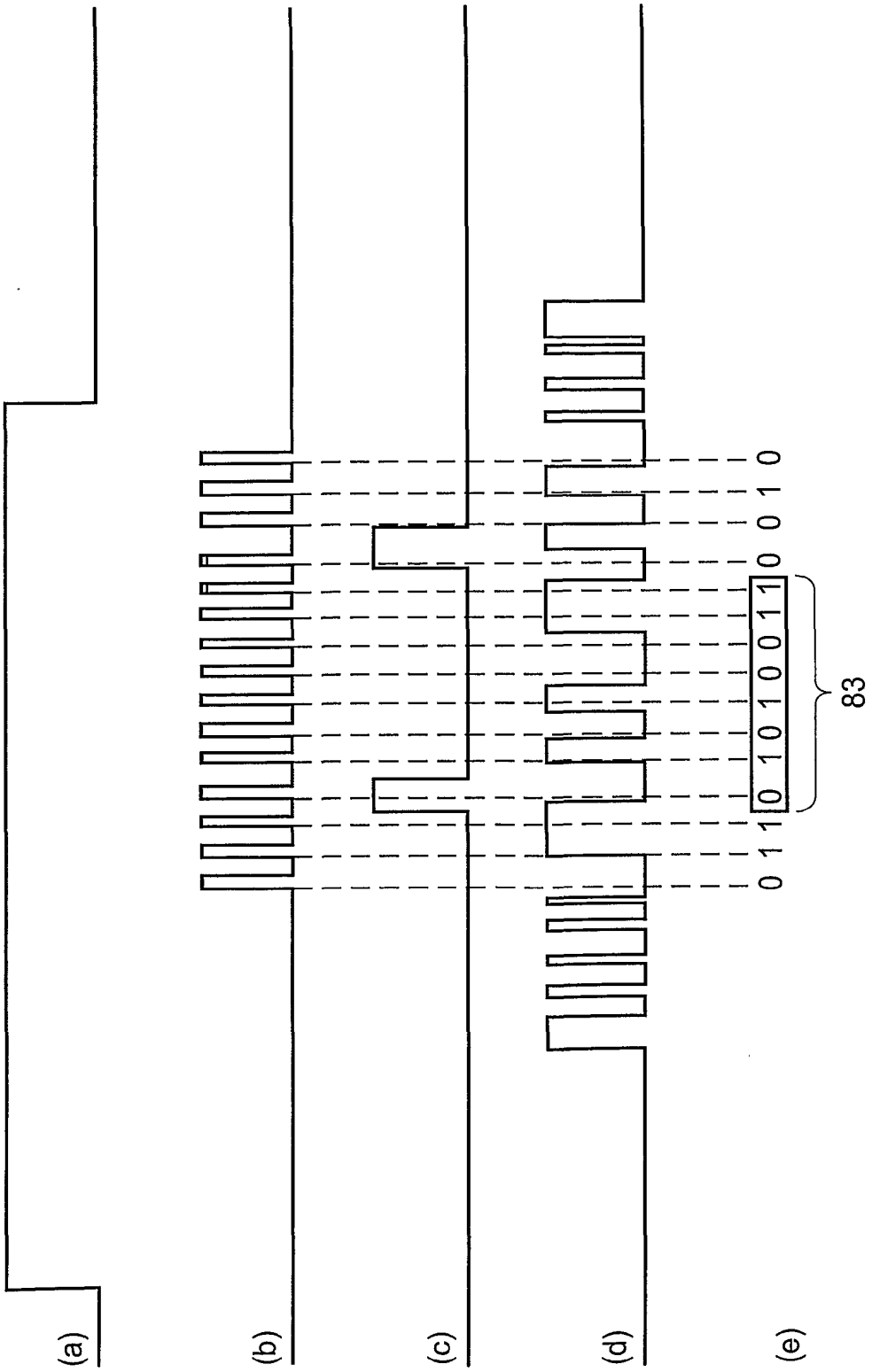


Fig. 9

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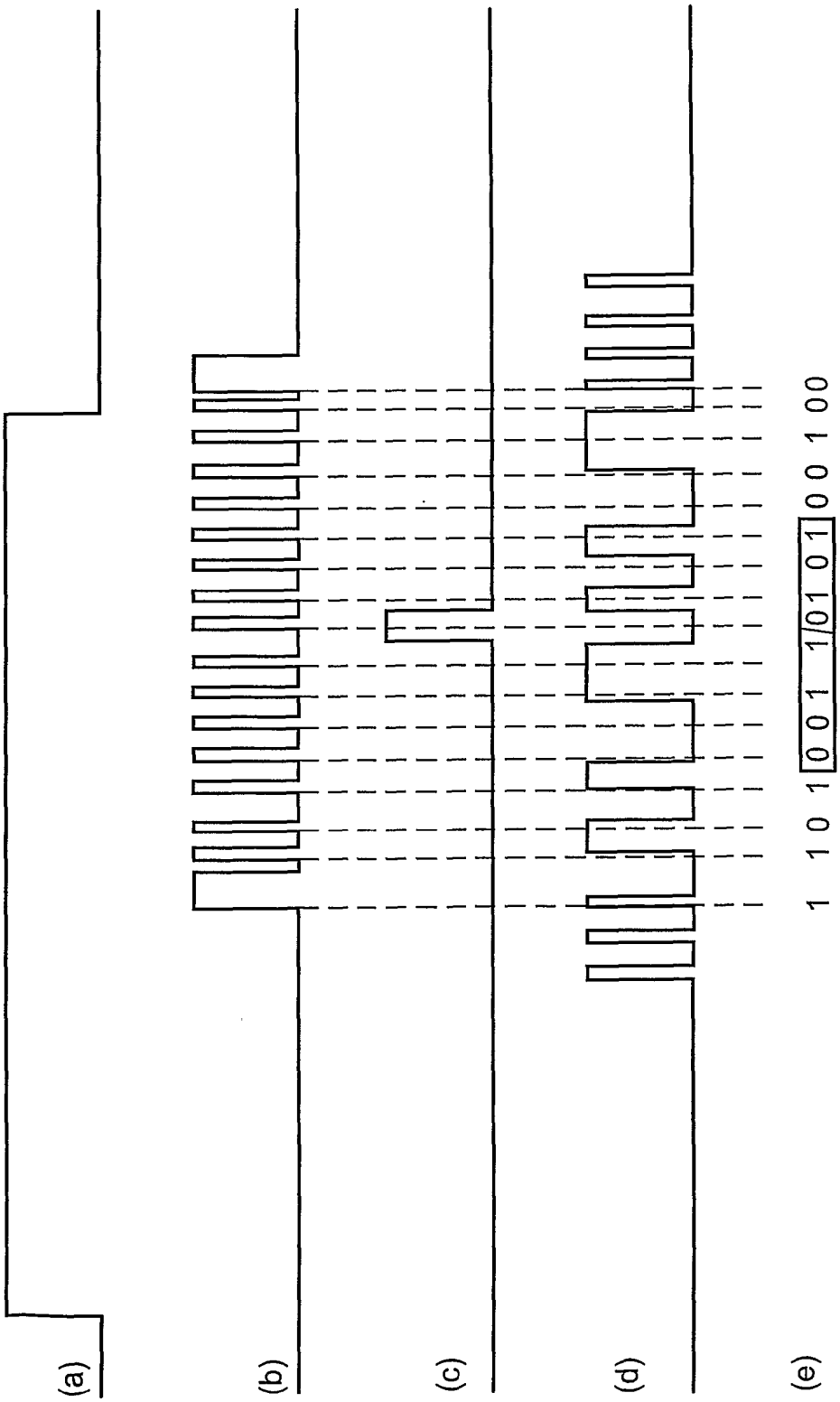


Fig. 10

K-FEE SYSTEM GMBH, EX2009, page 5845
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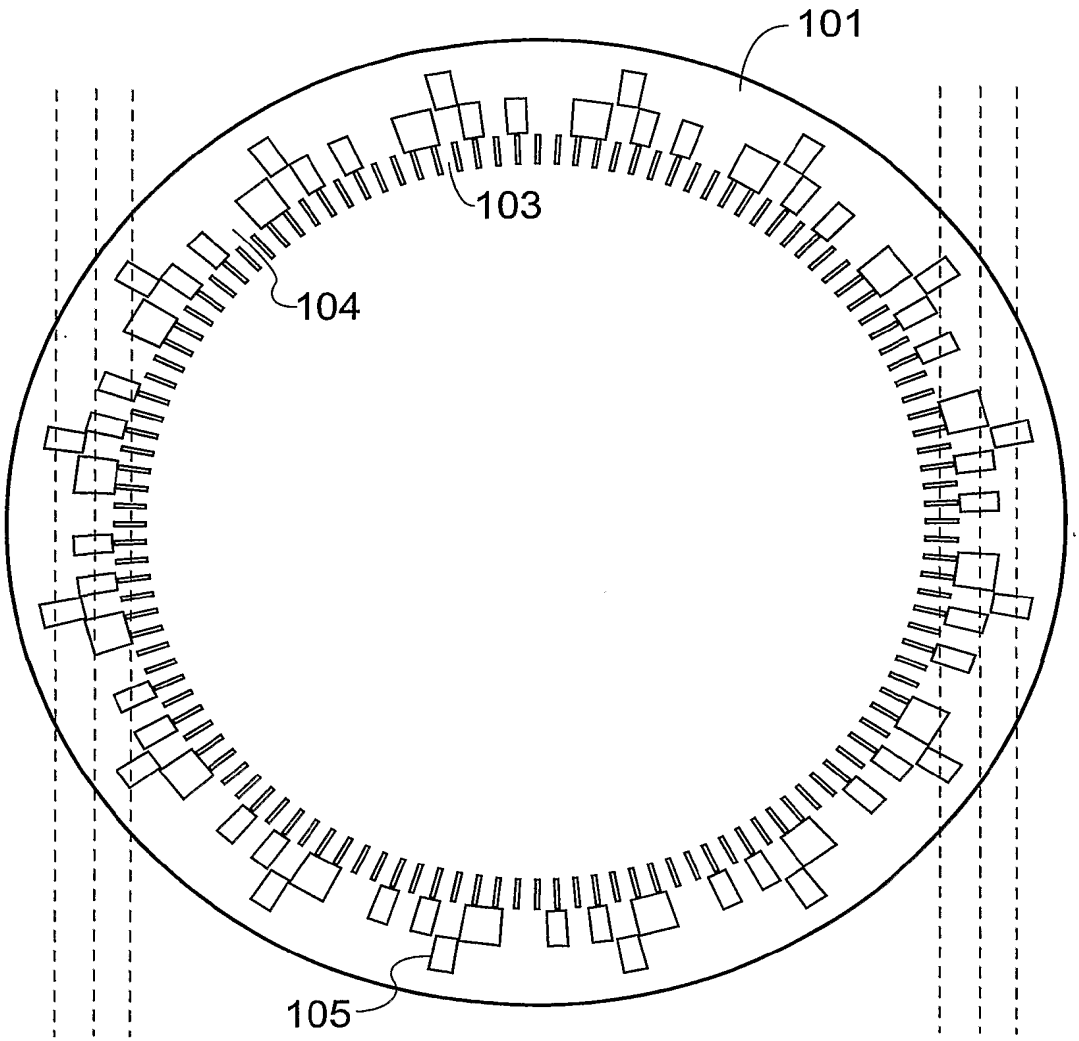


Fig. 11

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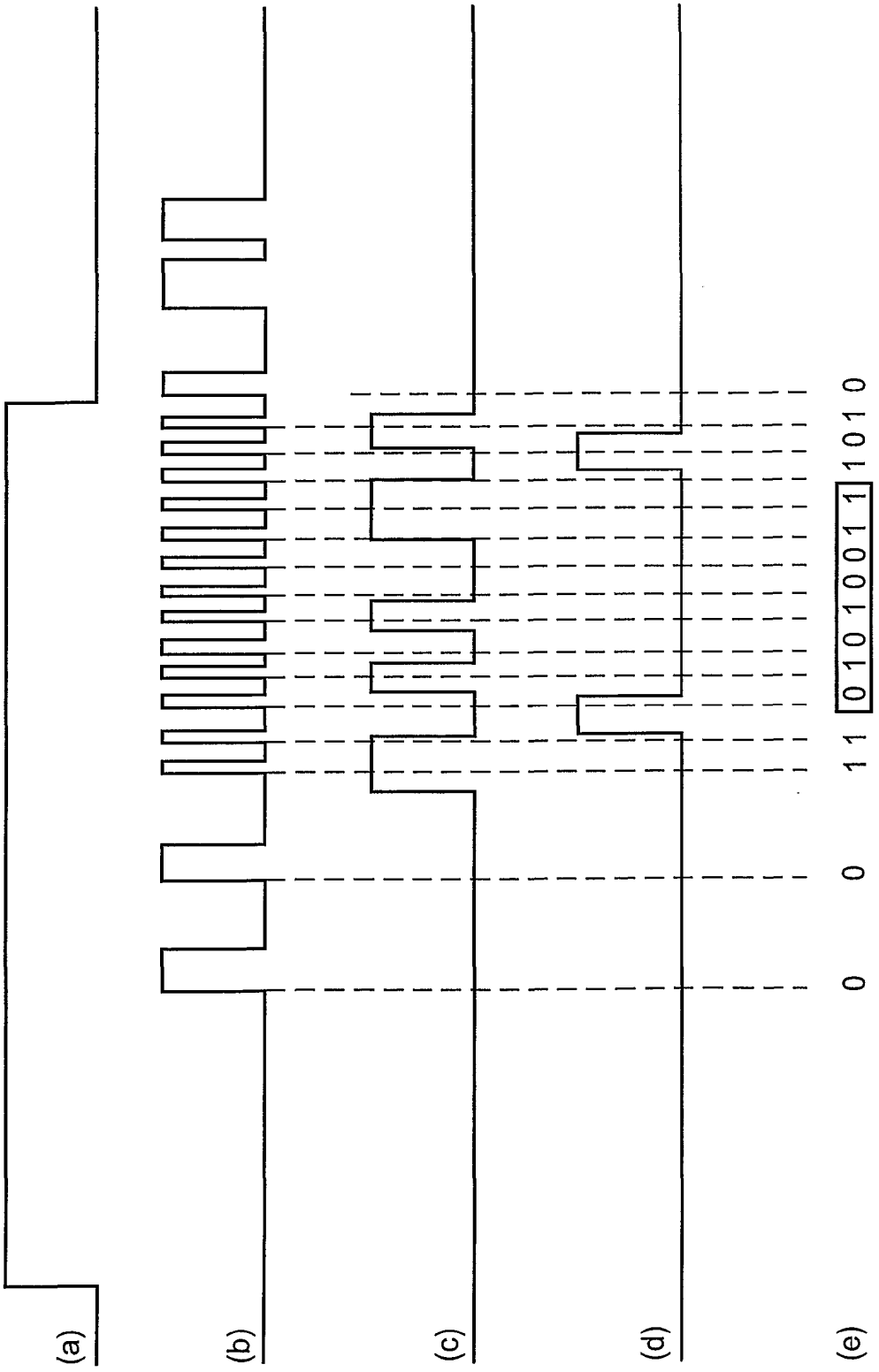


Fig. 12

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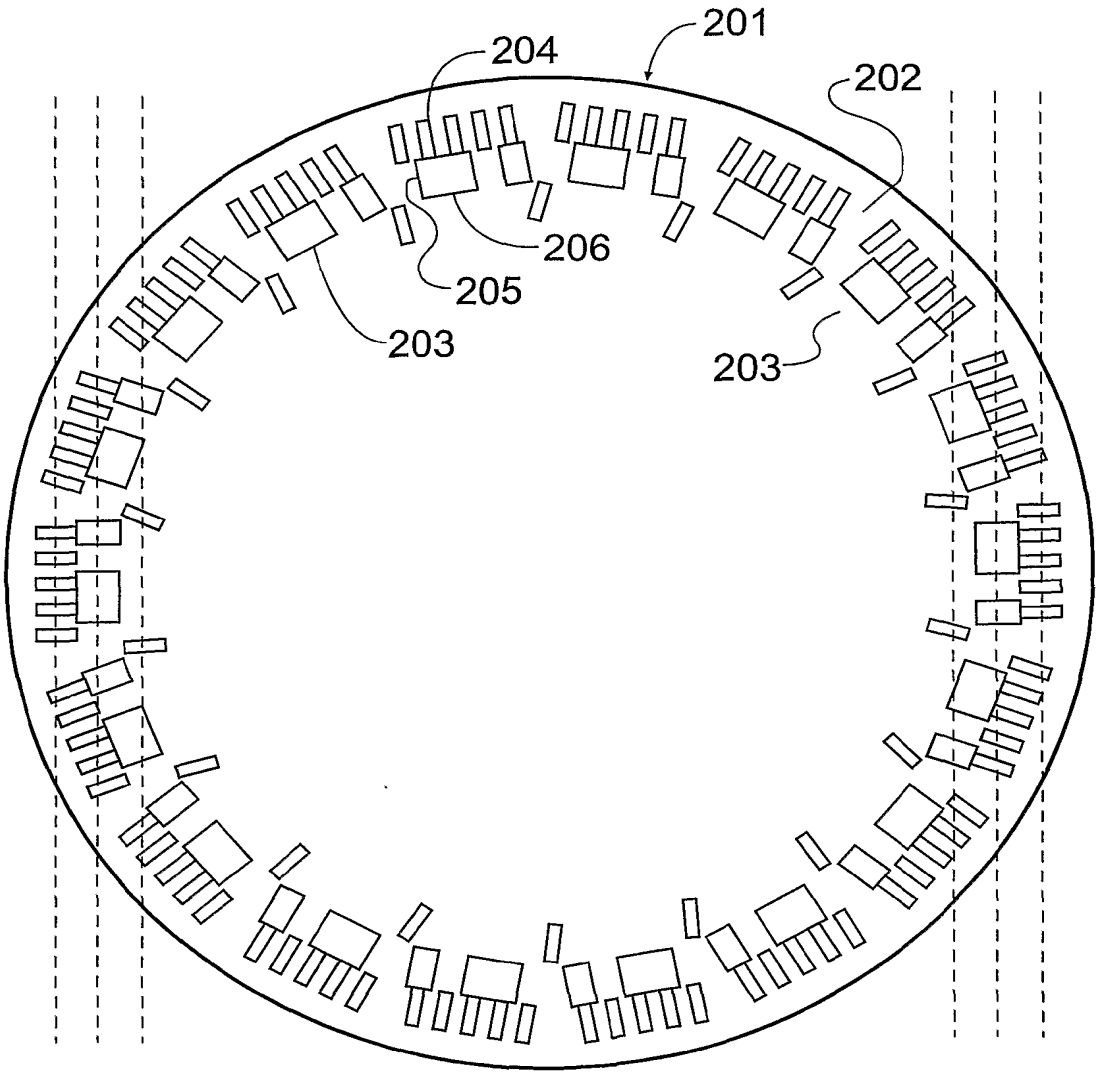


Fig. 13

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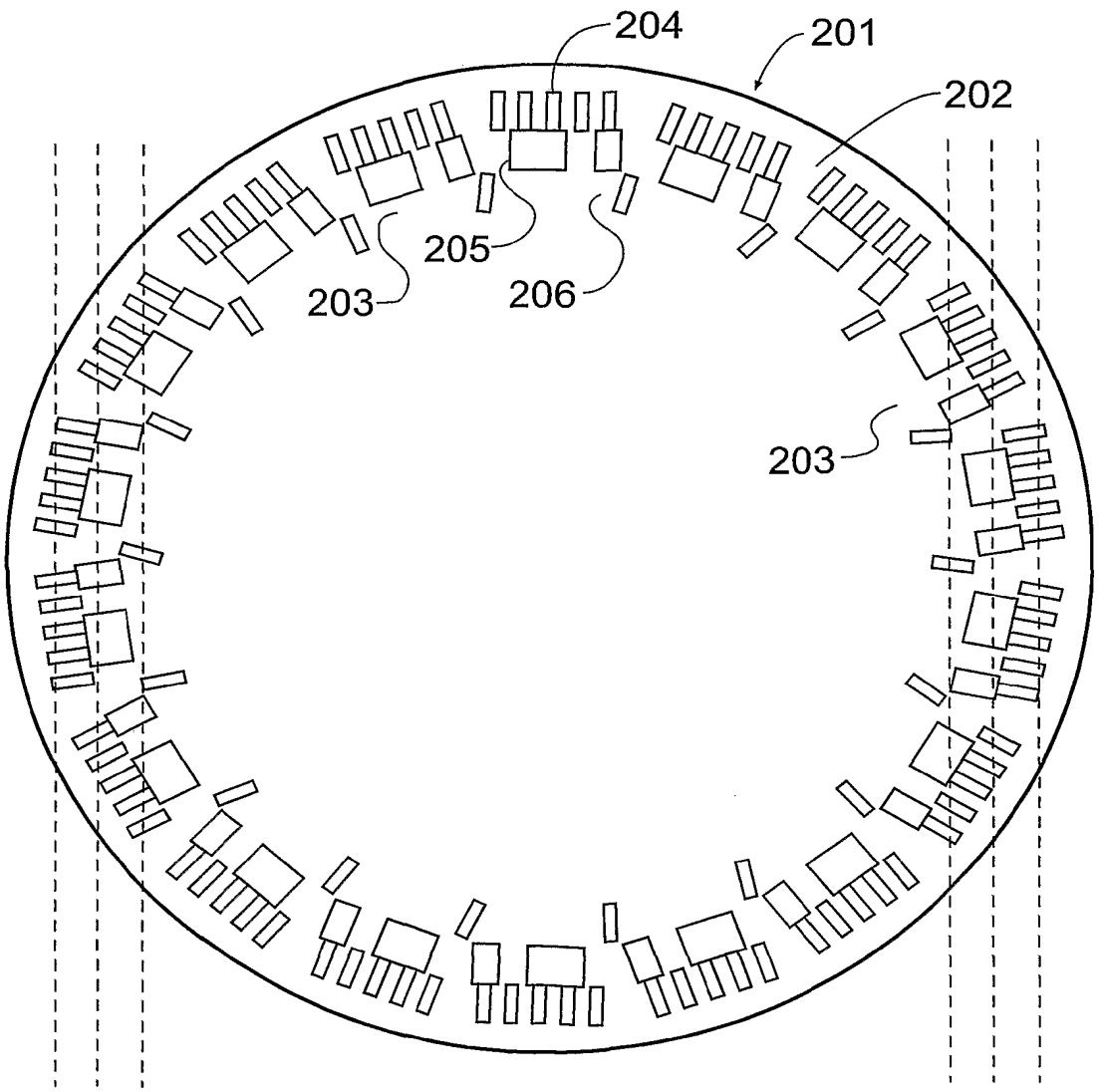


Fig. 14

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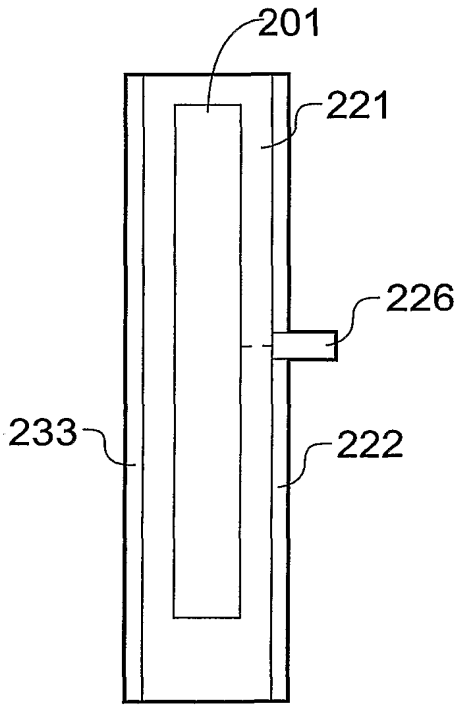


Fig. 15

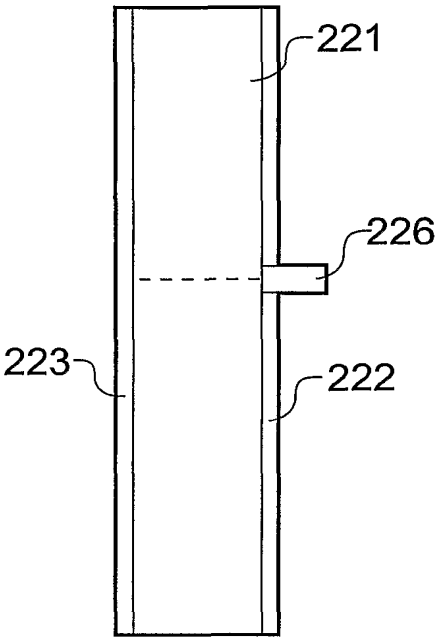


Fig. 16

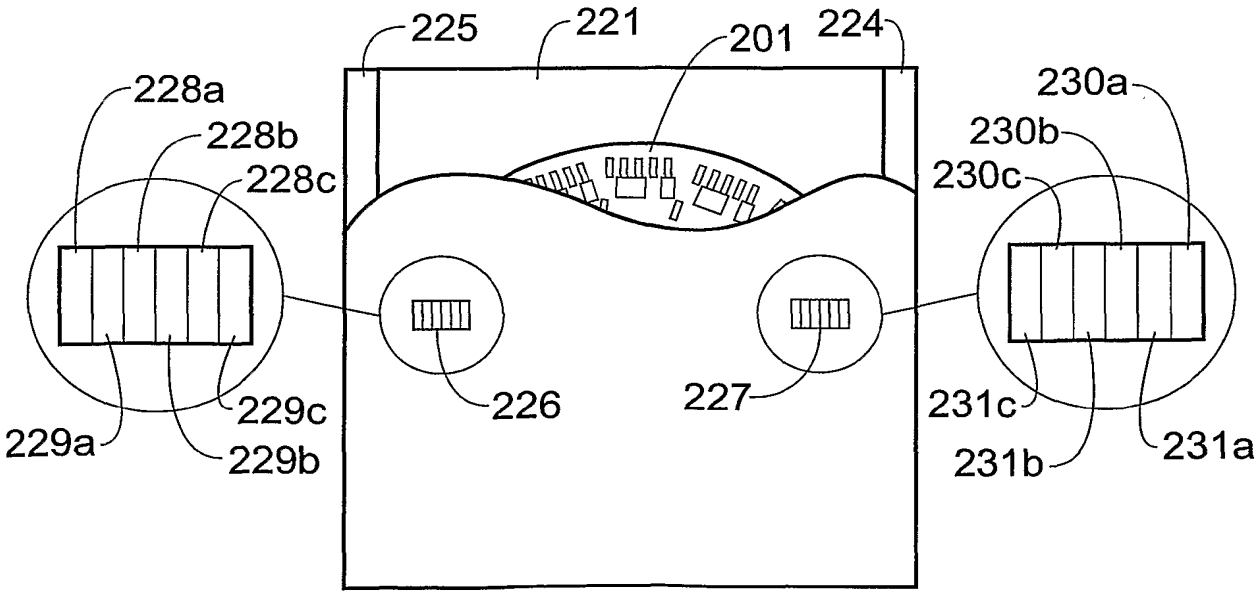


Fig. 17

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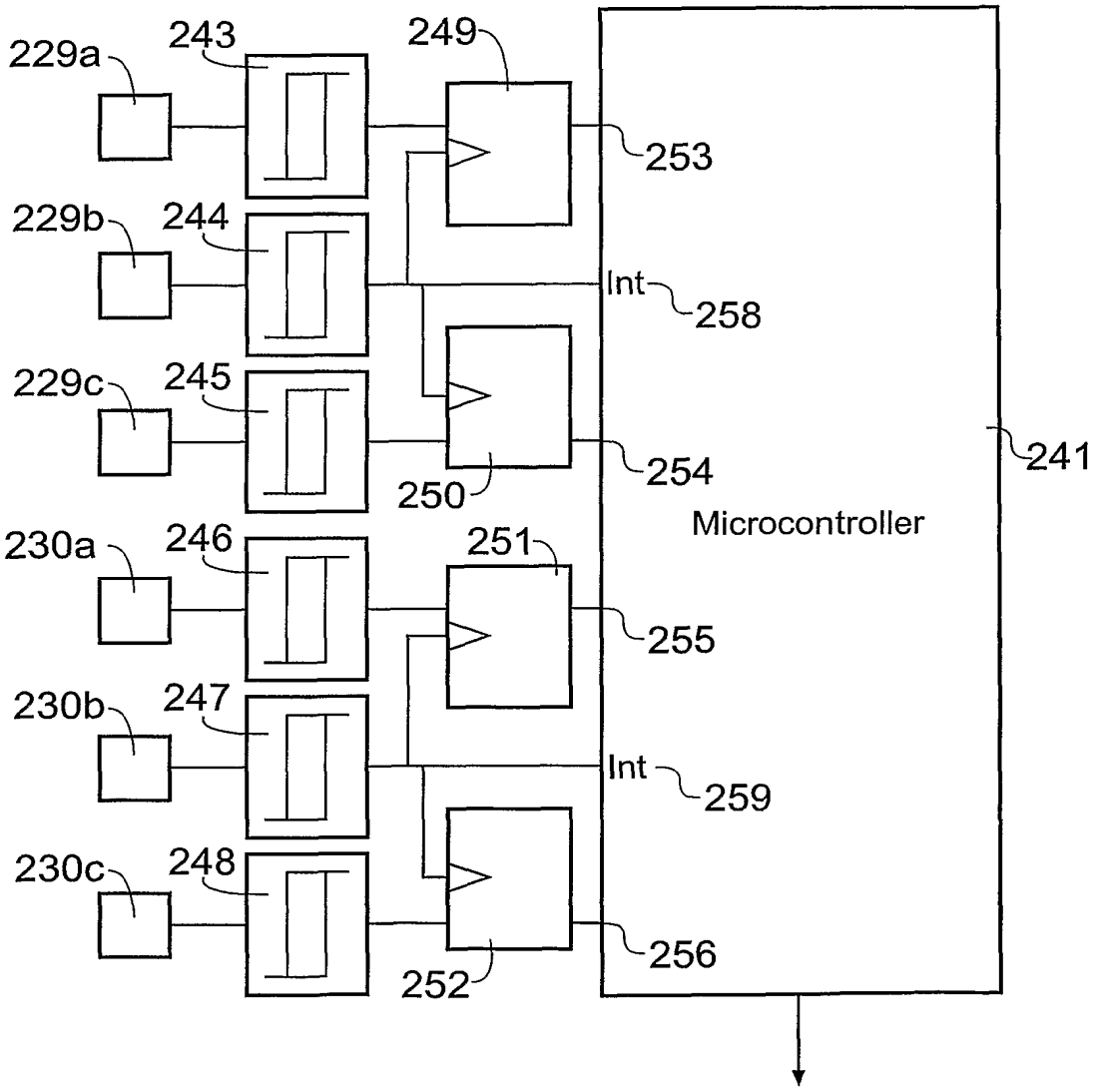


Fig. 18

K-FEE SYSTEM GMBH, EX2009, page 5851
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

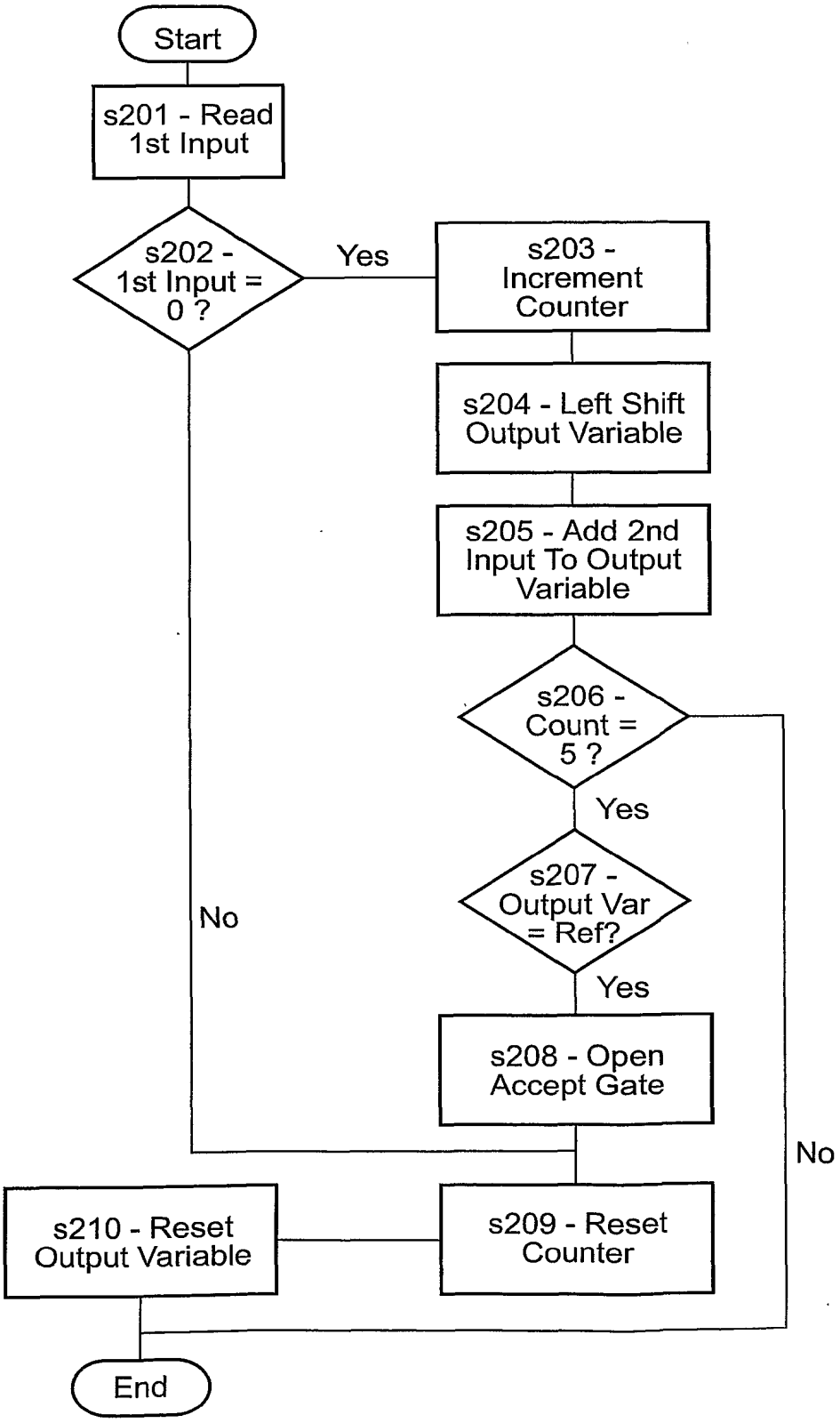


Fig. 19

K-FEE SYSTEM GMBH, EX2009, page 5852
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00502, U.S. PATENT 10,994,923

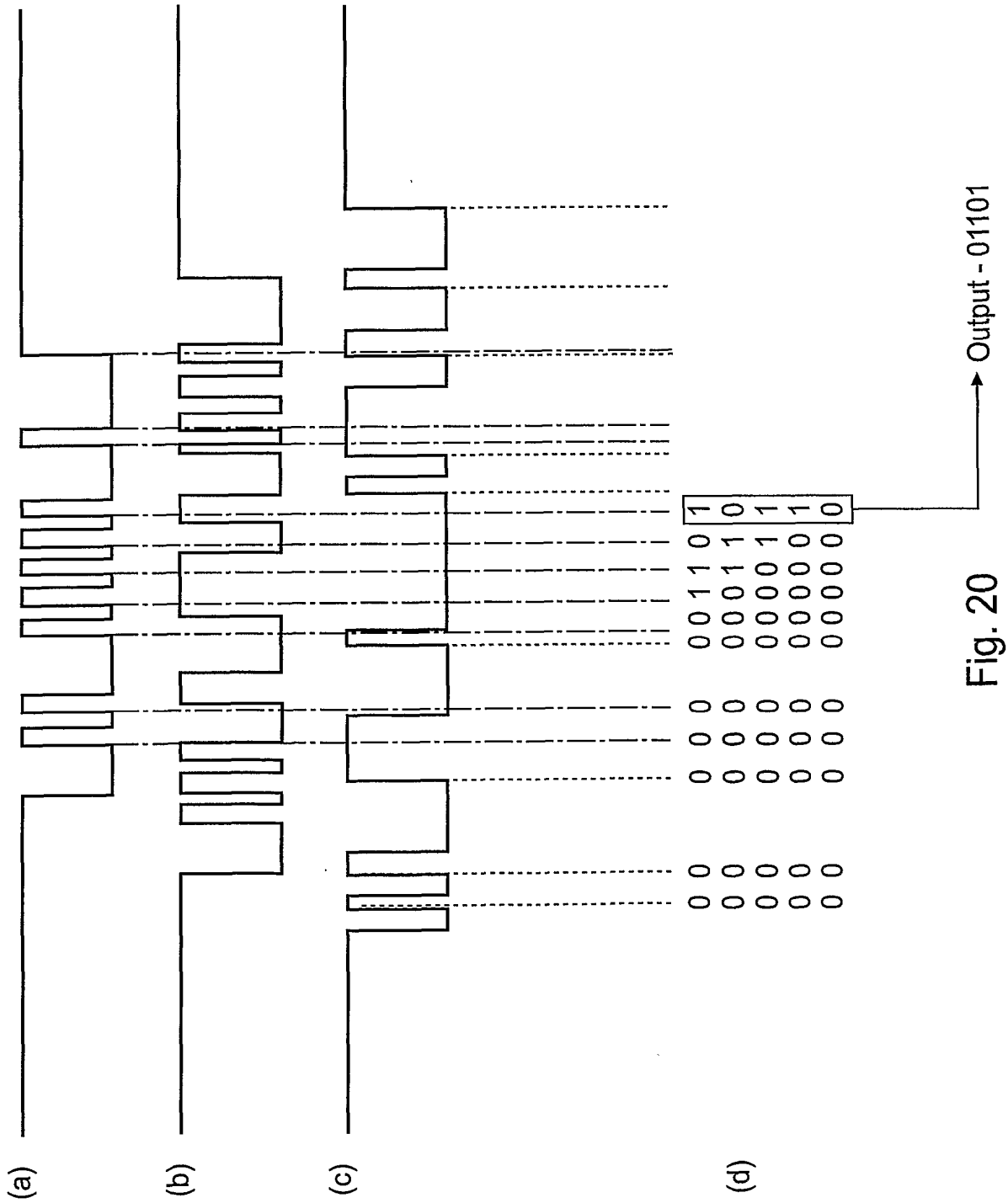


Fig. 20

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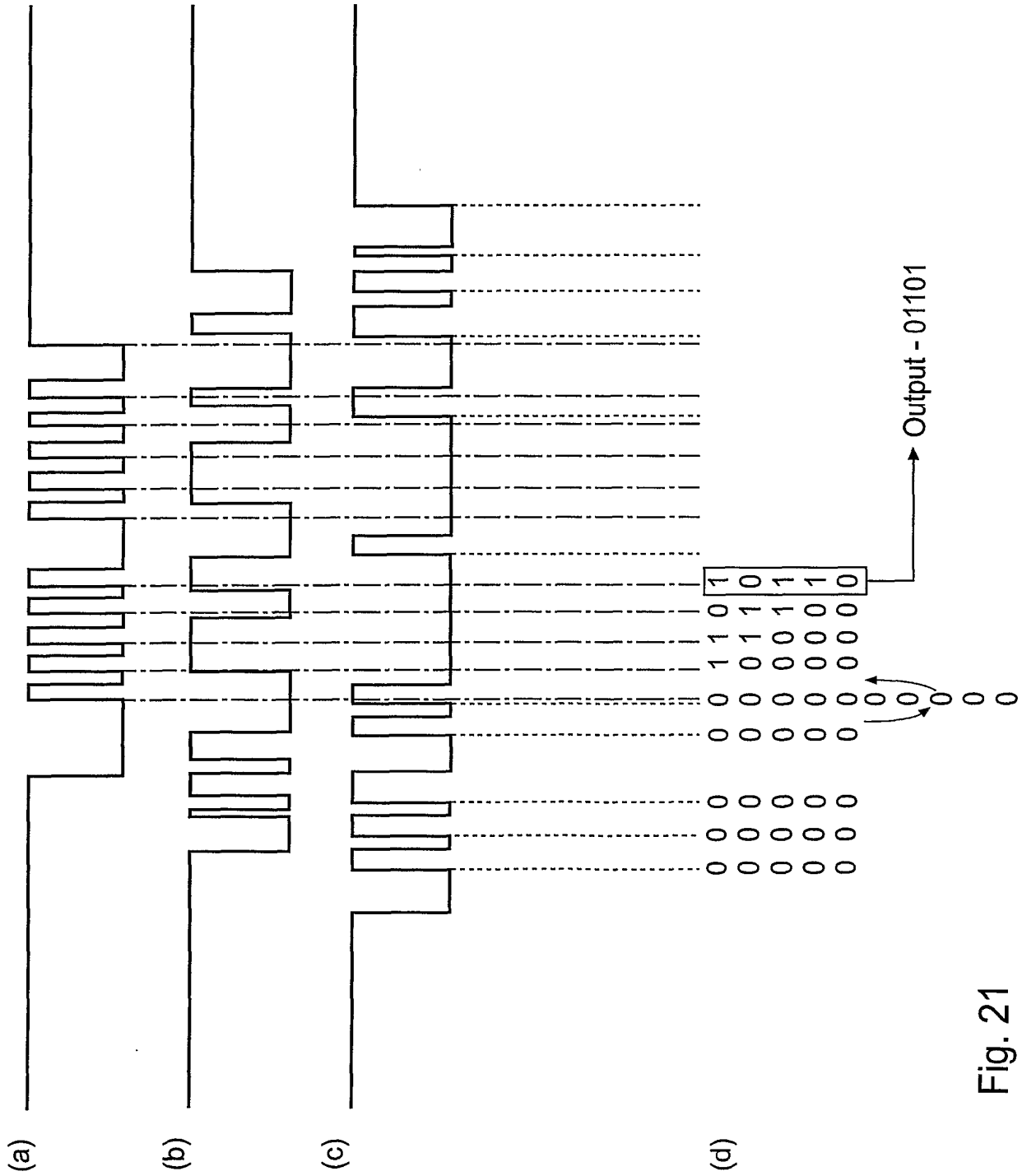


Fig. 21

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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

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

[X] Patent family members are listed in annex.

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

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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

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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

International 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

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

(19) JAPANESE PATENT OFFICE

PATENT ABSTRACTS OF JAPAN

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B65D 81/34

(21) Application number: **2002045303**

(22) Date of filing: **21.02.02**

(71) Applicant: **KASHIWAGI MOLD:KK**

(72) Inventor: **JUSO MITSUAKI**

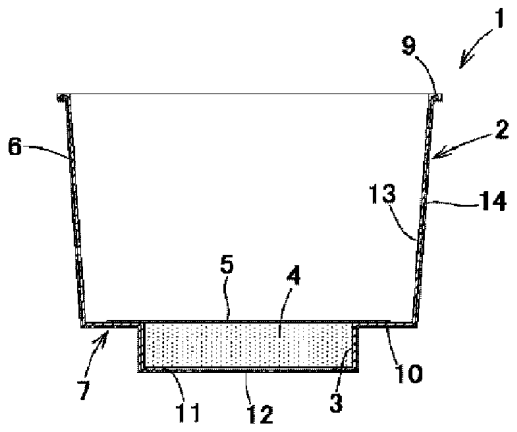
(54) **DRIPPING CARTRIDGE**

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(57) Abstract:

PROBLEM TO BE SOLVED: To provide a dripping cartridge which can be prepared cheaply, is disposable, can reduce its packed volume, can reduce the shipping cost and can improve the portability.

SOLUTION: This dripping cartridge has a cartridge-shaped base material layer 13 which is made of a thermoplastic synthetic resin material and has an extraction hole 11 at the bottom and a nonwoven fabric layer 14 which is made of a thermoplastic synthetic resin material and is laminated wholly on the inside or outside of the base material layer 13 to cover the extraction hole 11 and constitute a filter 12 in the extraction hole 11. This dripping cartridge is prepared by laminating a nonwoven sheet made of a thermoplastic synthetic resin material having a filter function wholly on at least one side of a bored thermoplastic synthetic resin sheet and then subjecting this laminated material sheet to a sheet-forming operation to form it into a cartridge shape having an extraction hole at the bore.



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IPR2023-00502, U.S. PATENT 10,994,923

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報**（Ａ）　(11)特許出願公開番号
特開2003－235733
（P2003－235733A）
(43)公開日　平成15年８月26日(2003.8.26)

(51)Int.Cl.[7]		識別記号	ＦＩ			ﾃｰﾏｺｰﾄﾞ(参考)
Ａ４７Ｊ	31/06		Ａ４７Ｊ	31/06	Ａ	４Ｂ００４
	31/02			31/02		
Ｂ６５Ｄ	81/34	ＢＲＡ	Ｂ６５Ｄ	81/34	ＢＲＡＧ	

審査請求　未請求　請求項の数６　ＯＬ　（全　８　頁）

(21)出願番号　特願2002－45303(P2002－45303)

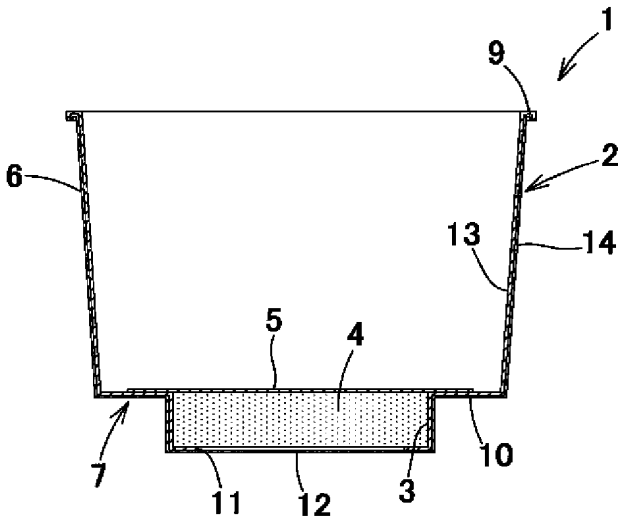
(22)出願日　平成14年２月21日(2002.2.21)

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(74)代理人　100074561
弁理士　柳野　隆生

Ｆターム(参考)　4B004 AA03 BA22

(54)【発明の名称】　ドリップ用カートリッジ

(57)【要約】
【課題】　安価に製作できて使い捨てが可能で、しかも包装形態の減容化を実現して、流通コストの削減と携行時の利便性を向上し得るドリップ用カートリッジを提供する。
【解決手段】　熱可塑性合成樹脂材料からなり、底面に抽出口１１を形成したカートリッジ形状の基材層１３と、抽出口１１を塞ぐように基材層１３の外面或いは内面の全面にわたってラミネートされ、抽出口１１内においてフィルター１２を構成する熱可塑性合成樹脂材料からなる不織布層１４とを備え、予め抜き穴をあけた熱可塑性合成樹脂シートの少なくとも一方の面に、熱可塑性合成樹脂材料からなるフィルター機能を有する不織布シートを全面にわたってラミネートし、このラミネートしてなる材料シートを抜き穴が抽出口になるようにカートリッジ形状にシート成形した。



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【特許請求の範囲】
【請求項１】　熱可塑性合成樹脂材料からなり、底面に抽出口を形成したカートリッジ形状の基材層と、
前記抽出口を塞ぐように基材層の外面或いは内面の全面にわたってラミネートされ、抽出口内においてフィルターを構成する熱可塑性合成樹脂材料からなる不織布層と、
を備えたドリップ用カートリッジ。
【請求項２】　前記カートリッジの底面の中央部に収容部を凹設し、この収容部に焙煎コーヒー粉末を充填し、カートリッジの底面に焙煎コーヒー粉末を収容部内に封止する、通水性を持つ不織布からなる封止シートを貼着した請求項１記載のドリップ用カートリッジ。
【請求項３】　前記カートリッジを柔軟性を有し屈曲可能な熱可塑性合成樹脂シートで構成し、側壁部の上側壁部又は下側壁部を高さ方向の途中部で折り返して反転させ、上側壁部の内側に下側壁部を配置させて全高を低く設定した請求項１又は２記載のドリップ用カートリッジ。
【請求項４】　前記カートリッジの側壁部の高さ方向の途中部に環状段部を形成し、環状段部と反転させる壁部とを円弧面で滑らかに連設させ、環状段部を中心に上側壁部又は下側壁部を折り返して反転させ、上側壁部の内側に下側壁部を配置させて全高を低く設定した請求項１又は２記載のドリップ用カートリッジ。
【請求項５】　反転させる上側壁部又は下側壁部に伸縮方向に延びる縦リブを円周方向に間隔をあけて形成した請求項３又は４記載のドリップ用カートリッジ。
【請求項６】　予め抜き穴をあけた熱可塑性合成樹脂シートの少なくとも一方の面に、熱可塑性合成樹脂材料からなるフィルター機能を有する不織布シートを全面にわたってラミネートし、このラミネートしてなる材料シートを前記抜き穴が抽出口になるようにカートリッジ形状にシート成形するドリップ用カートリッジの製造方法。

【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、使い捨て可能な簡易コーヒードリップとして好適に利用可能なドリップ用カートリッジ及びその製造方法に関する。
【０００２】
【従来の技術】焙煎コーヒー用のドリップ用フィルターとしては、漏斗状の専用器具に、袋状に作った不織布や紙製のフィルターをセットして用いるものが広く普及している。また、焙煎コーヒー粉末を不織布製容器に封入してなるカートリッジを専用の器具の底面に装着して使用するものや、耐水紙の本体部とフィルターを組み合わせた使い捨ての一体型カートリッジ等が上市されている。これらのうち専用器具を用いるものは、フィルターやカートリッジは使い捨てであるが、専用器具は使用するたびに洗わねばならず、また、専用器具がかさばることもあり、特にアウトドア等の使用には利便性に欠ける点があった。また耐水紙のカートリッジについては構造が複雑で加工工数が多いため、製造コストが高くつくという問題があった。
【０００３】
【発明が解決しようとする課題】一般には、本体部とフィルター部とを一体化させてなる一体型のドリップ用フィルターを作る場合には、底面に抽出口を形成したカップ状の本体部を製作し、この本体部の底面に抽出口を塞ぐようにフィルターとして作用する不織布や濾紙を接着して製作する方法が採用されている。また、焙煎コーヒーを封入したカートリッジにおいても、焙煎コーヒー粉末を入れた、フィルター機能を果たす不織布容器と、お湯を溜めてフィルターに流す本体部とは、前述したように着脱可能な別部材で構成したり、後加工で両者を接着していることが多い。
【０００４】本出願人は、このことがドリップ用カートリッジやフィルターのコストダウンや利便性向上を阻害する要因のひとつであると考え、お湯を溜める本体部と抽出を行うフィルター部分とを一体に成形することにより、利便性及び生産性が高く、安価に製作可能な使い捨てタイプの焙煎コーヒー用のドリップフィルター付きカートリッジを提供できると考えた。
【０００５】また、従来のドリップ用カートリッジにおいては、利便性を高めるため１回分ずつピロー包装等の個包装にすると、１回分の抽出容量のお湯を溜める本体部の占める容量が大きくてかさばり、輸送並びに保管の効率が著しく悪くなるという問題があった。
【０００６】本発明の目的は、安価に製作できて使い捨てが可能で、しかも包装形態の減容化を実現して、流通コストの削減と携行時の利便性を向上し得るドリップ用カートリッジを提供することである。
【０００７】
【課題を解決するための手段及びその作用】本発明に係るドリップ用カートリッジは、熱可塑性合成樹脂材料からなり、底面に抽出口を形成したカートリッジ形状の基材層と、前記抽出口を塞ぐように基材層の外面或いは内面の全面にわたってラミネートされ、抽出口内においてフィルターを構成する熱可塑性合成樹脂材料からなる不織布層とを備えたものである。
【０００８】このカートリッジは、請求項６記載のような製造方法により製作できる。即ち、予め抜き穴をあけた熱可塑性合成樹脂シートの少なくとも一方の面に、熱可塑性合成樹脂材料からなるフィルター機能を有する不織布シートを全面にわたってラミネートし、このラミネートしてなる材料シートを前記抜き穴が抽出口になるようにカートリッジ形状にシート成形することにより製作できる。
【０００９】より具体的には、このカートリッジは、マッチモールド型による熱プレス成形で製造することが可

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能で、ポリプロピレン、ポリエステル等の熱可塑性合成樹脂シートに、成形装置の金型配置に対応させて、ドリップ用カートリッジに成形したときに抽出口として機能する抜き穴を１個または複数個設け、その抜き穴を覆う様に、熱可塑性合成樹脂材料からなる、フィルター機能を持つ不織布シートをラミネートしたものを材料シートとし、成形したときに、前記抜き穴がドリップ用カートリッジの底面に形成される抽出口となるよう、前記抜き穴の位置を検出しつつ、フィルター部と本体部とを同時に、一体に成形加工して製作できる。したがって、このカートリッジにおいては、材料シートを製作する段階で、熱可塑性合成樹脂シートに抜き穴を設け、フィルターの役目を果たす不織布シートをラミネートしておいて一体的にシート成形することにより、別工程で抽出口の抜き加工やフィルターの接着を行う必要が無く、安価に効率良くドリップ用カートリッジ容器を製作することが可能となる。

【００１０】ここで、前記カートリッジの底面の中央部に収容部を凹設し、この収容部に焙煎コーヒー粉末を充填し、カートリッジの底面に、その焙煎コーヒー粉末を収容部内に封止する、通水性を持つ不織布からなる封止シートを貼着してもよい。このように構成することで、焙煎コーヒー入りのドリップ用カートリッジを容易に且つ安価に製作できる。また、このカートリッジにおいては、抽出口の穴を抜いたり、下側のフィルターを接着する等の後加工の必要が無いため、一般の成形機付き自動充填ラインで、最終製品までの一貫加工が可能となる。

【００１１】前記カートリッジを柔軟性を有し屈曲可能な熱可塑性合成樹脂シートで構成し、側壁部の上側壁部又は下側壁部を高さ方向の途中部で折り返して反転させ、上側壁部の内側に下側壁部を配置させて全高を低く設定してもよい。この場合には、収納時等においてカートリッジを折り畳んで側壁部の高さを約半分にし、取り扱い時の減容化を図ることができ、使用時には折り返して反転させた上側壁部又は下側壁部を元の形状に引き延ばして容易に使用できる。また、一回分ずつピロー包装等の個包装を行っても、容積を小さくできるため輸送コストの削減が可能となる。

【００１２】前記カートリッジの側壁部の高さ方向の途中部に環状段部を形成し、環状段部と反転させる壁部とを円弧面で滑らかに連設させ、環状段部を中心に上側壁部又は下側壁部を折り返して反転させ、上側壁部の内側に下側壁部を配置させて全高を低く設定してもよい。このような環状段部を形成すると、環状段部を中心に比較的容易に側壁面を折り返すことが可能となり、折り返したときの外周の歪も小さくできる。また、折り返し部の位置が安定し、同じ高さで折り返すことが可能となる。

【００１３】反転させる上側壁部又は下側壁部に伸縮方向に延びる縦リブを円周方向に間隔をあけて形成してもよい。即ち、反転させる壁部においては、成形時に円周の短い内径側が、反転により円周の大きい外径側に配置されるため、該壁部には反転によりシワが発生し易いが、この発明では、反転させる壁部に伸縮方向に延びる縦リブを設けることで、反転させる壁部に対してその周方向に対して若干の伸縮性を付与させて、反転時に発生するシワを吸収して、壁部を反転させた状態でのカートリッジの外観を向上できる。また、使用時にはより容易に、反転した壁面を元へ戻すことが可能となる。尚、反転させる壁部を円周方向に沿って半径方向に振幅する波形状に形成しても同様の作用が得られる。

【００１４】本発明に係るドリップ用カートリッジの製造方法は、予め抜き穴をあけた熱可塑性合成樹脂シートの少なくとも一方の面に、熱可塑性合成樹脂材料からなるフィルター機能を有する不織布シートを全面にわたってラミネートし、このラミネートしてなる材料シートを前記抜き穴が抽出口になるようにカートリッジ形状にシート成形するものである。

【００１５】この製造方法においては、フィルターを一体に成形できるため、別工程で抽出口の穴抜き加工や底面に対するフィルターの接着加工を行う必要がなく、カートリッジの製作コストを低減できる。特に焙煎コーヒーを充填するカートリッジにおいては、一般の成形装置付き自動充填機を使用することにより、一貫して最終製品まで加工することが可能となる。

【００１６】

【発明の実施の形態】以下、本発明の実施例について図面を参照しながら説明する。図１～図３に示すように、ドリップ用カートリッジ１は、カップ状の本体部２と、本体部２の底部に形成した収容部３に充填した焙煎コーヒー粉末４と、本体部２の底面に貼着されて収容部３内に焙煎コーヒー粉末４を封止する封止シート５とを備えている。

【００１７】本体部２について説明すると、本体部２は上側へ行くにしたがって大径となる側壁部６とその底壁部７とを有し、側壁部６の上端部には補強用のフランジ部９が折り返して形成され、底壁部７の外周部にはコーヒーカップ等に上側にカートリッジ１をセットするための略平坦な環状の載置部１０が形成されている。底壁部７の略中央部には収容部３が凹設され、収容部３の底面には抽出口１１が形成され、抽出口１１にはその開口を塞ぐように不織布シートからなるフィルター１２が張設されている。そして、この本体部２の収容部３内に必要量の焙煎コーヒー粉末４を充填し、収容部３の上面開口を塞ぐように不織布からなる封止シート５を載置部１０の上面にヒートシールなどにより接着して、カートリッジ１を製作することになる。尚、抽出口１１は、円形でもよいし多角形でもよい。また、スリット状や扇状や小孔等の複数の孔で構成してもよい。

【００１８】本体部２は、熱可塑性合成樹脂材料からなるカップ状などのカートリッジ形状の基材層１３と、抽

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出口１１を塞ぐように基材層１３の外面の全面にわたってラミネートされ、抽出口１１内においてはフィルター１２を構成する熱可塑性合成樹脂材料からなる不織布層１４との２層構造に構成され、後述するように、基材層１３を構成する合成樹脂シート５０に抽出口１１に対応させて抜き穴５１を形成し、これに不織布層１４を構成する不織布シート５２をラミネートし、このラミネートしてなる材料シート５４をカートリッジ形状に熱プレス成形して製作されている。但し、不織布層１４は、基材層１３の内面の全面にわたってラミネートしてもよい。また、基材層１３に対応する位置において、不織布層１４に飾り穴等を形成してもよい。

【００１９】基材層１３を構成する熱可塑性合成樹脂としては、ポリプロピレンやポリエチレン等のポリオレフィン系合成樹脂材料や、これらの合成樹脂材料に無機系フィラーを配合したもの及び、ポリエステル、ポリカーボネートなどを好適に利用できる。

【００２０】不織布層１４を構成する不織布としては、長繊維スパンボンド不織布等の成形性を有し、基材層１３に対する熱融着性に優れた素材からなる不織布が好適に利用できる。具体的には、ポリアミド系、ポリアクリロニトリル系、ポリエステル系、ポリビニルアルコール系、ポリプロピレン系、ポリ塩化ビニル系、ポリ塩化ビニリデン系などの熱可塑性合成樹脂材料からなる長繊維スパンボンド不織布を採用できる。また、不織布層１４を構成する不織布（不織布シート５２）の目付は、本体部２内に注いだお湯が適度な速度で焙煎コーヒー粉末４を経てコーヒーカップ内へ供給されるような目付に設定することになる。尚、封止シート５も不織布層１４と同様の素材で構成することになる。

【００２１】本体部２は、カップ状以外の任意の形状に形成することが可能である。また、本体部２の容量は、標準的なコーヒーカップの容量よりもやや大きく設定され、本体部２の設定位置までお湯を注ぐことで、１回分のコーヒーを入れることができるようにしても良いし、本体部２の高さを極力低く設定するため、標準的なコーヒーカップの容量よりも小さな容量に設定して、複数回に分けてお湯を注ぐようにしてもよい。

【００２２】このカートリッジ１は、基本的には使い捨てが可能な簡易のカートリッジで、収容部３内にはコーヒーカップ１杯分のコーヒーを入れることができる分量の焙煎コーヒー粉末４が充填されている。但し、複数杯のコーヒーを入れることができる分量の焙煎コーヒー粉末４を充填することも可能である。

【００２３】このカートリッジ１の使用時には、カートリッジ１をコーヒーカップ等の容器上にセットし、本体部２内にお湯を注ぐだけで、注いだお湯が封止シート５を通って焙煎コーヒー粉末４に供給され、抽出されたコーヒーとともにフィルター１２を通って容器内に供給されることになる。

【００２４】尚、本実施例では、収容部３内に焙煎コーヒー粉末４を充填したが、緑茶や烏龍茶や紅茶などの茶葉を充填して、緑茶や烏龍茶や紅茶などを提供できるように構成することも可能である。

【００２５】また、本実施例では、カートリッジ１に焙煎コーヒー粉末４を備えさせたが、焙煎コーヒー粉末４及び封止シート５を省略して、別途に用意した焙煎コーヒー粉末４を本体部２内に入れて、コーヒーを抽出することも可能である。また、この場合には、図４、図５に示すカートリッジ１Ａのように、前記実施例における本体部２の収容部３に代えて、コーヒーカップに対するカートリッジ１の位置決め用の収容部３よりも深さを浅く設定した位置規制部１５を底壁部７の中央部に凹設したり、収容部３を完全に省略して、底壁部７の中央部に直接的に抽出口１１を形成することになる。

【００２６】前記カートリッジ１は、コーヒーの風味を保持するためにガスバリア性を有するバリアフィルム等で包装して市場に提供される。複数個の集合包装にすると、開封して短期間に使い切れない場合、そのままにすると風味が損なわれるため、残ったものの保存は缶やガラス瓶、またはバリアフィルム製の密閉保存袋等を用いる等の配慮が必要になる。包装形態は、このように特別の配慮を必要としない様に、また、アウトドア等に手軽に携行して利用できるように１回分ずつ個包装にすることが好ましい。しかし、カートリッジ１をピロー包装等で１回分ずつ個包装すると、お湯を溜める本体部２がかさばり、流通コストや販売コストが高くつき、携行にも不便で著しく利便性に欠けるものになってしまう。本出願人は前記問題を解決するため、本体部２の側壁部６をその高さ方向の途中部で折り返して反転させ、カートリッジ１の高さを約半分にすることで、包装形態の減容化を試み、次のような方法を発明した。

【００２７】本体部２の側壁部６の上側壁部又は下側壁部を高さ方向の途中部で折り返して反転できるように、基材層１３として、ポリエチレン、ポリプロピレン、及びそれらポリオレフィン系合成樹脂に無機系フィラーを配合したもの等、比較的柔軟で屈曲可能な特性を持つ熱可塑性合成樹脂シートを採用した。

【００２８】そして、図６（ａ）に示すように、カートリッジ１を倒立状にして略円柱状の受け台２０に装着し、カートリッジ１の下半部に適合するリング状の折り返し治具２１を倒立状にセットしたカートリッジ１に上側から被せ、折り返し治具２１でカートリッジ１の載置部１０を押えつつ、カートリッジ１の口縁部を外側に広げるように引き上げてカートリッジ１の上半部を反転させ、図６（ｂ）に示すように、側壁部６が折り返し治具２１の下端に当たるまで側壁部６を折り返して、カートリッジ１の高さを成形時の約半分に構成し、この状態で個包装することで、包装状態での減容化を可能となした。また、このカートリッジ１の使用時には、折り畳ん

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