reflectometer **120** implementing a scanning pattern **128**, according to some embodiments of the invention.

[0019] Embodiments of the invention comprise an angle-resolved reflectometer **120** comprising a coherent light source **86** and an optical system **125** arranged to scan a target pattern **82** using a spot **83** of coherent light from light source **86** to yield, at detector **87**, a plurality of realizations (i.e. pupil images) of the light distribution in the collected pupil. In embodiments, differences between the realizations of the light distribution in the collected pupil are a consequence of speckle and noise, which may be identified and removed by comparing the realizations. Spot **83** covers a part of target pattern **82** and the scanning is carried out according to a scanning pattern **128** (see below, **Figure 3**). The scanning may be carried out mechanically, by moving target pattern **82** with respect to an objective lens **89** of optical system **125** (e.g. by moving objective lens **89** with respect to a wafer **80** having target **82** or by moving wafer **80** with respect to objective lens **89**), or the scanning may be carried out optically by changing the beam path of the illuminating spot (see below). Reflectometer **120** further comprises a processing unit **130** arranged to generate a composite image of the collected pupil distribution by combining the plurality of realizations (i.e. pupil images) of the light distribution in the collected pupil. For example, the collected pupil may be the pupil of objective lens **89**.

[0020] In embodiments, reflectometer **120** focuses spatially coherent illumination on a smaller spot than is achievable using spatially incoherent illumination. Angle-resolved reflectometer **120** may be able, by utilizing spatially coherent illumination, to support smaller test patterns compared with a reflectometer **120** using spatially incoherent illumination. Coherent light source **86** may comprise a laser source that is capable of generating bright spatially coherent illumination that provides sufficient illumination for angle-resolved reflectometer **120**. Such illumination avoids high levels of shot noise which result from insufficient brightness of spatially incoherent light sources.

[0021] **Figure 3** is a high level schematic diagram illustrating scanning patterns **128** having difference sizes and densities, according to some embodiments of the invention. For example, to the left, **Figure 3** illustrates a scanning pattern **128A** which is relatively dense and yields relatively low noise but takes the longest measurement time. To the right, **Figure 3** illustrates a scanning pattern **128C** which is relatively sparse and small

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and yields relatively high noise yet takes the shortest measurement time. Scanning pattern **128B** is intermediate between **128A** and **128C** with respect to its size, level of noise and scanning duration.

[0022] In embodiments, the parameters of scanning pattern **128** and spot **83** may be configured to optimize the measured parameters and reduce errors arising from imperfections in test pattern features. Adjusting the parameters of scanning pattern **128** and spot **83** may be carried out before operation as a calibration procedure, or during measurements as a dynamic measurement procedure.

[0023] The impact of such errors may be reduced by illuminating larger areas, with a larger spot **83**, of test pattern **82** and capturing the reflected light from this larger area. In this way the impacts of imperfections in target **82** are reduced through averaging. While using the spatially coherent illumination results in illuminating only relatively small spots **83** on test pattern **82**, moving wafer **80** relative to the focused spot **83** allows a larger area of test pattern **82** to be illuminated. The wafer scan may be carried out during the time it takes for the system sensor to capture one image of the light distribution in the pupil or successive images can be captured as different areas of the target are illuminated. When successive images are captured, they can be combined to represent an average image of the light distribution in the pupil. Translating wafer **80** to move spot **83** on target **82** is one possible implementation. A similar implementation would consist of translating objective lens **89** relative to target **82** and wafer **80** so that the focused spot **83** translates on test pattern **82**.

[0024] **Figure 1** illustrates an embodiment in which the scanning is carried out optically rather than mechanically (i.e. without physical relative movement of lens **89** and target **82**). In this example, the optical scanning may be carried out by tilting a tiltable mirror **129** (as a non-limiting example of an optical scanning) in optical system **125**, and thereby reduce speckle error in the optical path, as explained in the following.

[0025] When a spatially coherent beam propagates through optical system **125**, light scattered by imperfections in the optical components propagates with the original beam (from source **86**) as additional coherent wavefronts. At a sensor plane (of detector **87**), the original beam interferes with the scattered wavefronts to generate speckle in the image. A small change in the position or pointing of the original beam can change the

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relative positions and angles of scattered wavefronts sufficiently so that the resulting speckle pattern is wholly or partially decorrelated with the original speckle pattern. This same motion in the original beam may be sufficiently small that its character at the imaging sensor is essentially unchanged. Without wishing to be bound by theory, when many speckle patterns are generated within the acquisition time of imaging sensor **87**, the magnitude of the residual speckle in the image is reduced through the averaging of the many decorrelated speckle patterns. It would also be possible to acquire a succession of images each with a different beam orientation and decorrelated speckle pattern. These successive images may be averaged with the resulting effect of reducing the magnitude of the residual speckle in the image. Changing the position of the spatially coherent beam over time and summing the resulting images has the general effect of decreasing the spatial coherence of the image.

[0026] In embodiments, the position and angle of a spatially coherent beam may be modified using scanning optical component **129** such as a piezo driven scan mirror, resonant scanner, rotating polygon scanner, spinning holographic scanner or acousto-optic deflector. System **120** may controllably scan the spatially coherent beam so that it moves about a pupil plane, scan the beam so that it moves about a field plane or scan the beam so that it moves about in both the pupil and field planes. In angle-resolved reflectometer **120**, it is critical to have a stable, low-noise beam distribution in the pupil plane. For this reason, a motion that leaves the beam position essentially stationary in the pupil plane and scans the beam position in the field plane is a preferred implementation.

[0027] **Figure 4** is a high level schematic block diagram illustrating various parameters and controlled variables of scanning angle-resolved reflectometer **120**, according to some embodiments of the invention. **Figure 4** schematically illustrates coherent light source **86**, detector **87** and objective lens **89** of reflectometer **125**, as well as parameters and characteristics associated with mechanical scanning **122** (relative translational movement of objective lens **89** and wafer **80** with target **82**) and optical scanning **127**, as explained below. Reflectometer **120** may comprise a control unit **140** arranged to control scanning pattern **128** (as explained above and below) and control and coordinate mechanical and optical scanning **122**, **127** and the interrelation between them, as explained below. Reflectometer **120** may comprise a processing unit **130** arranged to process images from

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detector **87**, generate measurements and integrated images from the processed images and further provide feedback to control unit **140** regarding different features of the images, as these are taken and processed. As explained below, such feedback allow further noise reduction by additional manipulation of wither or both mechanical and optical scanning **122**, **127**.

[0028] In embodiments, scanning target **82** may be carried out by synchronous optical and wafer (mechanical) scanning to yield multiple realizations of the light distribution in the collected pupil from a stationary spot position **83** on target **82**. The realizations may differ from each other in the speckle they possess, which may thus be removed. Processing unit **130** may be further arranged to reduce speckle in the image using the realizations of the light distribution in the collected pupil from a stationary spot position. Scanning the beam through optical system **125** may be utilized to reduce the speckle in the final pupil image by generating and averaging many decorrelated speckle images, but at the same time focused spot **83** scans over a larger area of test pattern **82**. This has the potentially negative effect of requiring a larger test pattern **82** which consumes more valuable area on wafer **80**. By combining optical scanning **127** and wafer scan **122**, reflectometer **120** may be configured to reduce speckle in the image and spot **83** may be kept stationary on test pattern **82** by precisely synchronizing wafer scan **122** and optical scan **127** by control unit **140**.

[0029] In embodiments, scanning target **82** may be carried out by controllably asynchronous mechanical and optical scanning. Processing unit **130** may be further arranged to reduce speckle in the image using optical scanning **127** and to reduce an error introduced by test pattern imperfections using mechanical scanning **122**. While optical scans **127** and wafer scans **122** can be synchronized in angle-resolved reflectometer **120** to scan the spatially coherent beam through optics **125** and keep it stationary on test pattern **82**, the scans may also be intentionally desynchronized. Such controllable desynchronization may be used to allow for the beam to be scanned through optics **125** to reduce the magnitude of the speckle that is introduced in the image while also controlling the size of the region of test pattern **82** that is illuminated to minimize the impact of test pattern imperfections. The magnitude of optical scan **127** may be set to achieve the

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desired speckle reduction, and the magnitude of wafer scan **122** desynchronization may be set to achieve the desired averaging over test pattern imperfections.

[0030] In embodiments, control unit **140** may be further arranged to determine scanning pattern **128** by balancing a level of speckle reduction achieved by optical scanning **127** and a time consumed by mechanical scanning **122**. In particular, scanning pattern **128** may be optimized to balance noise reduction and measurement time. For a given test pattern **82**, reflectometer **120** may be arranged to minimize the impacts of feature imperfections by scanning over the largest possible area and the most possible points within the area. Reflectometer **120** may also be arranged to achieve the greatest optical speckle reduction by scanning the largest possible range within optical system **125** and by scanning over the most possible points within the scan range. However, large and dense scanning patterns **128A** (e.g. **Figure 3**, to the left) that originate either from translating wafer **80** or from optical scanning **127** (e.g. by optical component **129**) may require a relatively long time to execute. It is desirable for semiconductor metrology tools to take as little time as possible to make measurements. Short measurement times increase a tools wafer throughput and lowers its cost of ownership. A direct tradeoff exists between scan range and density and measurement time.

[0031] In embodiments, reflectometer **120** may comprise dynamically programmed scanning components for performing mechanical scanning **122** and optical scanning **127**. Control unit **140** may be arranged to control the dynamically programmed scanning components to optimize noise, error and speckle reduction with operational parameters such as measurement duration and accuracy.

[0032] Examples for dynamically programmable scanning components comprise wafer stages and tilt mirrors. These may be dynamically programmed to set their scanning ranges and patterns. This provides the option to modify a particular system's balance between noise reduction, via scan range and density, and measurement speed. Reflectometer **120** may thus be configured for a short scan that produces lower precision results but at a faster wafer throughput (e.g. akin to pattern **128C**) and then be modified for a long scan that produces higher precision results at a slower wafer throughput (e.g. as illustrated by pattern **128A**. Overall patterns **128A-C** ranges of measurement precision and measurement durations, which may be dynamically controlled by control unit **140**.

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[0033] In embodiments, reflectometer **120** may implement and utilize programmed scan patterns **128** for intelligent reduction of test pattern and optical noise. For example, there may be instances in which particular areas of test pattern **82** introduce more measurement noise than other areas. In embodiments, processing unit **130** of reflectometer **120** may be arranged to identify high-noise regions of test pattern **82**. In embodiments, control unit **140** of reflectometer **120** may be arranged to remove the identified high-noise regions from scanning pattern **82**. In another example, particular areas within optical scan pattern **128** might introduce more noise than other areas within the optical scan. In embodiments, processing unit **130** of reflectometer **120** may be arranged to identify high-noise regions in optical scan **127**. In embodiments, control unit **140** of reflectometer **120** may be arranged to avoid the identified high-noise regions during optical scanning **127**.

[0034] In embodiments, reflectometer **120** may be arranged to identify these high-noise regions of test pattern **82** and optical scan **127** during a training mode. Test scanning pattern **128**, mechanical scanning **122** and/or optical scans **127** may then be defined to avoid these high-noise areas during actual measurements. This principle could be applied to only wafer scan **122**, only optical scan **127**, or to a combination of wafer and optical scans **122**, **127**.

[0035] In embodiments, scanning pattern **128** may further comprise a specified intensity distribution as a function of scan positions. The specified intensity distribution may be implemented in mechanical scanning **122** and/or optical scans **127**. For example, the specified intensity distribution may be symmetric but non-uniform, such as a Gaussian distribution. The specified intensity distribution may comprise a shape function of scanning pattern **128** (e.g. circular, rectangular etc.) and/or a profile function (e.g. Gaussian or any other symmetric distribution) of scanning pattern **128**. The intensity distribution may be used to increase metrology accuracy, with or without relation to the identification of high noise regions described above.

[0036] In embodiments, processing unit **130** may be further arranged to carry out the generation of the composite image by applying a weighted average to the realizations of the light distribution in the collected pupil, each realization reflecting a different optical and/or mechanical scan position. The weighting may be determined according to the specified intensity distribution of scanning pattern **128**, for example the weighting may

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enhance any part of the intensity distribution. Hence, the individual metrology results obtained per scan point may be combined into an analysis which, while not being a simple intensity average over collection pupil configurations, yields a more accurate and repeatable metrology result. The weighted average and the weighting parameters may be selected to optimize the metrology results.

[0037] In embodiments, processing unit **130** may be further arranged to adapt the weighting according to at least one metrology metric, such as metrology sensitivity to the position of spot **83**.

[0038] In embodiments, control unit **140** may be arranged to control or modify the specified intensity distribution of scanning pattern **128** to identify or optimize the intensity distribution (shape and function) to a specific test pattern **82**, to specific measurement stacks or according to metrology configurations. For example, different intensity distributions may be applied in train mode and measurement results of processing unit **130** may be compared to identify an optimal intensity distribution of spot **83**.

[0039] **Figure 5** is a high level schematic flowchart illustrating an angle-resolved reflectometry method **200**, according to some embodiments of the invention. Method **200** comprises scanning a target pattern using a spot of coherent light to yield a plurality of realizations of a light distribution in a collected pupil (stage **210**) and generating a composite image of the collected pupil distribution by combining a plurality of collected pupil images (stage **270**). In embodiments, scanning **210** may comprise covering parts of the target pattern with a coherent spot (stage **212**) and/or scanning the target pattern according to a scanning pattern (stage **214**).

[0040] In embodiments, method **200** may comprise carrying out the scanning mechanically (stage **220**) e.g. by moving the objective lens with respect to the wafer (stage **222**) or by moving the wafer with respect to the objective lens (stage **224**).

[0041] In embodiments, method **200** may comprise carrying out the scanning optically (stage **230**), e.g. by tilting a tiltable mirror in the optical path of the spot to scan the target optically (stage **232**).

[0042] In embodiments, method **200** may comprise synchronizing mechanical and optical scanning to yield multiple realizations of the light distribution in the collected pupil from

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a stationary spot position on the target (stage **240**) and reducing speckle in the image using the realizations of the light distribution in the collected pupil from the stationary spot positions (stage **242**). Alternatively or complementarily, method **200** may comprise controlling an asynchronous mechanical and optical scanning to reduce speckle as well as an error introduced by test pattern imperfections (stage **245**).

[0043] Generally, method **200** may comprise coordinating mechanical and optical scanning of the target pattern (stage **250**), e.g. by controlling dynamically programmed scanning components which carry out the mechanical scanning and the optical scanning (stage **252**).

[0044] In embodiments, method **200** may comprise determining the scanning pattern by balancing a level of speckle reduction achieved by the optical scanning and a time consumed by the mechanical scanning (stage **255**). In other embodiments, method **200** may comprise identifying high-noise regions of the test pattern (stage **260**) and removing the identified high-noise regions from the scanning pattern (stage **262**), and/or identifying high-noise regions in the optical scan (stage **265**) and avoiding the identified high-noise regions during the optical scanning (stage **267**).

[0045] In embodiments, the spot of coherent light has a specified intensity distribution and method **200** may further comprise carrying out the generation of the composite image by applying a weighted average to the realizations of the light distribution in the collected pupil (stage **280**). The weighting may be determined according to the specified intensity distribution of the scanning pattern (stage **285**). In embodiments, method **200** may further comprise adapting the weighting according to at least one metrology metric (stage **287**). In embodiments, method **200** may further comprise modifying the specified intensity distribution and identifying an optimal intensity distribution with respect to measurement parameters such as a specific test pattern or metrology configuration (stage **290**).

[0046] Advantageously, reflectometers **120** and methods **200** may provide any of the following multiple benefits: (i) Reflectometer **120** and method **200** may enable smaller test patterns **82** because spatially coherent illumination may be focused to a smaller spot than spatially incoherent illumination. (ii) Reflectometer **120** and method **200** may reduce impacts of test pattern imperfections because scanning the wafer relative to the illumination spot during the image acquisition reduces the impacts of test pattern

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imperfections through averaging. (iii) Reflectometer **120** and method **200** may reduce impacts of optical noise because scanning the beam through the optics reduces the impacts of speckle noise by averaging many decorrelated speckle views during the image acquisition. (iv) Reflectometer **120** and method **200** may enable reduction of optical noise on small test patterns because synchronizing wafer stage motion with optical scan motion may allow the optical beam to be scanned through the optics for speckle reduction while keeping the spot stationary on the small test pattern. (v) Reflectometer **120** and method **200** may enable the optimization of optical noise reduction and test pattern noise reduction because desynchronizing wafer stage motion and optical scan motion may allow any optical beam scan through the optics for speckle reduction and any spot scan on the target for target noise reduction. (vi) Reflectometer **120** and method **200** may enable optimization of noise reduction and measurement speed because the size and density of the optical and wafer scans can be modified to tradeoff between noise reduction and measurement speed. (vii) Reflectometer **120** and method **200** may enable avoidance of high-noise region of test pattern and optics because the scanned areas of the test pattern and optics may be defined to avoid regions which introduce high levels of measurement noise. (viii) Reflectometer **120** and method **200** may maximize test pattern noise reduction because incoherent illumination at the exit of a multimode fiber uniformly illuminates the intended area of the test pattern.

[0047] These benefits may be achieved by various configurations of reflectometer **120** and method **200**, which may incorporate any subgroup of features from those described above. Embodiments of reflectometer **120** and method **200** may combine any of the following features: (i) illumination of the sample with substantially spatially coherent illumination; (ii) use of stage scanning during the acquisition of a measurement of a single test pattern; (iii) use of optical scanning during the acquisition of a measurement of a single test pattern; (iv) combination of stage scanning and optical scanning during the acquisition of a measurement of a single test pattern; (v) stage scanning synchronized with optical scanning so that the illumination spot is kept stationary on the test pattern during the acquisition of the measurement from this test pattern; (vi) stage scanning desynchronized in a controlled manner with optical scanning so that independent scan patterns can be generated in the beam passing through the optics and in the spot motion

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on the test pattern during the acquisition of a measurement of a single test pattern; (vii) an ability to adjust scan size and density for optimizing the tradeoff between measurement noise and measurement time during the acquisition of the measurement of a single test pattern; (viii) reduction of spatial coherence by scanning a laser spot at the entrance of a multimode fiber.

[0048] Advantageously, reflectometers **120** and methods **200** overcome the following limitations of current technologies.

[0049] Since wafers are expensive to process, as much of the wafer area as possible needs to be reserved for functional circuitry. To this end, it is desirable to make test patterns small so that they consume little wafer area. To avoid interaction between the measurement light and wafer geometries surrounding the test pattern, the size of the focused spot in an angle-resolved reflectometer must be even smaller than the test pattern. The smallest possible spot can be formed by focusing a spatially coherent beam of light. An angle-resolved reflectometer that focuses a spatially coherent beam onto the test pattern has a potential competitive advantage over reflectometers that use less spatially coherent light, in that the smaller focused spot can allow for smaller test patterns and leave more wafer area available for functional circuitry.

[0050] When measurements of the test pattern are made with a small focused spot the magnitude of these modifications to the light distribution can lead to significant errors or noise in the measurement of the test pattern parameters. An angle-resolved reflectometer that is capable of collecting information from as much of the test pattern as possible has a competitive advantage in that the measurement error introduced by target imperfections can be minimized through spatial averaging.

[0051] When a spatially coherent beam propagates through an optical system, imperfections in the optical components scatter some fraction of the beam. This scattered light propagates along with the primary beam and interferes with it to produce speckle. In an optical metrology system, such as an angle-resolved reflectometer, information regarding a test pattern is contained in the reflected intensity profile of the spatially coherent beam. Speckle created by the optical system can modulate the beam intensity in an unpredictable manner and result in errors in the subsequent measurement of test target parameters.

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[0052] The disclosed reflectometers **120** and methods **200** are capable of minimizing the size of the illuminated area on the wafer to support the smallest possible test patterns, as well as illuminating as large of an area of the test pattern as necessary to minimize the impacts of pattern imperfections, while concurrently minimizing the measurement errors introduced by speckle generated in the optical system.

[0053] Advantageously, reflectometers **120** and methods **200** provide better solutions than technologies related to stationary spatially incoherent illumination and stationary spatially coherent illumination.

[0054] In stationary spatially incoherent illumination: The size of the spot of spatially incoherent light that is focused onto the wafer can be defined by a field stop placed in the illumination path of the optical system. By increasing the size of the field stop the area of the test pattern that is illuminated can be increased and the impacts of target imperfections can be reduced by effectively averaging the measurement over a larger area of the test pattern. Limitations to a configuration utilizing spatially incoherent illumination arise when the size of the test pattern needs to be decreased. Decreasing the size of the test pattern requires a reduction in the size of the illuminated spot as well. This can be accomplished by reducing the size of the field stop, but this results in a significant loss of light and an increase in spatial coherence. An angle-resolved reflectometer that uses a spatially incoherent light source is thus light starved when illuminating small test patterns. The loss of additional light at the field stop worsens the situation and increases measurement errors due to shot noise. Increasing the spatial coherence by decreasing the size of the field stop increases the impacts of speckle from the optical system as well. An angle-resolved reflectometer with stationary spatially incoherent illumination is hence not optimal for measuring small test patterns, because it suffers from increasing shot noise and speckle as the illumination field stop is decreased to support the smaller test patterns.

[0055] In stationary spatially coherent illumination: A spatially coherent beam can be focused to a small spot on the wafer and this allows for the test pattern to be made small as well. However, the small spot illuminates local imperfections in the test pattern and does not reduce the impacts of these imperfections by averaging over a larger area of the test pattern. Spatially coherent illumination also generates speckle in the optical system

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which adds noise to the test pattern measurements. An angle-resolved reflectometer with stationary spatially coherent illumination can measure small test patterns, but cannot be adjusted to increase the size of the illuminated patch to allow for averaging of test pattern imperfections and suffers from speckle noise.

[0056] Hence, reflectometers **120** and methods **200** are superior to these two approaches.

[0057] In embodiments, method **200** may be used to implement spatial coherence reduction in multimode fibers. For example, embodiments of the invention may comprise scanning a face of a multimode fiber using a spot of coherent light to yield a signal having reduced spatial coherence yield mix modes.

[0058] A large-core multimode fiber may be used to deliver spatially coherent light to the measurement head. The multimode fiber acts like an extended object if different points on the fiber face are uncorrelated. Ordinarily, a laser coupled into a multimode fiber only excites a small subset of modes of the fiber. To achieve the desired decorrelation, the laser may be arranged to excite all, or a broad distribution of, the modes of the fiber. Randomness is not necessary for decorrelation. Decorrelation may be achieved by exciting the modes sequentially on a time scale long compared to the coherence time. Then the short correlation time is transferred to a short correlation length. Randomness just adds noise. Unfortunately, fiber instability will always generate some randomness. The point of adding additional randomness is that lots of randomness can be quieter than a little randomness.

[0059] An approach for achieving this maybe to laterally scan the focused laser beam across the fiber face, or to laterally scan the fiber face across the focused laser beam, in a random or pseudo-random pattern. Such scanning is akin to scanning **128** that was illustrated above and may likewise be carried out optically or mechanically. This scan may be carried out e.g. using a fold mirror with a high speed tip-tilt actuator. If the scan is sufficiently fast, the time-varying mode structure is averaged out over the integration time of the detector, resulting in essentially an incoherent extended source. Another approach for randomly mixing the modes would be to vibrate the multimode fiber using a voice coil or other actuator.

[0060] When performing wafer metrology, accuracy, precision, and tool induced shift (TIS) depend on the capacity to retrieve high fidelity spectroscopic or angular

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information from small metrology targets. Good metrology performance requires a method for weeding out the induced diffractions from the apertures discussed above. The present invention teaches extrapolating the diffraction-induced signal contamination that reduces the performance of prior art measurements to a "no-diffraction" limit where the metrology performance is clean of such diffraction effects.

[0061] Diffraction through apertures in a metrology system introduces errors which are distinguishable in the measurement output. Embodiments of the invention compensate for these errors computationally by deriving a functional dependency of at least a part of the error on the aperture size. The functional dependency may be derived for different measurement parameters, such as metrology results or measured intensities. The derivation may be carried out before actual measurements or during the measurements (on the fly). The functional dependency may be used to calibrate the measurement system for a large set of aperture size combinations with respect to multiple apertures in the system.

[0062] Disclosed methods also provide the margin of error of the measurement induced by the diffraction related signal contamination. As illustrated in **Figure 6,** various apertures in metrology optical system **90** may induce diffraction errors.

[0063] Diffraction effects may cause a degradation of metrology performances such as accuracy and may also cause a degradation of precision due to an enhanced sensitivity to focus and radiation spot alignment errors. The ideas disclosed herein comprise of collecting signals from a multitude of aperture sizes, and using the information collectively to extrapolate the data to a "no-diffraction limit" where the metrology performance is clean of the contaminating interference effects.

[0064] This idea is illustrated schematically in **Figure 7**, illustrating a generic dependency of some measurable variable termed "$\text{Quantity}^{\text{raw}}$" on an aperture size of one of an aperture in system **90**, e.g. the smallest aperture. The measured raw quantity is denoted by $\text{Quantity}^{\text{raw}}$ and the aperture size is denoted by L. L_1, L_2, L_3, …, L_n denote the values that L obtains in measurement no. 1,2,3,…n. The no-diffraction limit is obtained at $L=\infty$ where $\text{Quantity}^{\text{raw}} = \text{Quantity}^{\text{ideal}}$ and a goal of the disclosed methods is to extrapolate the data collected for $\text{Quantity}^{\text{raw}}$ at $L= L_1, L_2, L_3, \ldots, L_n$ to $L=\infty$, to obtain

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an estimate for $Quantity^{ideal}$, which can be used to correct $Quantity^{raw}$ measured at a given aperture size.

[0065] Because the metrology error effects induced by diffractions may behave in a fluctuating manner as a function of L, the system and method may perform a train mode to choose the values of L for which the function $Quantity^{raw}(L)$ is smooth and from which the extrapolation to $L\rightarrow\infty$ can be done.

[0066] Such dependencies of measured variables on aperture sizes may be measured with respect to different apertures in system **90** to create a multiple dimensional correction matrix referring to some or all apertures in system **90**. The relevant apertures for analysis may be selected according to their sizes, or according to their influence on the resulting diffraction error. For example, a first approximation may comprise compensating for diffraction effects caused by the smallest aperture. In case of two similar smallest apertures, the correction matrix may be two dimensional.

[0067] The "Quantity" which is extrapolated to its $L\rightarrow\infty$ limit and that is plotted on the y-axis may be one or more of various possible measurement parameters, such as per-pixel intensity or a derived intensity (like the differential signal in scatterometry overlay), or the ultimate metrology outcome (like the CD of a layer, or the overlay between two layers as schematically demonstrated e.g. in **Figure 10A** below). Performing the extrapolation(s) provides an estimate for the error margin in the metrology. For example, one may perform the extrapolations by two or more extrapolation techniques (e.g. different forms for the extrapolating function, different intervals in L used in the interpolation) and compare the results. The difference between the results can serve as a good estimate for the error margin in the metrology. Embodiments of the invention may use any of several instruments, such as e.g. a wheel with a number of apertures, an adjustable iris type of aperture or electro-optical devices like an SLM (spatial light modulator) to determine and modify different aperture sizes (values of $L - L_i$).

[0068] This idea is illustrated in more detail in an example given in **Figure 10A**, being a schematic diagram illustrating an example for the way the inaccuracy in a scatterometry overlay measurement may depend on the size of the collection field stop, according to some embodiments of the invention. **Figure 10A** demonstrates the way an overlay measurement depends on the collection field stop size for certain collection field stop

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sizes L (ranging ca. 4-23 μm) that have been chosen judicially to avoid the diffraction-induced metrology error fluctuations discussed above. These results were obtained in simulations of an overlay target measured with overlay scatterometry. The simulation results were calculated for a very large overlay target printed on a resist wafer. The true overlay of the simulated stack equals 16nm and the deviation from 16nm is a result of a misalignment error of the illumination with respect to the overlay scaterometry target.

[0069] **Figure 8** is a high level schematic flowchart illustrating a method **300** of algorithmically eliminating diffraction from optical metrology, according to some embodiments of the invention.

[0070] Method **300** comprises estimating, quantitatively, a functional dependency of at least one measurement parameter on a size of at least one aperture in a metrology system (stage **310**); identifying at least one diffraction component of the functional dependency which relates to the size of the at least one aperture (stage **320**); and deriving, from the at least one identified diffraction component, at least one correction term for the at least one measurement parameter with respect to measurement conditions (stage **330**). The measurement conditions comprises specified sizes of the at least one aperture that generate a diffraction error in the at least one measurement parameter. The measurement conditions may further comprise additional parameters such as illumination wavelengths and illumination source properties (e.g. spot alignment). Method **300** further comprises compensating, computationally, for the diffraction error by applying the derived correction term(s) to the at least one measurement parameter (stage **340**). Thus, method **300** corrects measurement parameters by computationally removing diffraction errors due to aperture sizes (stage **342**).

[0071] In embodiments, at least one of estimating **310**, identifying **320**, deriving **330** and compensating **340** may be carried out by at least one computer processor **105**. In embodiments, a computer program product comprising a computer readable storage medium having computer readable program embodied therewith is disclosed, The computer readable program is configured to carry out at least one of stages **310**, **320**, **330** and **140** of method **300**, as well as any other stages of method **300**.

[0072] In embodiments, method **300** may further comprise selecting aperture sizes that yield a smooth functional dependency (stage **311**). The aperture sizes may be selected to

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yield a functional dependency that enables identification **320** and derivation **330**. In embodiments, the appropriate aperture sizes may be selected by going through different aperture sizes in a train mode.

[0073] In embodiments, estimating **310** may be carried out by fitting a curve to the measurements (stage **312**) according to theoretical or analytical considerations or simulation results. Identification **320** may then be carried out by using the fitted curves to identify the diffraction component(s) (stage **322**) – e.g. as terms in a series describing the fitted curve.

[0074] In embodiments, method **300** may comprise using at least one metrology result as the at least one measurement parameter comprises at least one metrology result (stage **314**), e.g. the at least one metrology result may comprise any of an overlay measurement, a critical dimension (CD) measurement, a focus measurement, a dose measurement, side-all angle calculations, a film thickness measurement, etc.

[0075] In embodiments, method **300** may comprise integrating estimating **310** and identifying **320** in a metrology measurement process (stage **325**) to continuously monitor and if necessary update the correction term(s) according to measurements carried out in the fly.

[0076] In embodiments, estimating **310** and identifying **320** may be carried out prior to a metrology measurement process and be used to calibrate the metrology system (stage **324**). In embodiments, method **300** may further comprise refining the correction by reiterating the error estimation (stage **345**), e.g. by calibrating metrology measurements according to the derived correction term, as explained below. In embodiments, method **300** may comprise deriving a second order correction term by reiterating any of estimating **310**, identifying **320** and deriving **330** after a first order compensating **340**.

[0077] **Figure 9** is a high level schematic block diagram illustrating a metrology system **100**, according to some embodiments of the invention.

[0078] Metrology system **100** is arranged to compensate computationally for a diffraction error associated with a size of at least one aperture **95** in metrology system **100** by applying one or more correction terms **130** to at least one measurement parameter **112**, **114**. The measurement parameters may comprise either metrology measurement results **112** such as the critical dimension (CD) of a layer or an overlay between two layers

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and/or other measurement parameters **114** such as a per-pixel intensity or a derived intensity (like the differential signal in scatterometry overlay). Correction term(s) **130** may be derived by estimating, quantitatively, a functional dependency (e.g. **Figures 7, 10A**) of the measurement parameter(s) on the size of aperture **95** and identifying at least one diffraction component of the functional dependency which relates to the size of aperture **95**. Metrology system **100** may comprise a controller **110** (e.g. having at least one computer processor **105**) arranged to carry out the estimating and the identifying (e.g. by controlling aperture size and measuring parameters) on the fly and/or arranged to, calibrate metrology system **100** according to the identifying at least one diffraction component of the functional dependency. The actual manipulation of aperture size may be carried out by any aperture size determining instrument **115** such as e.g. a wheel with a number of apertures, an adjustable iris type of aperture, or electro-optical devices like an SLM.

[0079] In embodiments, the estimation of the functional dependency may be carried out with respect to a selected plurality of aperture sizes which yield such functional dependency that enables the identification and the derivation (e.g. by being a smooth function).

[0080] In embodiments, correction terms **130** for several apertures may be calculated dependently or independently to create a multiple dimensional correction matrix referring to some or all apertures in system **100**.

[0081] In embodiments, system **100** may be further arranged to refine the computational compensation by using the functional dependency to derive a second order correction term and adjust the at least one measurement parameter accordingly. In embodiments, system **100** may be arranged to reiterate the correction process to compensate for different errors to sequentially refine the results and reduce the measurement errors.

[0082] In embodiments, estimation (stage **210**) may comprise fitting a curve (based e.g. on theoretical, analytical or simulation results) for the functional dependency of $Quantity^{raw}$ on the aperture size L as $L \rightarrow \infty$. The fitting parameters may then be used to calculate $Quantity^{ideal}$. For example, if the function dependency is expressed (Equation (1)): $Quantity^{raw}(L) = A + Correction(L)$, where $Correction(L) = B/L^{q1}+C/L^{q2}+D/L^{q3}+\ldots$, where $0<q_1<q_2<q_{3<\ldots}$, then the ultimate metrology result would be A because

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$Quantity^{ideal} \equiv Quantity^{raw}(L \to \infty) = A$. In that case, compensating (stage **240**) may comprise simply replacing the metrology measurements $Quantity^{raw}(L)$ by the fit parameter "A", thereby extrapolating $Quantity^{raw}(L)$ to its $L \to \infty$ "no-diffractions" limit. This procedure requires the measurement of $Quantity^{raw}(L)$ at least for two values of L, which are judicially chosen as explained above (**Figure 7**).

[0083] In cases where the function Correction(L), and equivalently, the coefficients B, C, D, ..., exhibit an approximate universal dependency on the system parameters (which means they depend much more strongly on the wavelength, polarization, illumination profile, etc., than on the wafer metrology like the overlay and the deviation of the CD from the nominal CD), the following estimation procedure may be used.

[0084] One would first determine the function Correction(L), or equivalently the coefficients B, C, D, ..., which define it. These coefficients may be accurately fixed in train mode (by using a large multitude of L-values, and by an increased light level/measurement time). This fixes the functional dependency of $Quantity^{raw}(L)$ on L and allows one to correct $Quantity^{raw}(L)$ on-the-fly and to arrive at an accurate estimate of $Quantity^{ideal}$, by using one measurement of $Quantity^{raw}(L)$ at a single value of L. For example, if one performs a train measurement and finds that to a good approximation, C, D, ..., are all negligible, but that B is a non-negligible function of tool-only parameters then one may correct for the metrology outcome by replacing it, at a given value of L, in the following way (Equation (2)): Metrology outcome = $Quantity^{raw}(L) \to$ Metrology outcome = $Quantity^{raw}(L) - B/L^{q1}$. That is, the systems and methods may identify non-negligible terms of the correction function and their type of dependency on the system parameters, and correct measurements only by these non-negligible terms, in respect of their dependencies on system parameters.

[0085] It is noted in passing that the afore-mentioned assumption on the universal behavior of the function "Correction(L)" is a very reasonable one and is supported by simulations (see below) as the metrology outcome affects the diffractions very weakly (such as the overlay or the deviation of the CD value from the nominal CD). For example the overlay enters into the diffraction effect in a functional form which depends on the combination $2\pi \cdot$overlay/Pitch. As the pitch is around 600nm, the error induced by this dependency is in the order of a few percent.

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[0086] Advantageously, the current invention improves measurement accuracy by suppressing the aperture induced diffraction effects. In addition to establishing $Quantity^{ideal}$, it provides a way of calculating the margin of error ($Quantity^{raw}$ - $Quantity^{ideal}$), since that is one of the outcomes of the fitting procedures done in measurement or in train mode. This provides a quantitative confidence in the measurements.

[0087] **Figure 10A** is a schematic diagram illustrating an example for the way the inaccuracy in a scatterometry overlay measurement may depend on the size of the collection field stop, according to some embodiments of the invention. **Figure 10A** is used in the following as a detailed non-limiting example of the way the current invention may be applied to overlay metrology. In this illustrated case, the "Quantity" is the overlay reported by overlay scatterometry, the "L's" are the collection field stop sizes, and the error in the overlay estimation is due to a misalignment between the illumination spot and the grating structure that is being measured.

[0088] **Figure 10B** is a schematic diagram illustrating an example for the way the inaccuracy in a scatterometry overlay measurement depends on the size of the collection field stop for two different values of the true overlay, according to some embodiments of the invention. As **Figure 10B** clearly shows, this error decreases to zero when L increases (the simulated overlay was chosen to be 16nm in this example, as illustrated in **Figure 10A**). The values of L chosen for the plot were chosen according to the description above. **Figure 10B** also clearly demonstrates that the dependence of the inaccuracy on the metrology parameters (the overlay in the current example) is negligible as the `universality' assumption stated above declares.

[0089] In the current example, implementing method **300** may comprise the following stages. First, stage **312** comprises fitting the data in **Figure 10A**: A very good fit is found to a function of the form: $OVL(L) = A + 18.885/L^p$, which describes the simulation data well for $p \approx 2.0$ and $A = 16.027$. The final metrology overlay results are then the value $OVL(L \rightarrow \infty) = A = 16.027$. This would lead to an overlay error inaccuracy of 0.027nm (recalling that the true overlay used in these exemplary simulations is 16nm). Stage **314** comprises using the calculated inaccuracy to correct the measurements.

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[0090] Advantageously, the fit can also be done from the lower two stop size values of L=4.15μm and L=7.25μm only. In such case the value of A becomes 16.215, leading to an inaccuracy estimation of 0.215nm (using L=7.25 μm alone gives an inaccuracy of around ~0.5nm and the result of L=4.15μm gives an inaccuracy of around ~1.1nm).

[0091] Another way of implementing method **300** is to consider the fit discussed above as a calibration to the way overlay values depend on the collection field stop size. To demonstrate this fact. **Figure 10B** further shows how the overlay inaccuracy behaves for two overlay targets, whose overlay values equal 0nm and 16nm. As clearly illustrated by **Figure 10B**, the inaccuracy depends only very weakly on the true overlay of the stack, as argued above. This opens the way to perform the following type of second order calibration (stage **324**), namely (i) using the calibration formula obtained by fitting the overlay data (in the example above this formula is $OVL(L) = 16.027 + 18.885/L^2$), and then (ii) applying the formula to a new overlay measurement in the following way (the new overlay meausrement are denoted by OVL'(L)). First, the new overlay measurement OVL'(L) is replaced by a corrected measurement: OVL'(L) → OVL'(corrected, L) = $OVL'(L) - 18.885/L^2$.

[0092] Figure 11A is a schematic diagram illustrating an example for the way the correction method using a first type of calibration reduces the overlay measurement error, according to some embodiments of the invention. **Figure 11A** illustrates the improvement achieved by applying the second order approximation as described above. In the illustrated example, the resulting error reduction by the calibration is presented for a case where the true overlay =0. Note that this involves a single measurement at a single value of L.

[0093] Clearly, the uncalibrated results lead to significant overlay errors, especially for small collection field stop sizes, while the calibrated results reduce these errors significantly. Note that these errors can also cause precision degradation if the root cause for the inaccuracy (spot misalignment in the current example) fluctuates in time.

[0094] Figure 11B is a schematic diagram illustrating an example for the way the correction method using a second type of calibration reduces the overlay measurement error, according to some embodiments of the invention. The second type of calibration is carried out in the following manner. First, the overlay measurements that were used for

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calibration are denoted by by OVL(L;0). For example, these may be the measurements which were fitted to OVL(L;0) = A + Correction(L), where A = 16.027, and Correction(L)=18.885/L^2. At this point, the best estimate for the true overlay in this calibration measurement is 16.027nm. In this second type of calibration, the fact that the diffraction effects on the two overlay measurements depend very weakly on the actual value of the overlay, is used to correct the new overlay measurement. The new overlay measurement is denoted by OVL(L;1) as follows: OVL(L;1) → OVL(L;1,corrected) = OVL(L;1) + OVL(L;0)-A. As illustrated in Figure **11B**, the second type of calibration is preferable, in this example, to the first type of calibration as it yields more stable corrections with respect to a varying stop size.

[0095] It is noted in passing that in both calibration methods presented above, it is important that the measurement conditions do not changed significantly from the calibration measurement to the actual measurement. This includes the light properties (wave-length, polarization, alignment of system with respect to target, focus, etc.). In case it cannot be assured that the measurement conditions are the same, additional calibrations may be needed to calibrate and compensate for the differences. For example, if an overlay scatterometry system is misaligned along the x-axis by an amount d with respect to a large overlay target, then the overlay measurement, OVL, should be formulated as a two dimensional function which depends on the collection field stop size, L and on d: OVL(L,d). Since at L→ ∞, the decentering causes zero inaccuracy the function may be expressed as OVL(L,d) = A+ f(d) · g(L), with g(L→∞)=0.

[0096] In the two dimensional case, the calibration process may be divided into the following steps. First, d may be fixed at a d_0 and OVL(L, d_0) is fitted to obtain A. The Correction(d,L) is defined as Correction(d,L) ≡ OVL(L,d) – A, and the Correction(d_0,L)=f(d_0) · g(L) is obtained. Then, the Correction(d_0,L) is divided by Correction (d_0,L_0) to obtain a numerical estimate for the ratio r_g(L)= g(L)/g(L_0).

[0097] These steps are then repeated for various values of d_i =d_1, d_2, d_3, d_4, etc. to obtain Corrections (d_i, L) and, by dividing these results as explained above - Correction(d_i,L) / Correction(d_i,L_i), the numerical estimates for function r_f(d) = f(d)/ f(d_0) are formed. Combining the above steps and the measurement of the overlay at L=L_0 and d=d_0, which provides Correction(L_0,d_0), the numerical estimate for OVL(L,d) can be expressed as

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$OVL(L,d) = A + Correction(L_0,d_0) \cdot r_f(L) \cdot r_g(d)$. As a result, for any new overlay measurement OVL(L, d) performed at some values of L and d, the correction would be $OVL(L,d) \rightarrow OVL(L,d;\ corrected) = OVL(L,d) - Correction(d_0,L_0) \cdot r_g(L) \cdot r_f(d)$.

[0098] Method **300** may thus further comprise calibrating the correction term with respect to at least one difference between derivation conditions (of metrology system **100** during the derivation) and measurement conditions (stage **332**). The at least one difference may relate, for example, to the wavelength or polarization of the measurement beam, to alignment of system **100** with respect to a target, to focus parameters, etc.

[0099] In embodiments, method **300** further comprises carrying out calibration **332** by expressing the functional dependency as relating to the at least one difference (stage **334**) and deriving the correction term with further respect to a range of values of the at least one difference (stage **336**).

[00100] Respectively, in embodiments, metrology system **100** may be further arranged to calibrate the correction term with respect to at least one difference between derivation conditions and measurement conditions, wherein the at least one difference relates to at least one of: wavelength, polarization, alignment with respect to a target, and focus. Metrology system **100** may be arranged to carry out the calibration by expressing the functional dependency as relating to the at least one difference and deriving the correction term with further respect to a range of values of the at least one difference.

[00101] In the above description, an embodiment is an example or implementation of the invention. The various appearances of "one embodiment", "an embodiment" or "some embodiments" do not necessarily all refer to the same embodiments.

[00102] Although various features of the invention may be described in the context of a single embodiment, the features may also be provided separately or in any suitable combination. Conversely, although the invention may be described herein in the context of separate embodiments for clarity, the invention may also be implemented in a single embodiment.

[00103] Embodiments of the invention may include features from different embodiments disclosed above, and embodiments may incorporate elements from other embodiments disclosed above. The disclosure of elements of the invention in the context of a specific embodiment is not to be taken as limiting their used in the specific embodiment alone.

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[00104] Furthermore, it is to be understood that the invention can be carried out or practiced in various ways and that the invention can be implemented in embodiments other than the ones outlined in the description above.

[00105] The invention is not limited to those diagrams or to the corresponding descriptions. For example, flow need not move through each illustrated box or state, or in exactly the same order as illustrated and described.

[00106] Meanings of technical and scientific terms used herein are to be commonly understood as by one of ordinary skill in the art to which the invention belongs, unless otherwise defined.

[00107] While the invention has been described with respect to a limited number of embodiments, these should not be construed as limitations on the scope of the invention, but rather as exemplifications of some of the preferred embodiments. Other possible variations, modifications, and applications are also within the scope of the invention. Accordingly, the scope of the invention should not be limited by what has thus far been described, but by the appended claims and their legal equivalents.

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CLAIMS

What is claimed is:

1. An angle-resolved reflectometer comprising:

   a coherent light source;

   an optical system arranged to scan a target pattern using a spot of coherent light from the light source to yield a plurality of realizations of a light distribution in a collected pupil, wherein the spot covers a part of the target pattern and the scanning is carried out according to a scanning pattern; and

   a processing unit arranged to generate a composite image of the collected pupil distribution by combining the plurality of realizations of the light distribution in the collected pupil.

2. The angle-resolved reflectometer of claim 1, wherein the scanning is carried out mechanically by moving an objective lens of the optical system and the target pattern relative to each other.

3. The angle-resolved reflectometer of claim 2, wherein the scanning is carried out by moving an objective lens of the optical system with respect to the target pattern.

4. The angle-resolved reflectometer of claim 2, wherein the scanning is carried out by moving the target pattern with respect to an objective lens of the optical system.

5. The angle-resolved reflectometer of claim 1, wherein the scanning is carried out optically.

6. The angle-resolved reflectometer of 5, wherein the optical scanning is carried out by a tiltable mirror in the optical system.

7. The angle-resolved reflectometer of claim 1, wherein:

   the scanning is carried out by synchronous mechanical and optical scanning to yield a plurality of realizations of the light distribution in the collected pupil from a stationary spot position on the target; and

   the processing unit is further arranged to reduce speckle in the image using the realizations of the light distribution in the collected pupil from the stationary spot position.

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8. The angle-resolved reflectometer of claim 1, wherein the scanning is carried out by controllably asynchronous mechanical and optical scanning and the processing unit is further arranged to reduce speckle in the image using the optical scanning and to reduce an error introduced by test pattern imperfections using the mechanical scanning.
9. The angle-resolved reflectometer of claim 1, further comprising a control unit arranged to control the scanning.
10. The angle-resolved reflectometer of claim 9, further comprising a control unit arranged to coordinate mechanical and optical scanning of the target pattern.
11. The angle-resolved reflectometer of claim 10, wherein the control unit is further arranged to determine the scanning pattern by balancing a level of speckle reduction achieved by the optical scanning and a time consumed by the mechanical scanning.
12. The angle-resolved reflectometer of claim 10, wherein the mechanical scanning and the optical scanning are carried out by respective dynamically programmed scanning components which are controlled by the control unit.
13. The angle-resolved reflectometer of claim 10, wherein the processing unit is further arranged to identify high-noise regions of the test pattern.
14. The angle-resolved reflectometer of claim 13, wherein the control unit is arranged to remove the identified high-noise regions from the scanning pattern.
15. The angle-resolved reflectometer of claim 10, wherein the processing unit is further arranged to identify high-noise regions in the optical scan.
16. The angle-resolved reflectometer of claim 15, wherein the control unit is arranged to avoid the identified high-noise regions during the optical scanning.
17. The angle-resolved reflectometer of claim 1, wherein the scanning pattern comprises a specified intensity distribution which is symmetric and non-uniform.
18. The angle-resolved reflectometer of claim 17, wherein the processing unit is further arranged to carry out the generation of the composite image by applying a weighted average to the realizations of the light distribution in the collected pupil, wherein the weighting is determined according to the specified intensity distribution of the scanning pattern.

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19. The angle-resolved reflectometer of claim 18, wherein the processing unit is further arranged to adapt the weighting according to at least one metrology metric.
20. The angle-resolved reflectometer of claim 17, wherein the control unit is further arranged to modify the specified intensity distribution and identify an optimal intensity distribution with respect to a specific test pattern or metrology configuration.
21. An angle-resolved reflectometry method comprising:

scanning a target pattern using a spot of coherent light to yield a plurality of realizations of a light distribution in a collected pupil, wherein the spot covers a part of the target pattern and the scanning is carried out according to a scanning pattern; and

generating a composite image of the collected pupil distribution by combining the plurality of realizations of the light distribution in the collected pupil.
22. The angle-resolved reflectometry method of claim 21, wherein the scanning is carried out mechanically by moving an objective lens and the target pattern relative to each other.
23. The angle-resolved reflectometry method of claim 22, wherein the scanning is carried out by moving a wafer with the target pattern.
24. The angle-resolved reflectometry method of claim 22, wherein the scanning is carried out by moving the objective lens.
25. The angle-resolved reflectometry method of claim 21, wherein the scanning is carried out optically.
26. The angle-resolved reflectometry method of claim 21, wherein:

the scanning comprises synchronous mechanical and optical scanning to yield a plurality of realizations of the light distribution in the collected pupil from a stationary spot position on the target; and

the method further comprises reducing speckle in the image using the realizations of the light distribution in the collected pupil from the stationary spot position.
27. The angle-resolved reflectometry method of claim 21, wherein the scanning comprises controllable asynchronous mechanical and optical scanning and the method further comprises reducing speckle in the image using the optical scanning

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and reducing an error introduced by test pattern imperfections using the mechanical scanning.

28. The angle-resolved reflectometry method of claim 21, further comprising coordinating mechanical and optical scanning of the target pattern.
29. The angle-resolved reflectometry method of claim 28, further comprising determining the scanning pattern by balancing a level of speckle reduction achieved by the optical scanning and a time consumed by the mechanical scanning.
30. The angle-resolved reflectometry method of claim 28, further comprising controlling dynamically programmed scanning components which carry out the mechanical scanning and the optical scanning.
31. The angle-resolved reflectometry method of claim 28, further comprising identifying high-noise regions of the test pattern and removing the identified high-noise regions from the scanning pattern.
32. The angle-resolved reflectometry method of claim 28, further comprising identifying high-noise regions in the optical scan and avoiding the identified high-noise regions during the optical scanning.
33. The angle-resolved reflectometry method of claim 21, wherein the scanning pattern comprises a specified intensity distribution and the method further comprising carrying out the generation of the composite image by applying a weighted average to the realizations of the light distribution in the collected pupil, wherein the weighting is determined according to the specified intensity distribution of the scanning pattern.
34. The angle-resolved reflectometry method of claim 33, further comprising adapting the weighting according to at least one metrology metric.
35. A method comprising

estimating, quantitatively, a functional dependency of at least one measurement parameter on a size of at least one aperture in a metrology system;

identifying at least one diffraction component of the functional dependency which relates to the size of the at least one aperture;

deriving, from the at least one identified diffraction component, a correction term for the at least one measurement parameter with respect to measurement

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conditions, the measurement conditions comprising specified sizes of the at least one aperture that generate a diffraction error in the at least one measurement parameter; and

compensating, computationally, for the diffraction error by applying the derived correction term to the at least one measurement parameter,

wherein at least one of the estimating, the identifying, the deriving and the compensating is carried out by at least one computer processor.

36. The method of claim 35, further comprising selecting a plurality of aperture sizes for carrying out the quantitative estimation of the functional dependency, wherein the aperture sizes are selected to yield such functional dependency that enables the identification and the derivation.
37. The method of claim 35, further comprising calibrating metrology measurements according to the derived correction term.
38. The method of claim 37, further comprising reiterating the calibration to refine the correction term.
39. The method of claim 35, further comprising deriving a second order correction term by reiterating the estimating and the identifying after the compensating.
40. The method of claim 35, wherein the estimating the functional dependency is carried out by curve fitting and the identification is carried out with respect to curve parameters.
41. The method of claim 35, wherein the at least one measurement parameter comprises at least one metrology result.
42. The method of claim 41, wherein the at least one metrology result comprises at least one of: an overlay measurement, a critical dimension measurement, a focus measurement, a dose measurement, side-all angle calculations, and a film thickness measurement.
43. The method of claim 35, further comprising calibrating the correction term with respect to at least one difference between derivation conditions and measurement conditions.

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44. The method of claim 43, wherein the at least one difference relates to at least one of: wavelength, polarization, alignment with respect to a target, and focus.
45. The method of claim 43, wherein the calibrating is carried out by expressing the functional dependency as relating to the at least one difference and deriving the correction term with further respect to a range of values of the at least one difference.
46. The method of claim 35, wherein the estimating and the identifying are integrated in a metrology measurement process.
47. The method of claim 35, wherein the estimating and the identifying are carried out prior to a metrology measurement process and are used to calibrate the metrology system.
48. A metrology system arranged to compensate computationally for a diffraction error associated with a size of at least one aperture in the metrology system by applying a correction term to at least one measurement parameter, wherein the correction term is derived by estimating, quantitatively, a functional dependency of the at least one measurement parameter on the size of the at least one aperture and identifying at least one diffraction component of the functional dependency which relates to the size of the at least one aperture.
49. The metrology system of claim 48, wherein the estimation of the functional dependency is carried out with respect to a selected plurality of aperture sizes which yield such functional dependency that enables the identification and the derivation.
50. The metrology system of claim 48, further comprising a controller arranged to carry out the estimating and the identifying on the fly.
51. The metrology system of claim 50, wherein the controller is arranged to estimate the functional dependency by curve fitting and to identify the at least one diffraction component with respect to curve parameters.
52. The metrology system of claim 50, wherein the controller is arranged to control aperture size by an aperture size determining instrument.
53. The metrology system of claim 48, calibrated according to the identifying at least one diffraction component of the functional dependency.

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54. The metrology system of claim 48, further arranged to refine the computational compensation by using the functional dependency to derive a second order correction term and adjust the at least one measurement parameter accordingly.
55. The metrology system of claim 48, further arranged to calibrate the correction term with respect to at least one difference between derivation conditions and measurement conditions, wherein the at least one difference relates to at least one of: wavelength, polarization, alignment with respect to a target, and focus.
56. The metrology system of claim 55, arranged to carry out the calibrating by expressing the functional dependency as relating to the at least one difference and deriving the correction term with further respect to a range of values of the at least one difference.
57. A computer program product comprising a computer readable storage medium having computer readable program embodied therewith, the computer readable program comprising:

computer readable program configured to estimate, quantitatively, a functional dependency of at least one measurement parameter on a size of at least one aperture in a metrology system;

computer readable program configured to identify at least one diffraction component of the functional dependency which relates to the size of the at least one aperture;

computer readable program configured to derive, from the at least one identified diffraction component, a correction term for the at least one measurement parameter with respect to measurement conditions, the measurement conditions comprising specified sizes of the at least one aperture that generate a diffraction error in the at least one measurement parameter; and

computer readable program configured to compensate, computationally, for the diffraction error by applying the derived correction term to the at least one measurement parameter.

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58. The computer program product of claim 57, wherein estimating the functional dependency is carried out by curve fitting and the identification is carried out with respect to curve parameters.
59. The computer program product of claim 57, further comprising computer readable program configured to refine the computational compensation by using the functional dependency to derive a second order correction term and adjust the at least one measurement parameter accordingly.
60. The metrology system of claim 57, further comprising computer readable program configured to calibrate the correction term with respect to at least one difference between derivation conditions and measurement conditions, wherein the at least one difference relates to at least one of: wavelength, polarization, alignment with respect to a target, and focus, the computer readable program further configured to carry out the calibrating by expressing the functional dependency as relating to the at least one difference and deriving the correction term with further respect to a range of values of the at least one difference.

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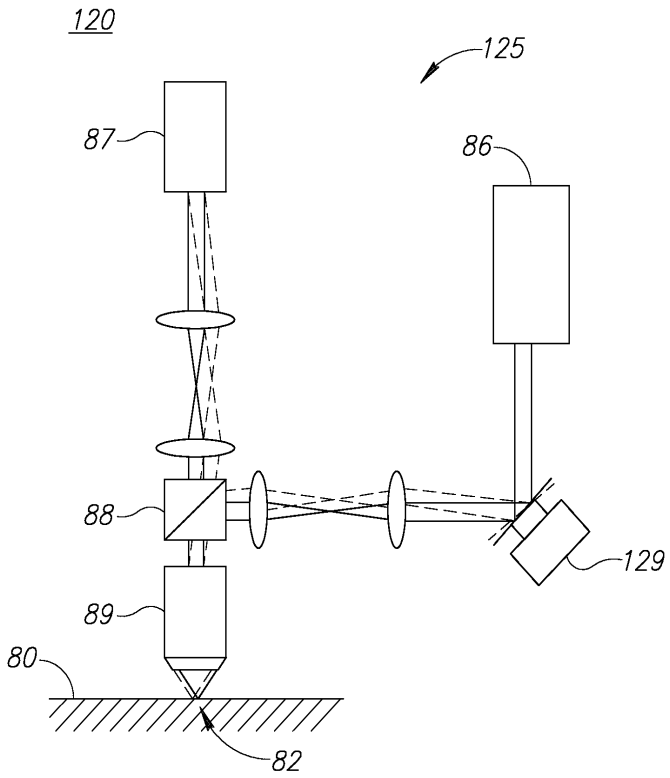


Figure 1

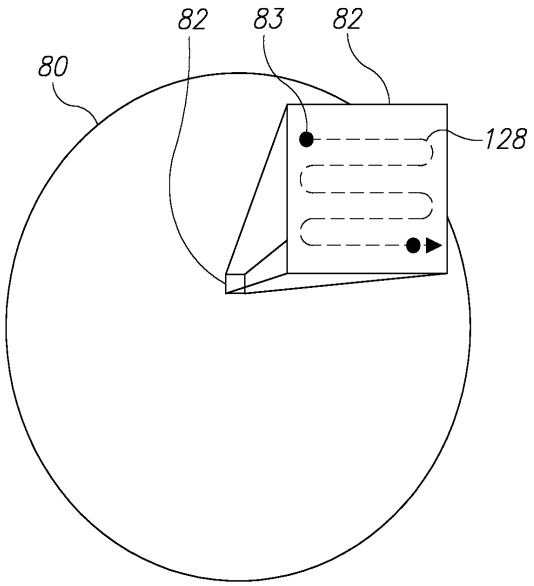


Figure 2

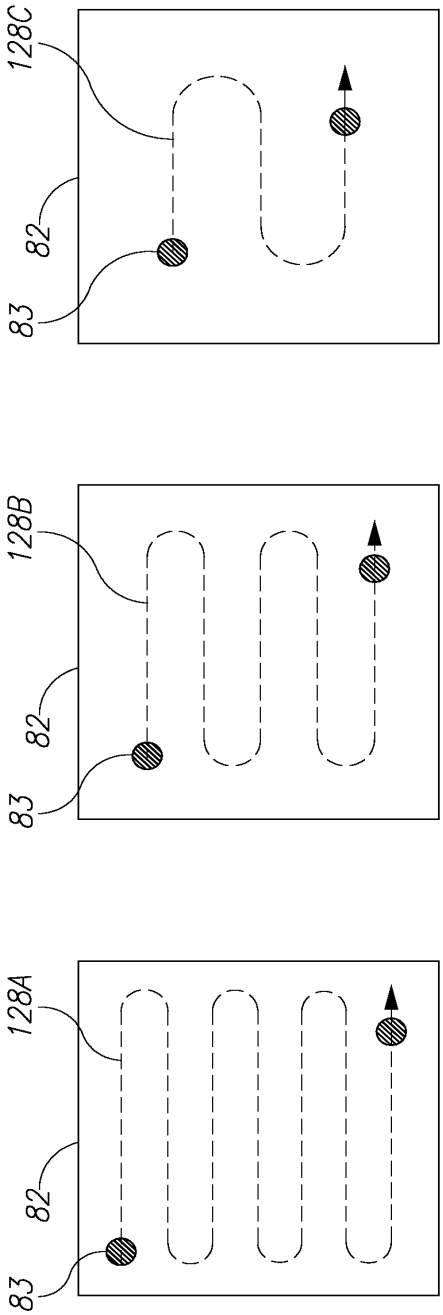


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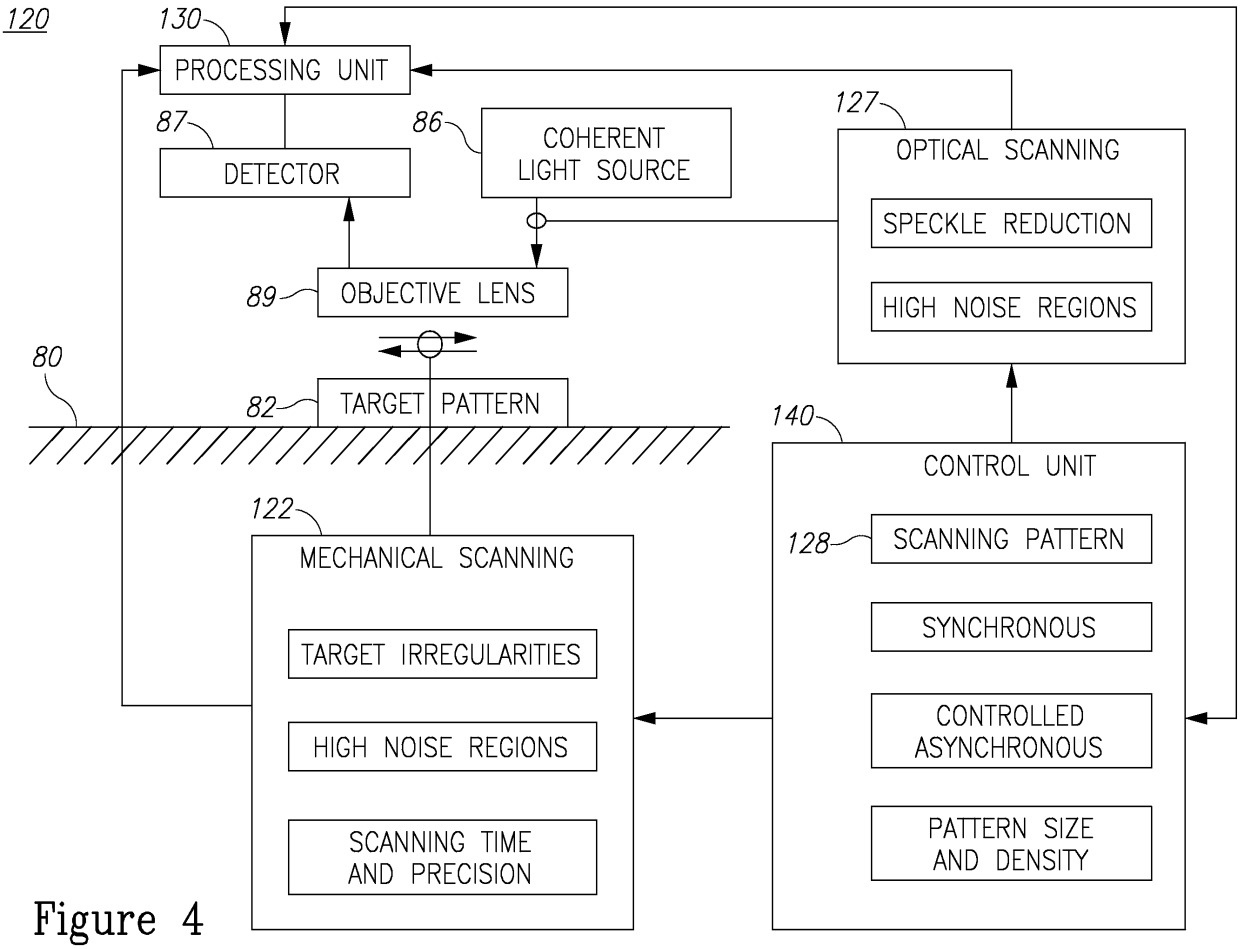

120
130
PROCESSING UNIT
87
DETECTOR
86
COHERENT LIGHT SOURCE
127
OPTICAL SCANNING
SPECKLE REDUCTION
HIGH NOISE REGIONS
89
OBJECTIVE LENS
80
82
TARGET PATTERN
140
CONTROL UNIT
122
MECHANICAL SCANNING
128
SCANNING PATTERN
SYNCHRONOUS
CONTROLLED ASYNCHRONOUS
PATTERN SIZE AND DENSITY
TARGET IRREGULARITIES
HIGH NOISE REGIONS
SCANNING TIME AND PRECISION

Figure 4

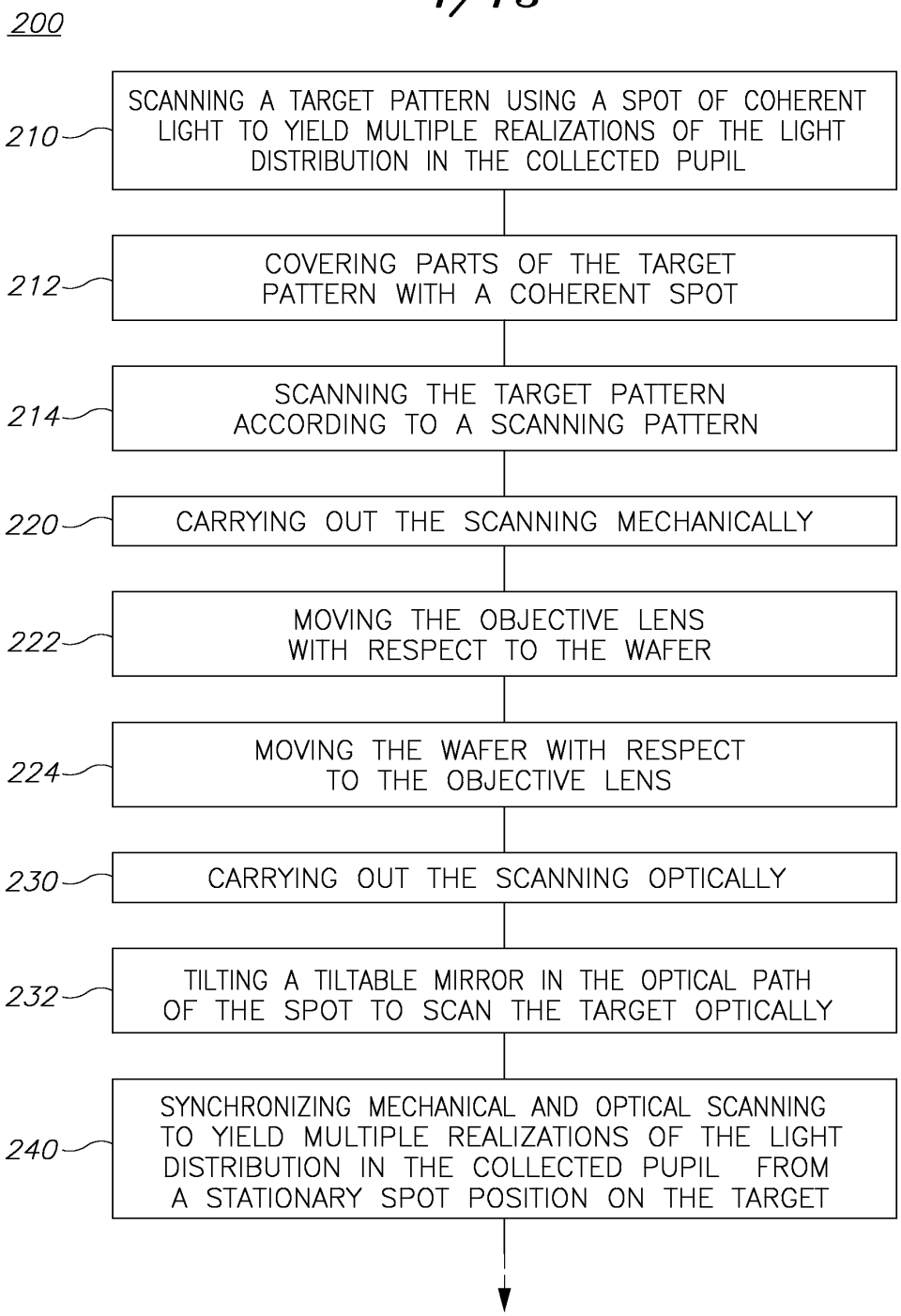

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210
SCANNING A TARGET PATTERN USING A SPOT OF COHERENT LIGHT TO YIELD MULTIPLE REALIZATIONS OF THE LIGHT DISTRIBUTION IN THE COLLECTED PUPIL
212
COVERING PARTS OF THE TARGET PATTERN WITH A COHERENT SPOT
214
SCANNING THE TARGET PATTERN ACCORDING TO A SCANNING PATTERN
220
CARRYING OUT THE SCANNING MECHANICALLY
222
MOVING THE OBJECTIVE LENS WITH RESPECT TO THE WAFER
224
MOVING THE WAFER WITH RESPECT TO THE OBJECTIVE LENS
230
CARRYING OUT THE SCANNING OPTICALLY
232
TILTING A TILTABLE MIRROR IN THE OPTICAL PATH OF THE SPOT TO SCAN THE TARGET OPTICALLY
240
SYNCHRONIZING MECHANICAL AND OPTICAL SCANNING TO YIELD MULTIPLE REALIZATIONS OF THE LIGHT DISTRIBUTION IN THE COLLECTED PUPIL FROM A STATIONARY SPOT POSITION ON THE TARGET

Figure 5

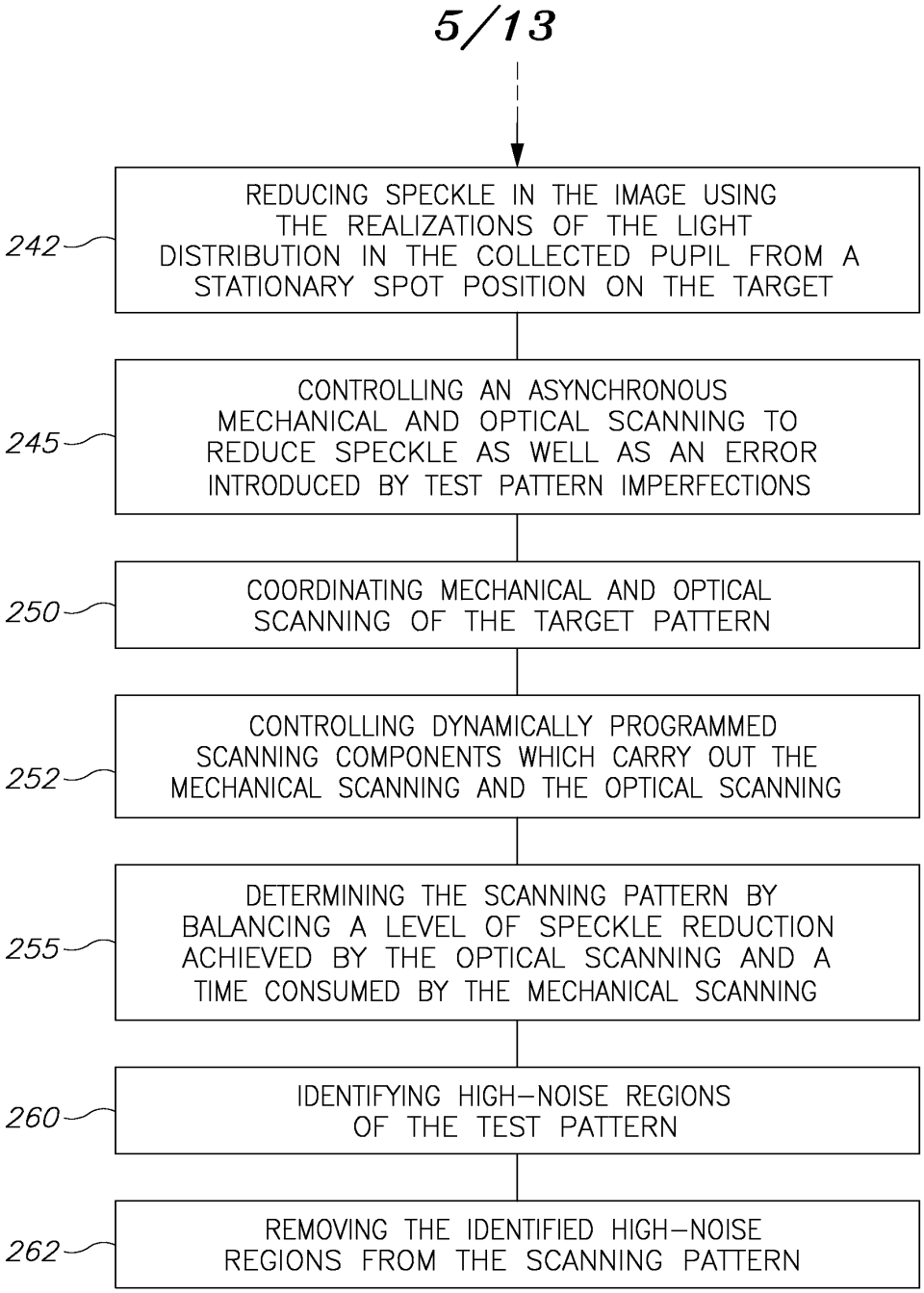


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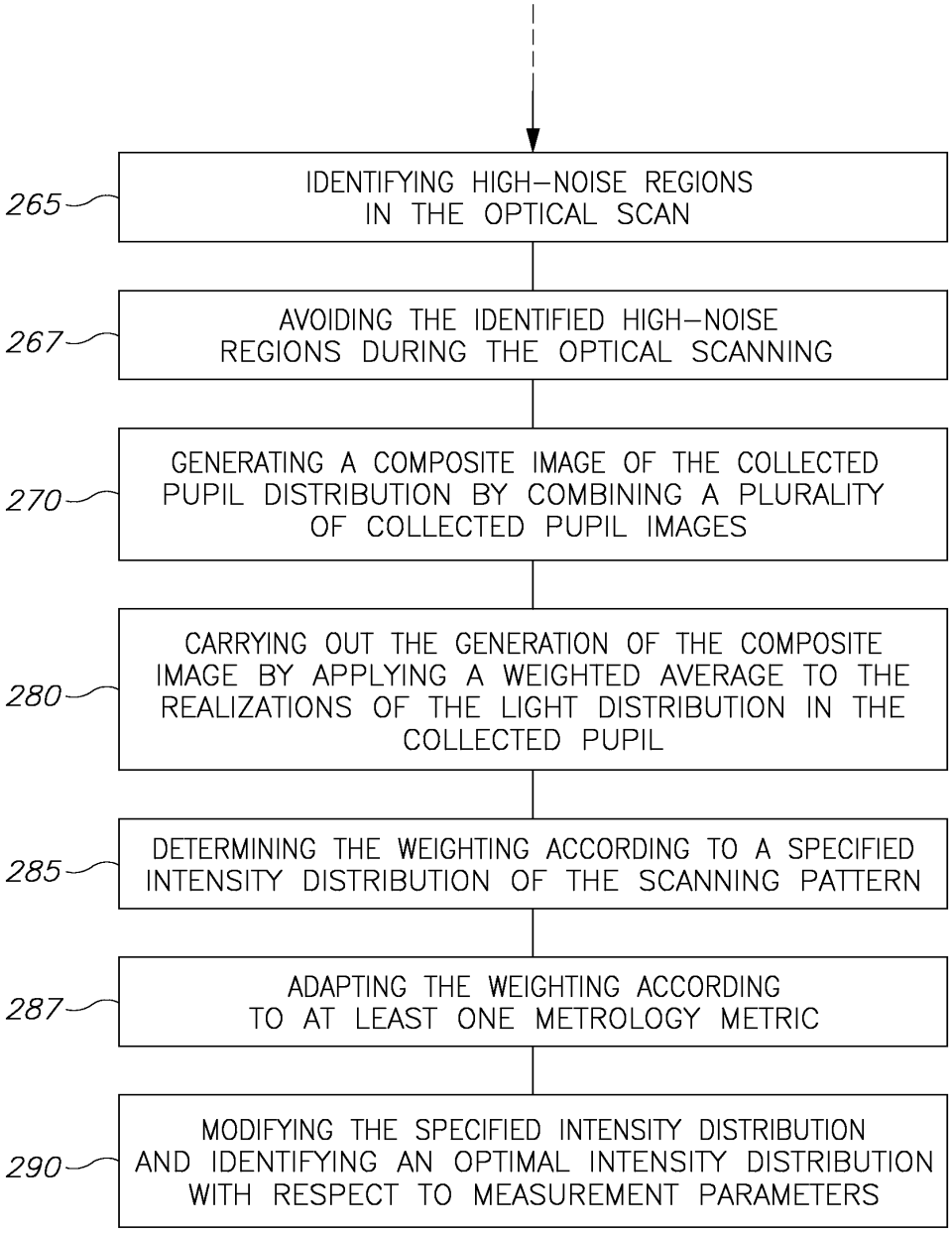


Figure 5 (cont. 2)

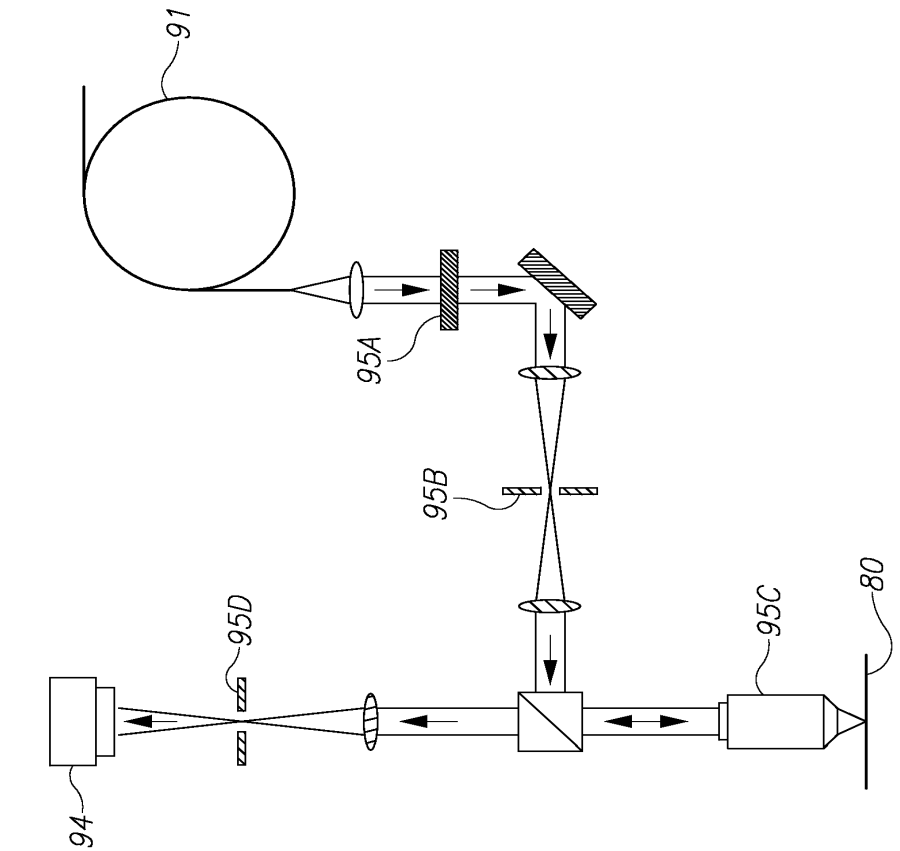


Figure 6
PRIOR ART

Figure 7

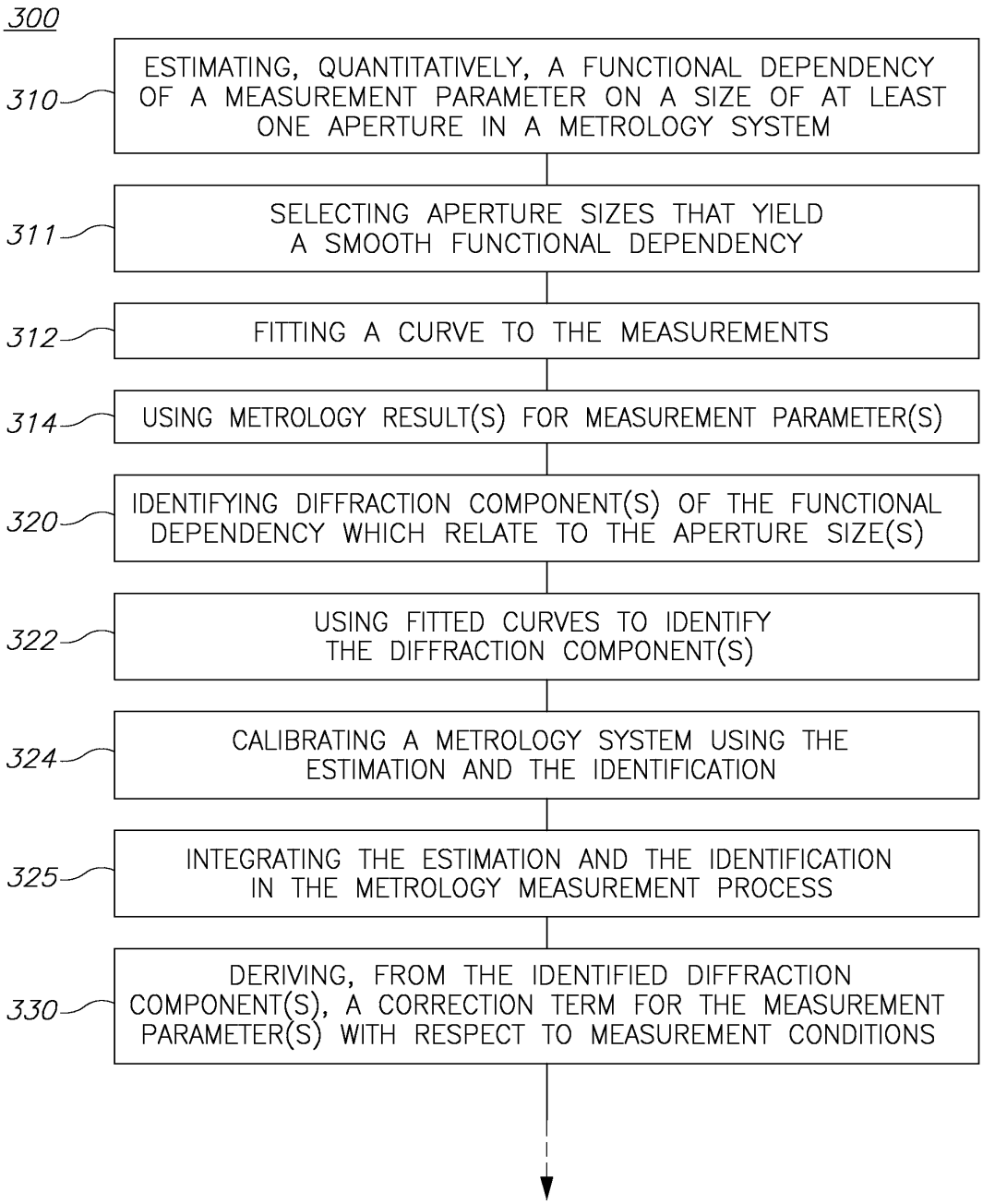

300
310
ESTIMATING, QUANTITATIVELY, A FUNCTIONAL DEPENDENCY OF A MEASUREMENT PARAMETER ON A SIZE OF AT LEAST ONE APERTURE IN A METROLOGY SYSTEM
311
SELECTING APERTURE SIZES THAT YIELD A SMOOTH FUNCTIONAL DEPENDENCY
312
FITTING A CURVE TO THE MEASUREMENTS
314
USING METROLOGY RESULT(S) FOR MEASUREMENT PARAMETER(S)
320
IDENTIFYING DIFFRACTION COMPONENT(S) OF THE FUNCTIONAL DEPENDENCY WHICH RELATE TO THE APERTURE SIZE(S)
322
USING FITTED CURVES TO IDENTIFY THE DIFFRACTION COMPONENT(S)
324
CALIBRATING A METROLOGY SYSTEM USING THE ESTIMATION AND THE IDENTIFICATION
325
INTEGRATING THE ESTIMATION AND THE IDENTIFICATION IN THE METROLOGY MEASUREMENT PROCESS
330
DERIVING, FROM THE IDENTIFIED DIFFRACTION COMPONENT(S), A CORRECTION TERM FOR THE MEASUREMENT PARAMETER(S) WITH RESPECT TO MEASUREMENT CONDITIONS

Figure 8

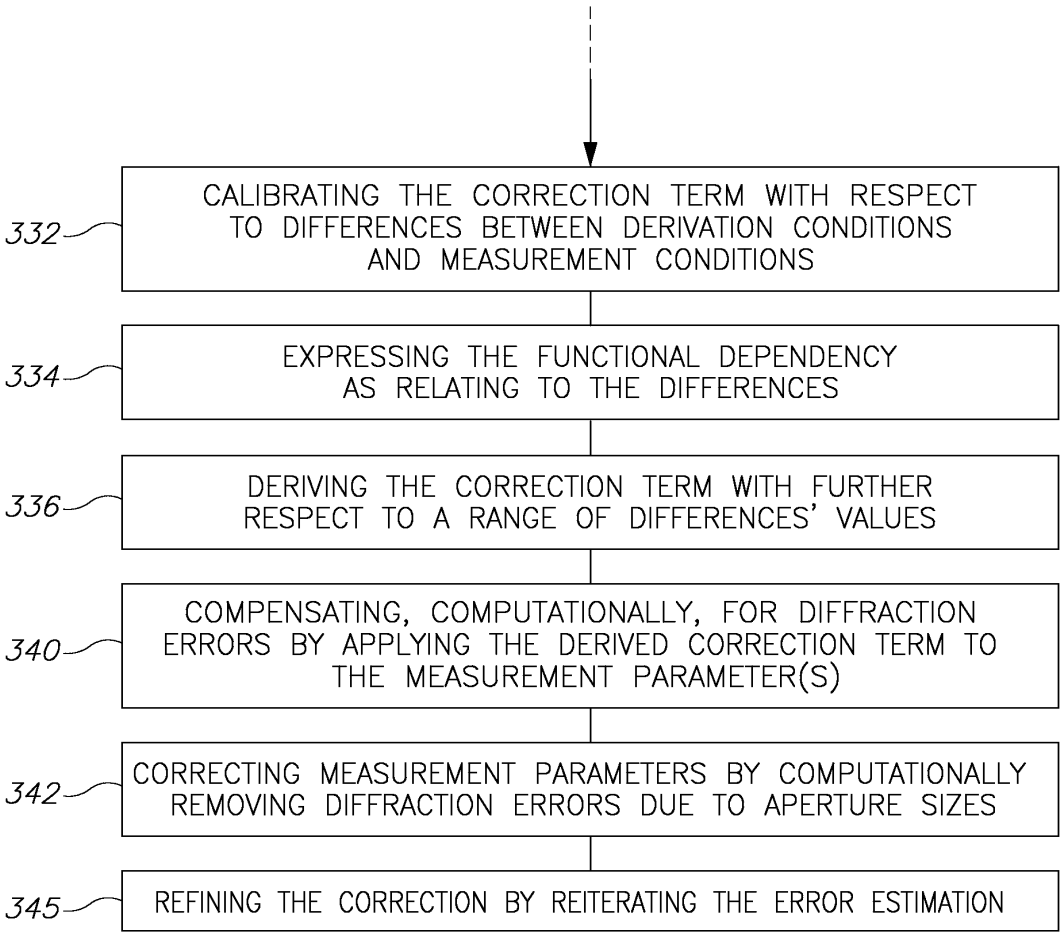


Figure 8 (cont. 1)

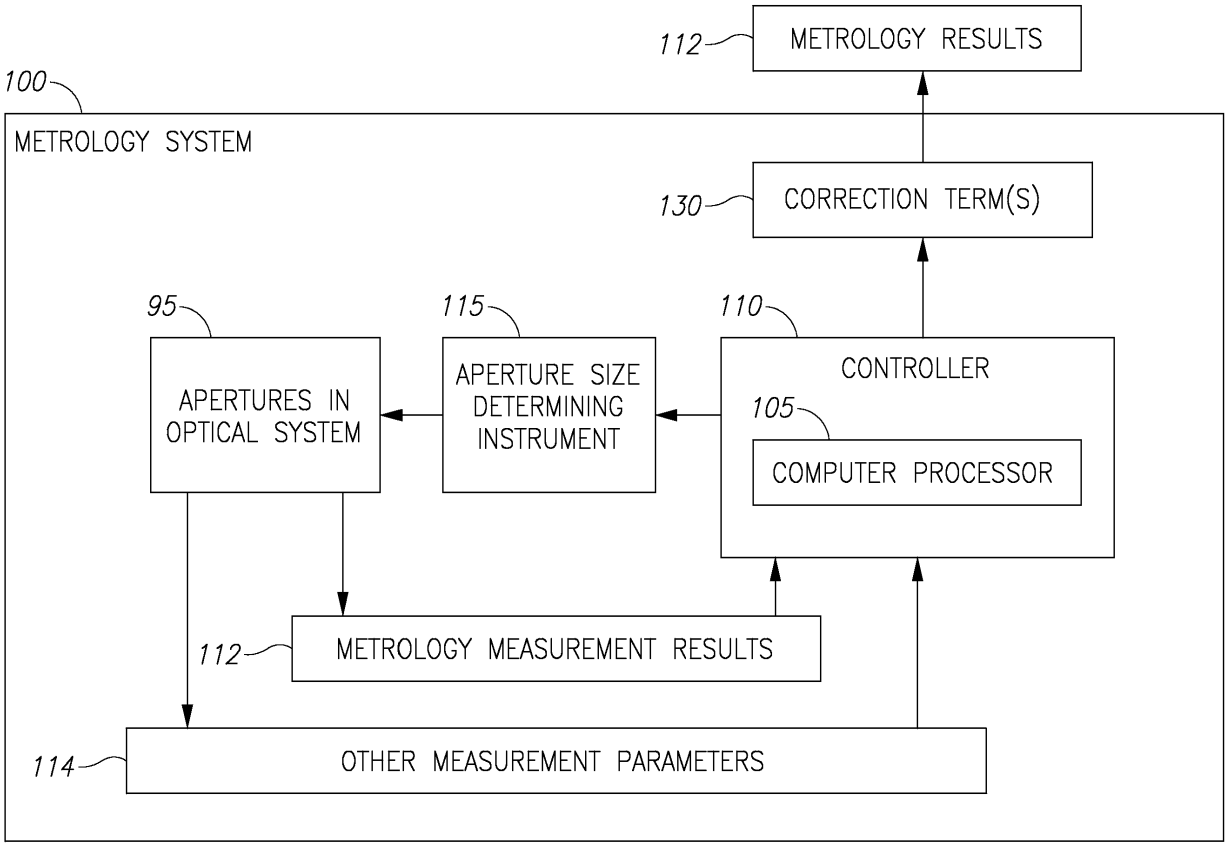

112
METROLOGY RESULTS
100
METROLOGY SYSTEM
130
CORRECTION TERM(S)
95
115
110
APERTURES IN OPTICAL SYSTEM
APERTURE SIZE DETERMINING INSTRUMENT
CONTROLLER
105
COMPUTER PROCESSOR
112
METROLOGY MEASUREMENT RESULTS
114
OTHER MEASUREMENT PARAMETERS

Figure 9

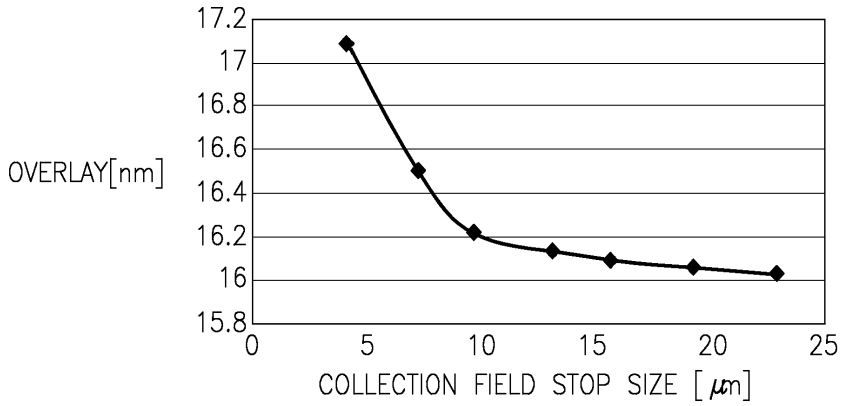


Figure 10A

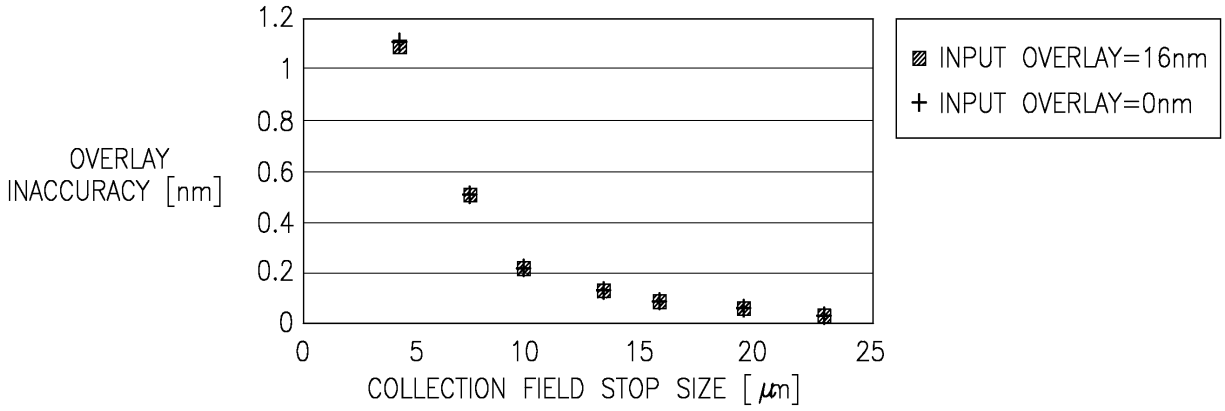


Figure 10B

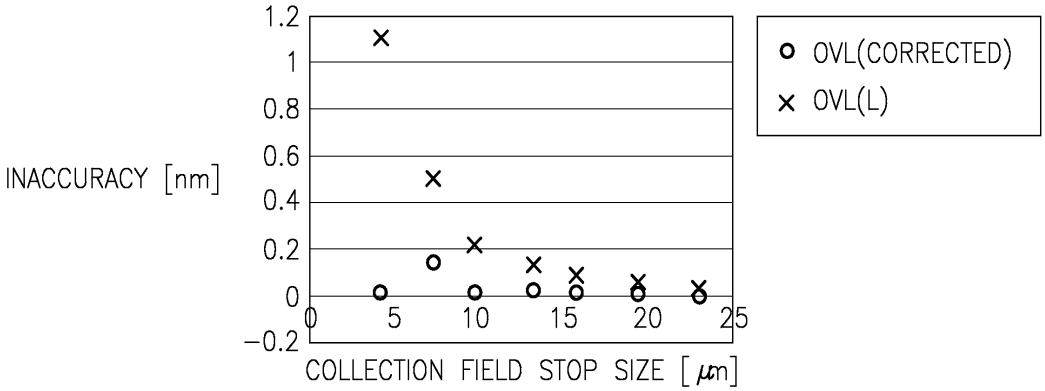


Figure 11A

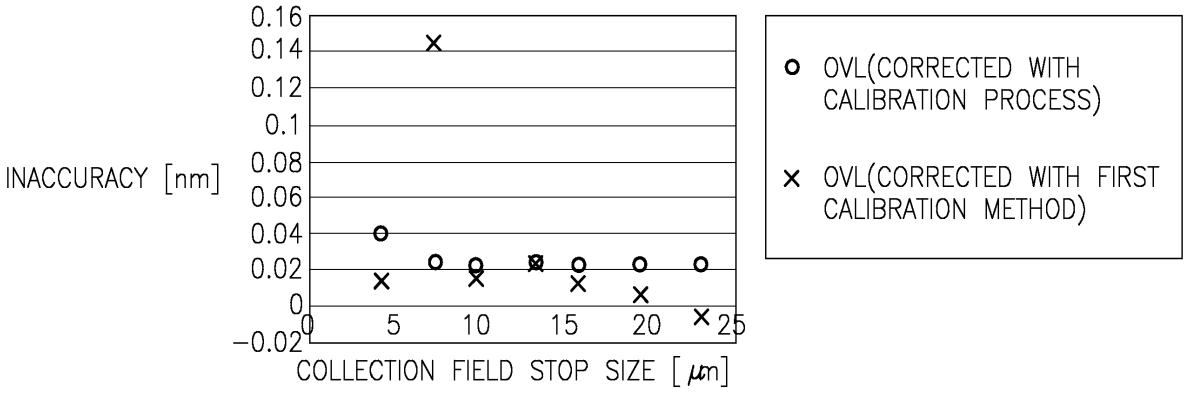


Figure 11B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/047691

A. CLASSIFICATION OF SUBJECT MATTER

H01L 21/66(2006.01)i

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)
H01L 21/66; H01L 21/268; G01R 31/26; G01N 21/88; G01N 21/47

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: reflectometer, light, scan, pattern, wafer and plural

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 2006-0250609 A1 (STEVEN W. MEEKS et al.) 09 November 2006 See abstract, paragraphs [0011]-[0029] and figures 1-3.	1-60
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Date of the actual completion of the international search	Date of mailing of the international search report
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International application No.
PCT/US2013/047691

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(21) International Application Number: PCT/EP98/03826

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(34) Countries for which the regional or international application was filed: CH et al.

(71) Applicant *(for all designated States except US)*: SOCIETE DES PRODUITS NESTLE S.A. [CH/CH]; P.O. Box 353, CH–1800 Vevey (CH).

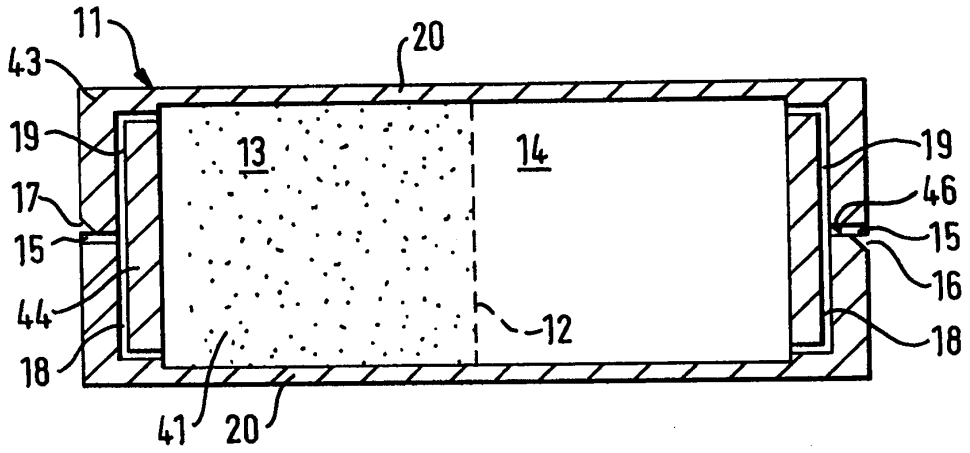
(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: YOAKIM, Alfred [FR/CH]; Avenue des Alpes 63, CH–1814 La Tour–de–Peilz (CH). MARILLER, Alain [CH/CH]; Les Tuileries, CH–1462 Yvonand (CH).

(74) Agent: THOMAS, Alain; Avenue Nestlé 55, CH–1800 Vevey (CH).

(81) Designated States: AL, AU, BA, BB, BG, BR, CA, CN, CU, CZ, EE, GE, HU, IL, IS, JP, KP, KR, LC, LK, LR, LT, LV, MG, MK, MN, MX, NO, NZ, PL, RO, SG, SI, SK, SL, TR, TT, UA, US, UZ, VN, YU, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, 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), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
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(54) Title: CLOSED FLEXIBLE SACHET



(57) Abstract

The invention relates to a closed flexible sachet (11) in the form of an individual portion provided for extraction under pressure, containg ground roast coffee (41), consisting of two identical flexible sheets or of a single folded flexible sheet of circular, oval or polygonal shape, creating a space for the coffee between the two sheets or between the two faces of the folded sheet (11), and the two sheets or the two faces of the folded sheet are welded over their periphery (20, 44) so that the said sachet is substantially symmetrical with respect to its welding plane, and the sachet is opened through the effect only of the rise in pressure which takes place upon injection of the extraction fluid, in which the two flexible sheets or the two faces of the folded sheet extend over one side of the said sachet beyond their welding line so as to provide, between the said sheets or between the two faces of the folded sheet, a channel (15) which allows the arrival of the extraction fluid, the said channel being substantially perpendicular to the welding line (44) on which it emerges.

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Closed flexible sachet

The invention relates to a closed flexible sachet in the form of an individual portion provided for extraction under pressure, containing at least one pulverulent substance for the preparation of a beverage chosen from ground roast coffee, tea, instant coffee, a mixture of instant coffee and ground coffee, a chocolate-type product or any other dehydrated edible substance, consisting of two identical flexible sheets or of a single folded flexible sheet of circular, oval or polygonal shape, creating a space for the pulverulent substance between the two sheets or between the two faces of the folded sheet, and the two sheets or the two faces of the folded sheet are welded over their periphery so that the said sachet is substantially symmetrical with respect to its welding plane, the material used for the flexible sheets is impermeable to oxygen and to water vapour in order to preserve it, and the sachet is opened through the effect only of the rise in pressure which takes place upon injection of the extraction fluid.

Patent WO 94/01344 already relates to a closed flexible sachet provided for extraction under pressure. With this sachet, at the time of extraction, one of the flexible sheets is perforated so as to allow the arrival of the extraction water. The drawback of perforating the sheet is that firstly it is necessary to guarantee the seal over the entire periphery of the sachet and, secondly, if the coffee in the sachet is not compacted, it is not always guaranteed that the said sachet will be perforated.

The object of the present invention is to develop a closed sachet provided for extraction under pressure, in which it is unnecessary to guarantee the seal over the entire periphery of the sachet at the time of extraction and which makes it possible to avoid perforating one of the two flexible sheets.

The present invention relates to a closed flexible sachet in the form of an individual portion

provided for extraction under pressure, according to the preamble of Claim 1, and in which the two flexible sheets or the two faces of the folded sheet extend over one side of the said sachet beyond their welding line so as to provide, between the said sheets or between the two faces of the folded sheet, a channel which allows the arrival of the extraction fluid, the said channel being substantially perpendicular to the welding line on which it emerges.

The presence of the channel between the two flexible sheets or between the two faces of the folded sheet makes it possible to insert therein a needle or any other sharp element allowing the extraction water to be supplied without perforating or tearing one of the flexible sheets. It is unnecessary for the needle or the sharp element to enter into the channel: it is also possible to envisage the arrival of the extraction water precisely at the entry of the said channel. In one or other alternative, the important thing is that, in the sachet according to the invention, the said sachet is not opened by inserting the needle or the sharp element to the extent of breaking the weld which closes the said sachet, but it is the pressurized water which initiates and completely opens the said weld of the sachet in order to allow the extraction liquid to enter. The water pressure is normally between 1 and 7 bar, i.e., in order to break the weld, a minimum pressure of water is required which allows the said weld to be opened up.

The method and the device which are used for the extraction of sachets according to the invention may advantageously be of the type which partially forms the subject of EP Patent Application Nos. 92107548 and 92112364. "Partially" is understood to mean that the device is used not for the arrival of the water but for the exit of the coffee. The lower face of the sachet is opened by localized ruptures after its deformation against the non-perforating and non-cutting raised and hollowed-out elements present on the lower face of the

device through the effect only of the rise in pressure which takes place upon injection of the extraction fluid.

The sachet according to the invention may be of square, rectangular, oval and other shapes. If the sachet is of rectangular shape, it has a width of approximately 2 to 15 cm, preferably of the order of 4-6 cm, and a length of from 6 to 20 cm. Depending on the size of the sachet, it is possible to envisage the extraction of a single cup or of several cups, for example of two cups. Once filled, the sachet has a thickness, at its centre, which is preferably between 5 and 20 mm. The measured amount of pulverulent substance contained may vary between 5 and 50 g, according to its use. The coffee is normally in the sachet in non-compacted form, which makes the said sachet relatively soft. It is, however, also possible to package compacted coffee. The depth of the arrival channel for the extraction fluid is normally from 3 to 10 mm and the diameter of this channel is also between 3 and 10 mm. The weld which closes the sachet normally has a depth of the order of 1 to 3 mm.

In order to accommodate the coffee on the flexible sheets or the folded flexible sheet, the sheets are moulded either by means of compression in a die/piston assembly, or by means of pressurization of the inner faces by a gas and/or suction of the outer faces. In both cases, the mould has the desired relief.

The sheets or the folded sheet may be made from flexible material such as aluminium with a thickness of from 5 to 40 microns or from plastic such as PET.

Preferably, the sheets will consist of a flexible, multi-layer material which is suitable for welding using customary methods whilst at the same time forming sufficient protection for the product against oxygen and water vapour. The following combination of materials is recommended:

- outer layer: PET (normal, woven or non-woven), PE, PP, PA, PS or paper;
- high-grade barrier central layer; aluminium with a thickness of between 5 and 20 microns, EVOH, PVDC, PET or PVA;
- inner layer: plastic, preferably PE or PP or OPP with welding lacquer. The seal is normally achieved at a temperature of between 180 and 250°C.

It is possible to envisage the following multi-layer combinations: PET-EVOH-PE or PET-aluminium-PE. The use of biodegradable or water-soluble material is also possible as a single layer or in combination with other material.

The sachet according to the invention is manufactured in the conventional manner by means of deformation by moulding or by drawing of the two flexible sheets or of the folded flexible sheet which are impermeable to oxygen and to water vapour, by measuring the amount of pulverulent substance onto one of the flexible sheets and by welding the two sheets or the two faces of the folded sheet over their periphery. The manufacturing operations are carried out under the protection of a stream of oxygen-free inert gas, for example under nitrogen or under CO_2.

The major advantage of the sachet according to the invention is that it allows the arrival of the extraction water via a small opening in the weld between the two flexible sheets or between the two faces of the folded sheet. In this context, it is possible to envisage several solutions. The channel between the two flexible sheets or between the two faces of the folded sheet may, in one version, emerge directly on the welding line and the extraction fluid then has a single path via which to arrive at the sachet. By contrast, if it is desired to improve the distribution of the flow into the bed of coffee, provision can be made for an arrival channel which is

subdivided, after the welding line of the two flexible sheets or of the two faces of the folded sheet, into at least two channels emerging at different points in the sachet: for example, in the case of a sachet for a single cup, two arrival channels are envisaged, and, in the case of a sachet for two cups, four arrival channels are envisaged.

In the sachet-extraction device, it is a sharp element which is engaged into the water-arrival channel. So as to guarantee satisfactory insertion of the said sharp element into the channel, provision is made on each flexible sheet or on each face of the folded sheet for a break at the location of the said channel, allowing separation of the said flexible sheets or of the said faces of the folded sheet at the moment the extraction device is pricked. In another embodiment, it is also possible to envisage offsetting the two faces of the folded sheet at the location of the channel. As already mentioned above, it is not obligatory for the sharp element to engage in the channel.

According to another embodiment of the sachet according to the invention, a tube, which is either adhesively bonded, or crimped or laid in position is placed in the extension of the channel. The advantage of this tube is that it facilitates the insertion of the sharp element.

At the moment of extraction of the sachet according to the invention, it is held in the extraction cavity and this guarantees satisfactory performance of the weld of the two flexible sheets. This performance is not guaranteed only at the location of the arrival channel for the extraction fluid, so that the pressure of the said fluid breaks the weld at this point, and only at this point, so as to allow the extraction water to enter into the sachet through this channel or the channels.

As already mentioned above, the sachet according to the invention needs a satisfactory seal

viz a viz the extraction fluid only at the location of the arrival channel. The consequence of this is that it facilitates the design of the extraction machine and therefore the latter's cost.

The remainder of the description is made with reference to the drawings, in which:

Fig. 1 is a plan view of a blank for manufacturing a sachet according to the invention;

Fig. 2 is a plan view of a blank in a second embodiment;

Fig. 3 is a diagrammatic plan view of the sachet during extraction;

Fig. 4 is a plan view of the sachet in a third embodiment;

Fig. 5 is a plan view of the sachet in a fourth embodiment;

Fig. 6 is a plan view of the sachet in a fifth embodiment;

Fig. 7 is a plan view of the sachet in a sixth embodiment; and

Fig. 8 is a plan view of the sachet in a seventh embodiment.

The blank (1) is a multi-layer flexible sheet based on aluminium, polyethylene and polypropylene, having a thickness of the order of 40 microns and which is foldable along the line (4). This sheet is thermoformed so as to create in it two cavities (2, 3) which make it possible to receive the ground roast coffee (40) therein. The flexible sheet is then folded along the line (4) and the two faces of the sheet are welded along the hatched lines (5, 42). This welding provides a channel (6) between the two faces, allowing the insertion of the sharp element for sachet extraction. In the case of Figure 1, there is a channel (6) emerging directly onto the bed of coffee. At the moment of use of the sachet, the water arrives via the said channel and the pressure of this water makes it possible to break the seal (45). To facilitate the insertion of the said sharp element, provision is made

for breaks (7, 8) on the two faces of the flexible sheet (1), which makes it possible, when the edge is pinched in the extraction device, satisfactorily to open up the opening of the channel (6). In the case of the figure, there is a sachet, for two cups, which has a width of 4.5 cm and a length of 9 cm in the case of each cavity (2, 3). The border (10) of the sachet which goes beyond the weld (42) has a width of from 2 to 4 cm.

In the case of Figure 2, there is a sheet (11) based on the same composite as for Figure 1, the said sheet being foldable along the line (12). It includes cavities (13, 14) for the ground roast coffee (41). The sheet is then folded over and welded along the hatched zones (20, 44) and a channel (15) is made in it which is subdivided into two channels (18, 19), allowing the water for extraction to arrive at two different points in the bed of coffee. When the water arrives, it breaks the weld in the zone (46) and thus allows sachet extraction. The breaks (16, 17) permit satisfactory opening of the channel (15) at the moment of extraction. The border (43) which goes beyond the weld (44) has a width of from 2 to 4 cm.

Figure 3 shows a sachet (20) of more oval shape, with its measured amount of coffee (21). The weld also appears in the form of hatched zones (22). The welding zone (23) forms the separation between the channel (24) and the bed of coffee (21). The sharp element (25) is displaced between its guides (26) from a set-back position to a position of engagement in the channel (24). It is from this moment onwards that the extraction fluid arrives at a pressure of between 1 and 3 bar and breaks the weld (23). The pressure in the sachet increases and the lower face of the said sachet presses against raised and hollowed-out elements which are diagrammatically represented at (27), until the said face tears at the locations of the said raised and hollowed-out elements so as to allow the coffee to flow into the cup placed beneath the extraction device.

Figure 4, finally, shows a sachet (30) which has a measured amount of coffee (31) with a weld (32), the weld (33) forming the separation between the measured amount of coffee and the channel (31) for the arrival of the extraction fluid. In this channel, provision is made for a tube (34), allowing satisfactory insertion of the sharp element.

Figure 5 shows a sachet (47) obtained from a folded-over sheet, which gives two faces (56, 57). This sachet is provided for a single cup of coffee with one measured amount of coffee (49). The weld appears in the form of hatched zones (50, 51). The welding zone (52) forms the separation between the channel (53) and the bed of coffee (49). After the weld (52), the channel (53) is subdivided into two channels (54, 55), so that the water satisfactorily moistens the coffee at two different locations. At the moment of extraction of the sachet (47), the offset of the two sheets (56, 57) allows satisfactory opening-up of the channel (53) to permit satisfactory positioning of the water-arrival channel on the said channel (53). The extraction fluid arrives at a pressure of between 1 and 4 bar and breaks the weld (52). The water then flows into the sachet and the pressure in the sachet increases, and the lower face of the said sachet presses against raised and hollowed-out elements represented diagrammatically at (58) until the said face tears at the locations of the said raised and hollowed-out elements so as to allow the coffee to flow into the cup placed beneath the extraction device.

Figure 6 shows a sachet (48) which makes it possible to prepare two cups of coffee with a measured amount of coffee (69) and a measured amount (70). The weld appears in the form of hatched zones (61, 62, 63). The welding zone (72) forms the separation between the channel (71) and the bed of coffee (69). After the weld (72), the channel (71) is subdivided into three channels: the two channels (64, 65) firstly allowing the extraction water to progress onto the bed of coffee

(69) and, secondly, a third channel (66) allowing the water to progress towards the second bed of coffee (70). This channel (66) is then itself subdivided into two channels (67, 68). At the moment the sachet is used, the extraction fluid arrives via the channel (71) at a pressure of between 1 and 4 bar and breaks the weld (72). The pressure in the sachet increases and the lower face of the said sachet presses against the raised and hollowed-out elements represented diagrammatically at (59, 60) until the said face tears at the locations of the said raised and hollowed-out elements so as to allow the coffee to flow into the two cups placed beneath the extraction device.

Figure 7 shows a sachet (73) obtained from a folded-over sheet giving two faces (74, 75). This sachet is provided for two cups of coffee with measured amounts of coffee (99, 100). The weld appears in the form of hatched zones (76, 77, 78). The welding zone (81) forms the separation between the channel (86) and the beds of coffee (99, 100). After the weld (81), the channel (86) subdivides into four channels: two channels (82, 83) for the bed of coffee (99) and two channels (84, 85) for the bed of coffee (100). At the moment of extraction of the sachet (73), the offset of the two sheets (74, 75) allows satisfactory opening-up of the channel (86) to allow satisfactory positioning of the water-arrival channel on the said channel (86). The extraction fluid arrives at a pressure of between 1 and 4 bar and breaks the weld (81). The water then flows into the sachet and the pressure in the sachet increases and the lower face of the said sachet presses against the raised and hollowed-out elements represented diagrammatically at (79, 80) until the said face tears at the locations of the said raised and hollowed-out elements so as to allow the coffee to flow into the two cups placed beneath the extraction device.

Figure 8 shows a sachet (87) which makes it possible to prepare two cups of coffee with one measured amount of coffee (101). The weld appears in

the form of hatched zones (88, 89, 90, 91). The welding zone (92) forms the separation between the channel (93) and the bed of coffee (101). After the weld (92), the channel (93) subdivides into three channels: the first two (94, 95) lead directly to the bed of coffee (101), and the third (96) conveys the water towards the bottom of the sachet. At the bottom of the sachet, it subdivides again into two channels (97, 98). In this embodiment, the water arrives at four points on the bed of coffee, which allows satisfactory moistening of the said coffee and satisfactory extraction from the sachet.

It is well understood that the sachet according to the invention may be manufactured either from two flexible sheets or from a single folded flexible sheet. The advantage of this second solution is that it dispenses with one welding zone and thus reduces the risks of a defective seal in the sachet according to the invention.

Explanation of the abbreviations:

PVDC	=	polyvinylidene chloride
EVOH	=	copolymer of ethylene and vinyl alcohol
PP	=	polypropylene
PE	=	polyethylene
PET	=	polyester
PA	=	polyamide
PS	=	polystyrene
OPP	=	oriented polypropylene
PVA	=	polyvinylacetate

Claims

1. Closed flexible sachet in the form of an individual portion provided for extraction under pressure, containing at least one pulverulent substance for the preparation of a beverage chosen from ground roast coffee, tea, instant coffee, a mixture of instant coffee and ground coffee, a chocolate-type product or any other dehydrated edible substance, consisting of two identical flexible sheets or of a single folded flexible sheet of circular, oval or polygonal shape, creating a space for the pulverulent substance between the two sheets or between the two faces of the folded sheet, and the two sheets or the two faces of the folded sheet are welded over their periphery so that the said sachet is substantially symmetrical with respect to its welding plane, the material used for the flexible sheets is impermeable to oxygen and to water vapour in order to preserve it, and the sachet is opened through the effect only of the rise in pressure which takes place upon injection of the extraction fluid, characterized in that the two flexible sheets or the two faces of the folded sheet extend over one side of the said sachet beyond their welding line so as to provide, between the said sheets or between the two faces of the folded sheet, a channel which allows the arrival of the extraction fluid, the said channel being substantially perpendicular to the welding line on which it emerges.

2. Sachet according to Claim 1, characterized in that the material for the flexible sheets or for the folded sheet is chosen from aluminium, PET, PE, PP, PA, PS, paper, EVOH, PVDC and PVA, the said sheets being single-layer or multi-layer sheets.

3. Sachet according to one of Claims 1 or 2, characterized in that the channel emerges directly on the welding line.

4. Sachet according to one of Claims 1 or 2, characterized in that the channel is subdivided after the welding line into at least two channels emerging at different points of the sachet.

5. Sachet according to one of Claims 1 to 4, characterized in that, in the extension of the channel, each flexible sheet or each face of the folded sheet comprises a break allowing a separation of the said flexible sheets.

6. Sachet according to one of Claims 1 to 4, characterized in that, in the extension of the channel, each sheet is offset to allow a separation of the said flexible sheets.

7. Sachet according to Claim 1, characterized in that the channel comprises a tube which is adhesively bonded, crimped or laid in position.

8. Sachet according to one of Claims 1 to 7, characterized in that the weld of the two flexible sheets or of the folded sheet is such that it opens under an injection-fluid pressure of between 1 and 7 bar.

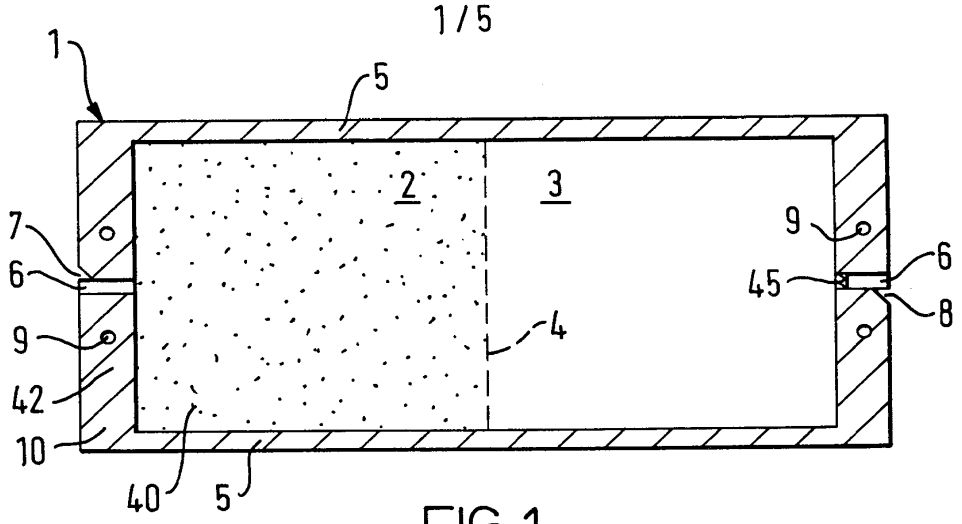

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FIG.1

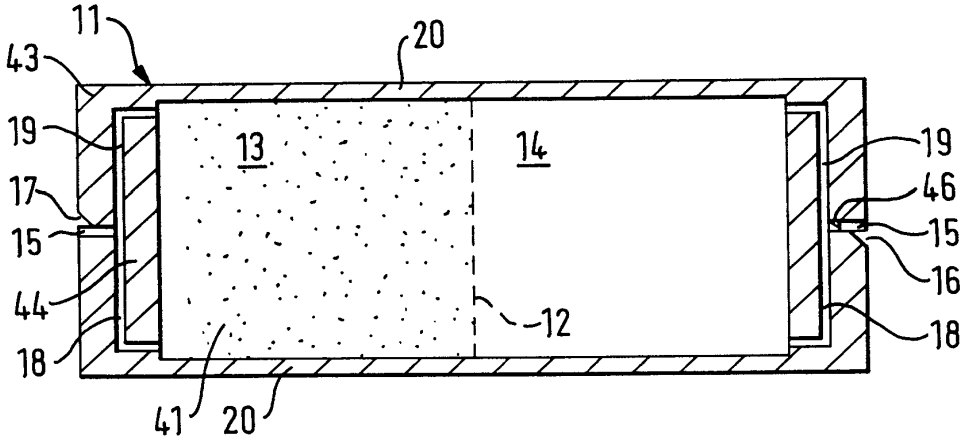

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FIG. 2

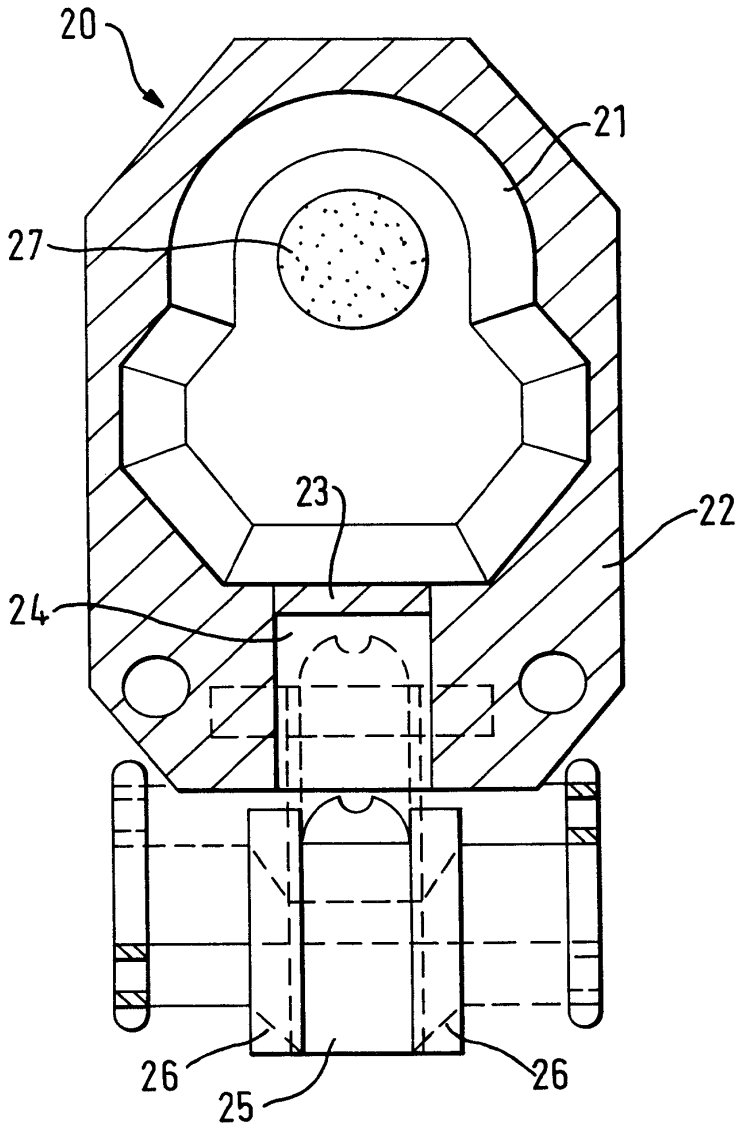


FIG. 3

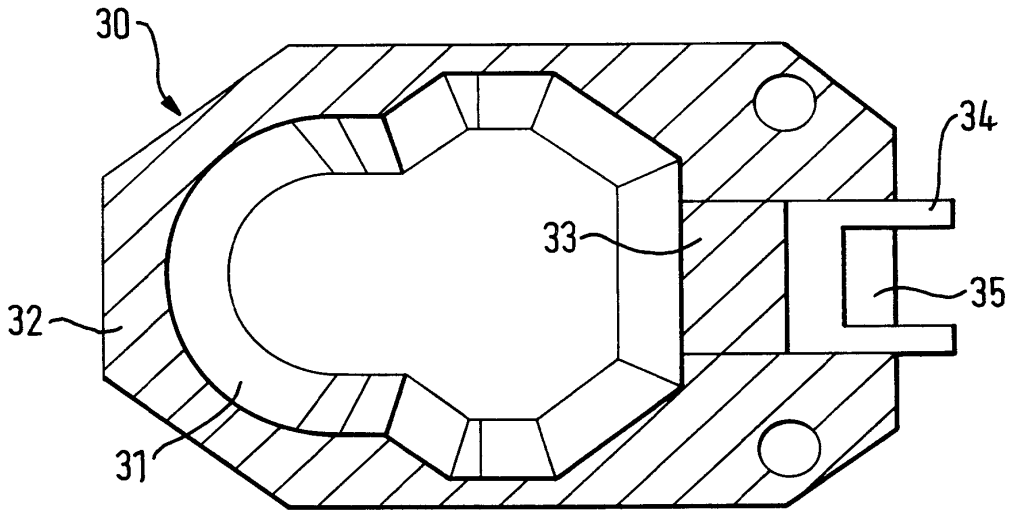


FIG. 4

K-FEE SYSTEM GMBH, EX2012, page 2355
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

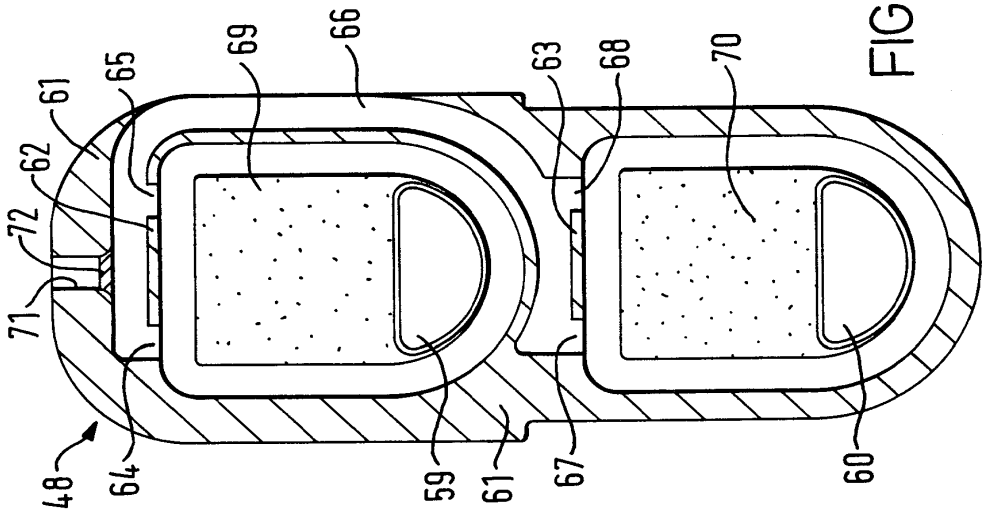

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FIG. 6

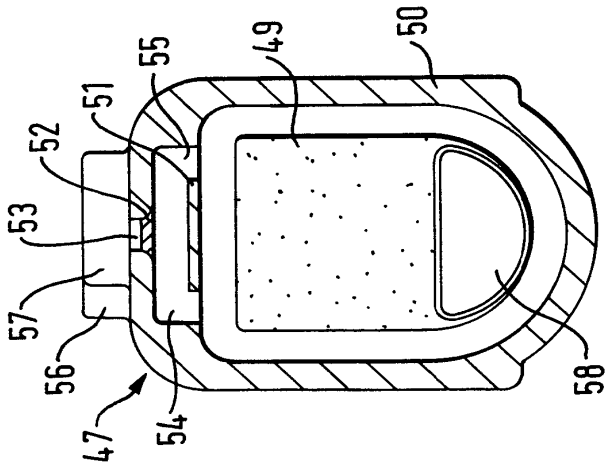

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FIG. 5

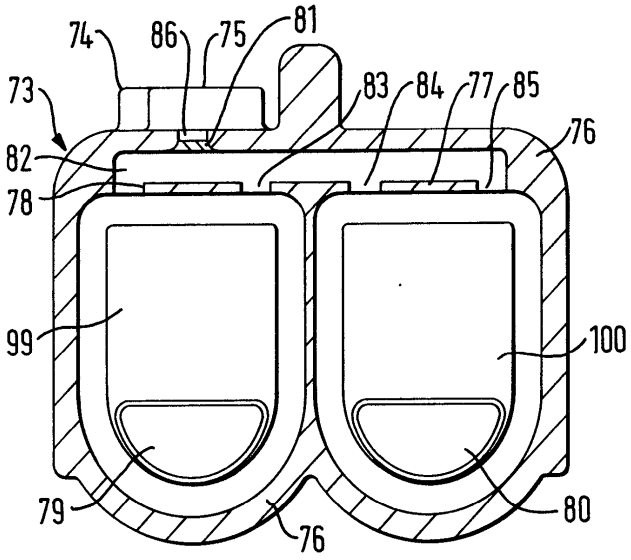


FIG. 7

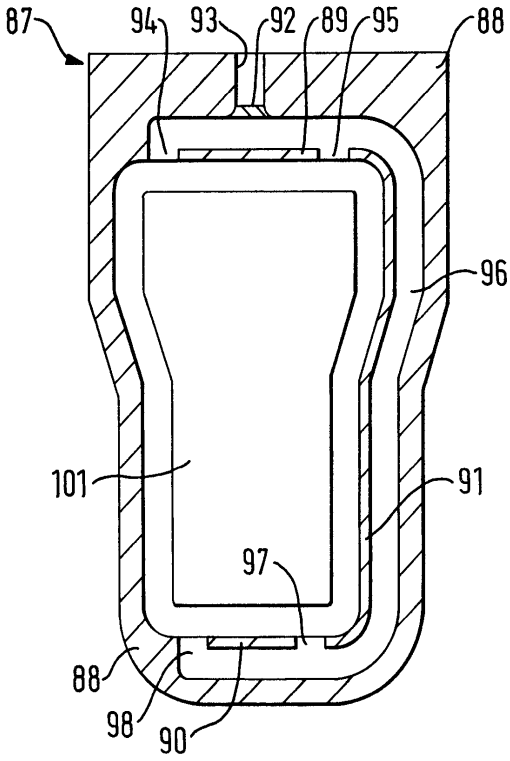


FIG. 8

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

INTERNATIONAL SEARCH REPORT

Ir .ational Application No
PCT/EP 98/03826

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 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 6 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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 228 374 A (TCHAKIRIAN) 29 November 1974 see page 2, line 7 - line 26; figures 1,2	1
A	GB 2 215 189 A (MARS) 20 September 1989 see page 1, line 32 - page 3, line 8; figure	1
A	US 4 220 259 A (LAGNEAX) 2 September 1980 see column 3, line 7 - column 4, line 29; figures	1

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

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
15 October 1998	26/10/1998

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	Newell, P

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Ir ational Application No
PCT/EP 98/03826

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2228374 A	29-11-1974	NONE	
GB 2215189 A	20-09-1989	NONE	
US 4220259 A	02-09-1980	BR 7808603 A	28-08-1979
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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

Electronic Patent Application Fee Transmittal

Application Number:	17383951
Filing Date:	23-Jul-2021
Title of Invention:	PORTION CAPSULE HAVING AN IDENTIFIER
First Named Inventor/Applicant Name:	Marc KRÜGER
Filer:	Paul J. Palinski/BECKY BALLARD
Attorney Docket Number:	1859.029USC10

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	260	260
		Total in USD ($)		**260**

Electronic Acknowledgement Receipt	
EFS ID:	44443489
Application Number:	17383951
International Application Number:	
Confirmation Number:	6871
Title of Invention:	PORTION CAPSULE HAVING AN IDENTIFIER
First Named Inventor/Applicant Name:	Marc KRÜGER
Customer Number:	25215
Filer:	Paul J. Palinski/BECKY BALLARD
Filer Authorized By:	Paul J. Palinski
Attorney Docket Number:	1859.029USC10
Receipt Date:	06-DEC-2021
Filing Date:	23-JUL-2021
Time Stamp:	18:09:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$260
RAM confirmation Number	E2021B6I09254414
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		NFOA_Response_1859_029USC10.pdf	159032 a07ed875b5a97f2668342e6f26a696852567e936	yes	12
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Claims		2	9	
	Applicant Arguments/Remarks Made in an Amendment		10	12	
Warnings:					
Information:					
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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.

Filed via EFS @ USPTO.gov on December 6, 2021
Practitioner's Docket No. 1859.029USC10 (KRU0022-WO-US-T11)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Marc KRÜGER	Art Unit: 3761
Application No.: 17/383,951	Examiner: Brian W. Jennison
Filed: July 23, 2021	Conf. No.: 6871

For: PORTION CAPSULE HAVING AN IDENTIFIER

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

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Applicant submits this statement in accordance with its duty of disclosure under 37 C.F.R. §§ 1.56, 1.97, and 1.98. The submission made herewith is in no way intended as an admission that the cited items constitute material prior art or otherwise would render the claims unpatentable in any way. The submission also is in no way intended to substitute for the Examiner's own independent investigation.

Copies of foreign patent documents and non-patent literature, together with a listing on form PTO/SB/08a are submitted herewith.

This Information Disclosure Statement is being submitted after the mailing of a first Office Action and before a Notice of Allowance. A fee of $260.00 is believed to be due; however, if any additional fee is due with the filing of this paper, please charge the amount to Deposit Account 50-1097.

Date: December 6, 2021

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17/383,951
	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
	Art Unit	3761
	Examiner Name	TBA
	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
	Art Unit	3761
	Examiner Name	TBA
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	Application Number	17/383,951
	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
	Art Unit	3761
	Examiner Name	TBA
	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

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	Examiner Name	TBA
	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

	34.	IS THERE A SERIOUS PROBLEM WITH COFFEE CAPSULES? https://www.bbc.com/news/magazine-35605927	
	35.	FRESHNESS INDICES OF ROASTED COFFEE https://www.researchgate.net/publication/26211090_Freshness_Indices_of_Roasted_Coffee_Monitoring_the_Loss_of_Freshness_for_Single_Serve_Capsules_and_Roasted_Whole_Beans_in_DifferentPackaging	
	36.	COMPARATIVE LIFE CYCLE ASSESSMENT https://uwspace.uwaterloo.ca/bitstream/handle/10012/12860/Li_Jingxi.pdf?sequence=5&isAllowed=Y	
	37.	SCHNITT-, STANZ- UNO ZIEHWERKZEUGE https://books.google.ch/books?id=-qCnBgAAQBAJ&pg=PA386&dq=tiefziehen+aluminiumblech&hl=en&sa=X& ved=2ah U KEwj HybqNx6L v Ah U DwKQKHSNsAbEQ6AEwA XoECAgQAg#v=onepage&q=tiefziehen%20aluminiumblech&f=false	
	38.	THERMO-MECHANICAL PROCESSING OF METALLIC MATERIALS https://books.google.ch/books?id=VE20YVDTBZUC&pg=PA370&dq=%22deep+drawing%22+%22aluminium+sheet%22&hl=fr&sa=X&ved=2ah U KEwj3ouSI0qL v AhWQyqQKH RbqD?YQ6AEwBHoECAUQAg#v=onepage&q=%22deep%20drawing%22%20%22aluminium%20sheet%22&f=false	
	39.	PACKAGING: SPECIFICATIONS https://books.google.ch/books?id=N1 TLbP9CiDUC&pg=PA265&Ipg=PA265&dq=aluminum+can+barcode+print++varnish&source=bl&ots=rJuPKZptU3&sig=ACfU3U0KHflM3Wh2Gw0zEblq7DDXt5TQxQ&hl=en&sa=X&ved=2ahUKEwjW0NmK64LvAhVnCWMBHRIYCloQ6AEwEXoECA0QAw#v=onepage&q=aluminum%20can%20barcode%20print%20%20varnish&f=fAlse	
	40.	IMPROVING TRACEABILITY IN FOOD PROCESSING AND DISTRIBUTION https://books.google.ch/books?id=v75QAwAAQBAJ&gg=PA209&dg=barcode+ink+gackaging+food&hl=fr&sa=X&ved=2ahUKEwiQ2JjVvKjvAhUDIMUKHU3gDPYQ6AEwBHoECAYQAg#v=oneQage&g=barcode%20ink%20gackaging%20food&f=false	
	41.	FOOD PACKAGING https://books.google.ch/books?id=NFRR6GayR74C&pg=PA2	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17/383,951
	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
	Art Unit	3761
	Examiner Name	TBA
	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

		65&dq=welding+plastic+packaging+food&hl=fr&sa=X&ved=2 ahUKEwiwhqff1 KPvAhWMl4sKHRXUDls4HhDoATACegQIB BAC#v=onepage&q=welding%20plastic%20packaging%20fo od&f=false	
	42.	COFFEE LOVE https://books.google.ch/books?id=0OxRp3jlQlsC&pg=PA 14& dq=coffee+capsu les& hl=fr &sa=X& ved=2ah U KEwj F0qvMk6X vAhWTBGMBHYddCp04ChDoATAlegQIAhAC#v=onepage& Q=coffee%20capsules&f=false	
	43.	STRUCTURAL DESIGN PROCEDURE https://books.google.ch/books?id=4L64mKIG_ 4UC&pg=PA 1 &dq=%22corrugated+plasti c%22&h l=fr&sa=X& ved=2ah U KE wjlcz6uaXvAhWRzaQKHcQpAF4O6AEwAnoECAMQAg# v=onepage&q=%22corrugated%20plastic%22&f=false	
	44.	PACKAGE ENGINEERING https://books.google.ch/books?id=DydNAAAA YAAJ&q=%22c orrugated+plastic%22&dq=%22corrugated+plastic%22&hl=fr &sa=X& ved=2ah U KEwiq296WvaXv Ah WI POwKHfcaDrk4KBD oATAGeQOIBBAC	

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.			

K-FEE SYSTEM GMBH, EX2012, page 2379
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/383,951	07/23/2021	Marc KRÜGER	1859.029USC10	6871

25215 7590 12/10/2021

The Dobrusin Law Firm P.C.
29 W. Lawrence Street
Suite 210
Pontiac, MI 48342

EXAMINER
JENNISON, BRIAN W

ART UNIT	PAPER NUMBER
3761	

NOTIFICATION DATE	DELIVERY MODE
12/10/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

dobrusin_PAIR@firsttofile.com
patmail@patentco.com
rmasquelier@patentco.com

K-FEE SYSTEM GMBH, EX2012, page 2380
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

Applicant-Initiated Interview Summary	**Application No.** 17/383,951	**Applicant(s)** KRÜGER, Marc		
	Examiner BRIAN W JENNISON	**Art Unit** 3761	**AIA (First Inventor to File) Status** No	**Page** 1 of 1

All Participants (applicant, applicants representative, PTO personnel)	**Title**	**Type**
BRIAN W JENNISON	Primary Examiner	Telephonic
PAUL PALINSKI	Attorney	

Date of Interview: 06 December 2021

Issues Discussed:

35 U.S.C. 112

It was suggested to amend the insertion shaft limitation in the independent claims. It was also suggested to cancel claims 22-23.

/BRIAN W JENNISON/ Primary Examiner, Art Unit 3761	

Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04
Please further see:
MPEP 713.04
Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)
37 CFR § 1.2 Business to be transacted in writing

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

K-FEE SYSTEM GMBH, EX2012, page 2381
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

25215 7590 12/20/2021

The Dobrusin Law Firm P.C.
29 W. Lawrence Street
Suite 210
Pontiac, MI 48342

EXAMINER
JENNISON, BRIAN W

ART UNIT	PAPER NUMBER
3761	

DATE MAILED: 12/20/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/383,951	07/23/2021	Marc KRÜGER	1859.029USC10	6871

TITLE OF INVENTION: PORTION CAPSULE HAVING AN IDENTIFIER

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	03/21/2022

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PTOL-85 (Rev. 02/11)

K-FEE SYSTEM GMBH, EX2012, page 2382
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

25215 7590 12/20/2021

The Dobrusin Law Firm P.C.
29 W. Lawrence Street
Suite 210
Pontiac, MI 48342

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/383,951	07/23/2021	Marc KRÜGER	1859.029USC10	6871

TITLE OF INVENTION: PORTION CAPSULE HAVING AN IDENTIFIER

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	03/21/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
JENNISON, BRIAN W	3761	426-115000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/383,951	07/23/2021	Marc KRÜGER	1859.029USC10	6871

25215 7590 12/20/2021

The Dobrusin Law Firm P.C.
29 W. Lawrence Street
Suite 210
Pontiac, MI 48342

EXAMINER	
JENNISON, BRIAN W	
ART UNIT	PAPER NUMBER
3761	

DATE MAILED: 12/20/2021

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 02/11)

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	**Application No.** 17/383,951	**Applicant(s)** KRÜGER, Marc	
	Examiner BRIAN W JENNISON	**Art Unit** 3761	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to 12/6/2021.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 21 and 24-35 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information , please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☑ All b) ☐ Some* c) ☐ None of the:

   1. ☑ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 12/6/2021.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☑ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/BRIAN W JENNISON/
Primary Examiner, Art Unit 3761

K-FEE SYSTEM GMBH, EX2012, page 2386
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Allowable Subject Matter

Claims 21, 24-35 are allowed.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRIAN W JENNISON whose telephone number is (571)270-5930. The examiner can normally be reached M-Th 9-5.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tu Hoang can be reached on 571-272-4780. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BRIAN W JENNISON/
Primary Examiner, Art Unit 3761

12/14/2021

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/383,951	KRÜGER, Marc
	Examiner	Art Unit
	BRIAN W JENNISON	3761

CPC - Searched*		
Symbol	**Date**	**Examiner**
A47J: 31/4492, 31/4482, 31/446, 31/468	11/22/2021	BJ
B65D: 85/8043, 65/466, 2203/06, 2203/10	11/22/2021	BJ

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
Evaluated in Global Dossier	11/22/2021	BJ
Conducted CPC search in EAST	11/22/2021	BJ
Conducted inventor search in EAST	11/22/2021	BJ
Evaluated IDS in EAST	11/22/2021	BJ
Evaluated NPL in Application	11/22/2021	BJ

/BRIAN W JENNISON/ Primary Examiner, Art Unit 3761	

K-FEE SYSTEM GMBH, EX2012, page 2388
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/383,951	KRÜGER, Marc
	Examiner	Art Unit
	BRIAN W JENNISON	3761

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
A47J	31/4492, 31/4482, 31/446, 31/468	11/22/2021	BJ
B65D	85/8043, 65/466, 2203/06, 2203/10	12/14/2021	BJ

/BRIAN W JENNISON/ Primary Examiner, Art Unit 3761	

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/383,951	KRÜGER, Marc
	Examiner	**Art Unit**
	BRIAN W JENNISON	3761

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/383,951	KRÜGER, Marc
	Examiner	**Art Unit**
	BRIAN W JENNISON	3761

CPC						
Symbol					**Type**	**Version**
B65D	/	85	/	8043	F	2013-01-01
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B65D	/	65	/	466	A	2013-01-01
B65D	/	2203	/	06	A	2013-01-01
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CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
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NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	13	
/BRIAN W JENNISON/ Primary Examiner, Art Unit 3761	14 December 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	21	16A

U.S. Patent and Trademark Office — Part of Paper No.: 20211214

K-FEE SYSTEM GMBH, EX2012, page 2391
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/383,951	KRÜGER, Marc
	Examiner	Art Unit
	BRIAN W JENNISON	3761

INTERNATIONAL CLASSIFICATION					
CLAIMED					
A47J	/	31	/	44	

NON-CLAIMED					
	/		/		

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	13	
/BRIAN W JENNISON/ Primary Examiner, Art Unit 3761	14 December 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	21	16A

U.S. Patent and Trademark Office — Part of Paper No.: 20211214

K-FEE SYSTEM GMBH, EX2012, page 2392
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/383,951	KRÜGER, Marc
	Examiner	**Art Unit**
	BRIAN W JENNISON	3761

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

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NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	13	
/BRIAN W JENNISON/ Primary Examiner, Art Unit 3761	14 December 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	21	16A

U.S. Patent and Trademark Office — Part of Paper No.: 20211214

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
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EAST Search History

EAST Search History (Prior Art)

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S75	389	B65D2203/06.cpc.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/09/25 14:17
S76	1,328	B65D2203/10.cpc.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/09/25 14:17
S77	571	A47J31/4492.cpc.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/09/25 14:17
S78	4,872	(S73 S74 S75 S76 S77)	US-PGPUB; USPAT; USOCR	OR	OFF	2020/09/25 14:17
S79	1	"20100078480"	US-PGPUB; USPAT; USOCR	OR	OFF	2020/09/25 14:18
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EAST Search History (Interference)

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L13	453	B65D65/466.cpc.	USPAT	OR	OFF	2021/12/14 12:01

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L15	453	B65D65/466.cpc.	USPAT	OR	OFF	2021/12/14 12:01
L16	169	B65D2203/06.cpc.	USPAT	OR	OFF	2021/12/14 12:01
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L19	96	A47J31/4482.cpc.	USPAT	OR	OFF	2021/12/14 12:02
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S81	396	B65D65/466.cpc.	USPAT	OR	OFF	2020/09/25 14:19
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Application No: 17/383,951

Foreign Priority claimed: (•) Yes ( ) No

35 USC 119 (a-d) conditions met: [✓] Yes [ ] No [ ] Met After Allowance

Verified and Acknowledged: /BRIAN W JENNISON/ Examiner's Signature [ ] Initials

Title: PORTION CAPSULE HAVING AN IDENTIFIER

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
07/23/2021	426	3761	1859.029USC10
RULE			

APPLICANTS

K-FEE SYSTEM GMBH, Bergisch Gladbach, GERMANY

INVENTORS

Marc KRÜGER, Bergisch Gladbach, GERMANY

CONTINUING DATA

This application is a CON of 17330572 05/26/2021

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IF REQUIRED, FOREIGN LICENSE GRANTED**

08/04/2021

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UNITED STATES

FILING FEE RECEIVED

$6,020

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17/383,951
	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
	Art Unit	3761
	Examiner Name	TBA
	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

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	Application Number	17/383,951
	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
	Art Unit	3761
	Examiner Name	TBA
	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17/383,951
	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
	Art Unit	3761
	Examiner Name	TBA /BRIAN W JENNISON/
	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17/383,951
	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
	Art Unit	3761
	Examiner Name	TBA
	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17/383,951
	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
	Art Unit	3761
	Examiner Name	TBA
	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17/383,951
	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
	Art Unit	3761
	Examiner Name	TBA
	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

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EXAMINER SIGNATURE			
Examiner Signature	/BRIAN W JENNISON/	Date Considered	12/14/2021
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.			

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.W.J/

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

Filed Via EFS @ USPTO. Gov on December 20, 2021
Docket No: 1859.029USC10 / KRU0022-WO-US-T11

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Marc Krüger	Art Unit: 3761
Application No.: 17/383,951	Examiner: Jennison, Brian W.
Filed: July 23, 2021	Conf. No.: 6871

For: PORTION CAPSULE HAVING AN IDENTIFIER

Docket No: 1859.029USC10 / KRU0022-WO-US-T11

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT UNDER 37 CFR 1.312

In response to the Notice of Allowance mailed December 20 2021, Applicant wishes to bring to the attention of the Examiner the following amendments to Claims 21, 29, and 32. No new matter has been added. Entry of these amendments is respectfully requested.

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AMENDMENTS TO THE CLAIMS

1) – 20) (Cancelled)

21) (Currently Amended) A beverage system for making a beverage, comprising:

A) a single-serve capsule comprising:

i) a base element with a cavity, in which a beverage material is provided, the base element being symmetrical about a central longitudinal axis thereof and having a rounded bottom portion;

ii) a flange extending outwardly from the base element, the flange comprising a top side and an opposing bottom side;

iii) a cover fastened to the top side of the flange, the cover is bowed outwardly in a central region of the cover relative to a peripheral region of the cover, the cover includes a region configured to be pierced at a location that is offset from the central longitudinal axis;

iv) a barrier layer to prevent moisture or aroma from escaping out of the single-serve capsule; and

v) an identifier, which includes a repeat pattern, provided on the bottom side of the flange;

B) a beverage machine comprising:

i) a sensor/detector;

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ii) a receptacle configured to receive the single-serve capsule;

iii) a pump controlled to supply water into the single-serve capsule only upon detection of the identifier by the sensor/detector and a determination by the beverage machine that the single-serve capsule is suitable for use with the beverage machine;

iv) a chamfered mandrel that is configured to pierce the cover at the location that is offset from the central longitudinal axis;

v) a groove that is laterally offset from the chamfered mandrel; and

vi) a seal that is at least partially seated in the groove and configured to bear against ~~the~~ a top side of ~~the~~ cover in a region between ~~the~~ a peripheral edge of the cover and the region of the cover that is pierced by the chamfered mandrel.

22) (Cancelled)

23) (Cancelled)

24) (Previously Presented) The beverage system according to claim 21, wherein the beverage machine comprises a waste container for the single-serve capsule to fall into.

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25) (Previously Presented) The beverage system according to claim 24, wherein the beverage machine comprises a pair of holding arms for guiding the single-serve capsule.

26) (Previously Presented) The beverage system according to claim 21, wherein the base element comprises a side wall that includes a plurality of indentations arranged about the central longitudinal axis.

27) (Previously Presented) The beverage system according to claim 26, wherein the cavity is defined by an inside wall, which includes a ledge at an upper region thereof, the ledge projects from the inside wall towards the central longitudinal axis.

28) (Previously Presented) The beverage system according to claim 26, wherein the identifier is located on the side wall.

29) (Currently Amended) A beverage system for making a beverage, comprising:

A) a single-serve capsule comprising:

i) a base element with a cavity, in which a beverage material is

provided, the base element being symmetrical about a central longitudinal axis and having a rounded bottom portion;

ii) a flange extending outwardly from the base element, the flange comprising a top side and an opposing bottom side;

iii) a cover that is fastened to the top side of the flange, the cover is bowed outwardly in a central region of the cover relative to a peripheral region of the cover, the cover includes a region configured to be pierced at a location offset from the central longitudinal axis;

iv) a barrier layer to prevent moisture or aroma from escaping out of the single-serve capsule; and

v) an identifier, which includes a repeat pattern, provided on the bottom side of the flange;

B) a beverage machine comprising:

i) a sensor/detector;

ii) a receptacle configured to receive the single-serve capsule;

iii) a pump controlled to supply water into the single-serve capsule only upon detection of the identifier with the sensor/detector and determination by the beverage machine that the detected identifier agrees with a stored reference;

iv) a chamfered mandrel that is configured to pierce the cover at the

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location offset from the central longitudinal axis;

v) a pair of holding arms for guiding the single-serve capsule;

vi) a waste container for the single-serve capsule to fall into;

vii) a groove that is laterally offset from the chamfered mandrel; and

viii) a seal that is at least partially seated in the groove and configured to bear against ~~the~~ a top side of ~~the~~ cover in a region between ~~the~~ a peripheral edge of the cover and the region of the cover that is pierced by the chamfered mandrel.

30) (Previously Presented) The beverage system according to claim 29, wherein the base element comprises a side wall, which includes a plurality of indentations, and the identifier is located on the side wall.

31) (Previously Presented) The beverage system according to claim 30, wherein the cavity is defined by an inside wall, which includes a ledge at an upper region thereof, the ledge projects from the inside wall towards the central longitudinal axis.

32) (Currently Amended) A beverage system for making a beverage, comprising:

A) a single-serve capsule comprising:

i) a base element with a cavity, in which a beverage material is provided, the base element being symmetrical about a central longitudinal axis;

ii) an inside wall defining the cavity, which includes a ledge at an upper region thereof, the ledge projects from the inside wall towards the central longitudinal axis

iii) a rounded bottom portion;

iv) a flange extending outwardly from the base element, the flange comprising a top side and an opposing bottom side;

v) a cover that is fastened to the top side of the flange, the cover is bowed outwardly in a central region of the cover relative to a peripheral region of the cover, the cover includes a region configured to be pierced at a location offset from the central longitudinal axis;

vi) a barrier layer to prevent moisture or aroma from escaping out of the single-serve capsule;

vii) a side wall comprising a plurality of indentations arranged about the central longitudinal axis;

viii) an identifier, which includes a repeat pattern, provided on the bottom side of the flange;

B) a beverage machine comprising:

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i) a sensor/detector;

ii) a receptacle configured to receive the single-serve capsule;

iii) a pump controlled to supply water into the single-serve capsule only upon detection of the identifier with the sensor/detector and a determination by the beverage machine that the single-serve capsule is suitable for use with the beverage machine;

iv) a chamfered mandrel that is configured to pierce the cover in the location offset from the central longitudinal axis

v) a pair of holding arms for guiding the single-serve capsule;

vi) a waste container for the single-serve capsule to fall into;

vii) a groove that is laterally offset from the chamfered mandrel; and

viii) a seal at least partially seated in the groove and configured to seal against the ~~top~~ a side of the cover in a region between a peripheral edge of the flange and the region of the cover that is pierced by the mandrel.

33) (Previously Presented) The beverage system according to claim 32, wherein the base element is made of a biodegradable material.

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34) (Previously Presented) The beverage system according to claim 32, wherein the base element is deep drawn.

35) (Previously Presented) The beverage system according to claim 32, wherein a ratio of a diameter of the side wall to a diameter of the flange is between 0.85 and 0.89.

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REMARKS

By way of the foregoing amendments and the markings to show changes, claims 21, 29, and 32 are amended. No new matter has been added. The claims as allowed are believed to be clear; however, in an abundance of caution, the foregoing claim amendments are submitted to further clarify the claims. These claim amendments do not change the scope of the as allowed claims. The claim amendments are believed to be proper under 37 CFR 1.312. The foregoing amendments are taken in the interest of expediting prosecution and there is no intention of surrendering any range of equivalents to which Applicant would otherwise be entitled in view of the prior art.

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CONCLUSIONS

In view of these amendments and remarks, Applicant believes this application is prepared for issuance. Applicant respectfully requests that a patent be issued as soon as possible. Should the Examiner have any questions, or wish to further discuss this application, Applicant requests that the Examiner contact the undersigned at (248) 292-2920. If for some reason Applicant has not requested a sufficient extension and/or has not paid a sufficient fee for this response and/or for the extension necessary to prevent the abandonment of this application, please consider this as a request for an extension for the required time period and/or authorization to charge our Deposit Account No. 50-1097 for any fee which may be due.

Respectfully submitted,

Dated: December 20, 2021

/Paul J. Palinski/

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NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

Electronic Patent Application Fee Transmittal

Application Number:	17383951
Filing Date:	23-Jul-2021
Title of Invention:	PORTION CAPSULE HAVING AN IDENTIFIER
First Named Inventor/Applicant Name:	Marc KRÜGER
Filer:	Paul J. Palinski/BECKY BALLARD
Attorney Docket Number:	1859.029USC10

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1200	1200

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1200**

Electronic Acknowledgement Receipt	
EFS ID:	44560167
Application Number:	17383951
International Application Number:	
Confirmation Number:	6871
Title of Invention:	PORTION CAPSULE HAVING AN IDENTIFIER
First Named Inventor/Applicant Name:	Marc KRÜGER
Customer Number:	25215
Filer:	Paul J. Palinski/BECKY BALLARD
Filer Authorized By:	Paul J. Palinski
Attorney Docket Number:	1859.029USC10
Receipt Date:	20-DEC-2021
Filing Date:	23-JUL-2021
Time Stamp:	14:30:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1200
RAM confirmation Number	E2021BJE30360005
Deposit Account	501097
Authorized User	BECKY BALLARD
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.21 (Miscellaneous fees and charges) 37 CFR 1.20 (Post Issuance fees)	

37 CFR 1.19 (Document supply fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.16 (National application filing, search, and examination fees)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	IssueFee_1859_029USC10.pdf	97303 c32bc85dc1a61d704c1de9ec7e9aa632a44f37be	no	1
Warnings:					
Information:					
2		312Amendments_1859_029USC10.pdf	150170 b9f57d83b965f5ac7912007d93dc966b1dcafdf5	yes	11

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment after Notice of Allowance (Rule 312)	1	1
	Claims	2	9
	Applicant Arguments/Remarks Made in an Amendment	10	11

Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	37869 6c923f84661d257f093fe6d16f4c7f9c03f986fc	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	285342		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

25215 7590 12/20/2021

The Dobrusin Law Firm P.C.
29 W. Lawrence Street
Suite 210
Pontiac, MI 48342

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

Becky Ballard	(Typed or printed name)
/Becky Ballard/	(Signature)
December 20, 2021	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/383,951	07/23/2021	Marc KRÜGER	1859.029USC10	6871

TITLE OF INVENTION: PORTION CAPSULE HAVING AN IDENTIFIER

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	03/21/2022

EXAMINER	ART UNIT	CLASS-SUBCLASS
JENNISON, BRIAN W	3761	426-115000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 The Dobrusin Law Firm, P.C.
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: K-FEE SYSTEM GMBH

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Bergisch Gladbach, Germany

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ☒ Corporation or other private group entity ❑ Government

4a. Fees submitted: ☒ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 50-1097

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Paul J. Palinski/ Date December 20, 2021

Typed or printed name Paul J. Palinski Registration No. 71,080

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

K-FEE SYSTEM GMBH, EX2012, page 2451
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/383,951	07/23/2021	Marc KRÜGER	1859.029USC10	6871

7590 12/22/2021

The Dobrusin Law Firm P.C.
29 W. Lawrence Street
Suite 210
Pontiac, MI 48342

EXAMINER	
JENNISON, BRIAN W	
ART UNIT	PAPER NUMBER
3761	

DATE MAILED: 12/22/2021

FOREIGN PRIORITY ACKNOWLEDGMENT

☑ 1. Certified Copy Timely Received Before Payment of the Issue Fee:

Applicant previously submitted a claim for foreign priority under 35 U.S.C. 119(a)-(d) or (f).

☐ Certified copies of the priority documents have been received.

☑ Certified copies of the priority documents have been received in Application No. PCT/EP2011/003677.

☐ Some of the certified copies of the priority documents have not been received: _____.

If the certified copy of a foreign application that has not been received is filed after the date the issue fee is paid, the patent will not include the priority claim unless corrected by a certificate of correction under 35 U.S.C. 255 and 37 CFR 1.323.

☐ 2. Certified Copy Received After Payment of the Issue Fee:

Applicant previously submitted a claim for foreign priority under 35 U.S.C. 119(a)-(d) or (f). Applicant submitted the certified copy after payment of the issue fee. The patent will not include the priority claim unless corrected by a certificate of correction under 35 U.S.C. 255 and 37 CFR 1.323.

Note: For utility or plant applications filed under 35 U.S.C. 111(a) on or after March 16, 2013, the certified copy may be timely received if the certified copy was filed within the later of four months from the filing date or sixteen months from the filing date of the prior foreign application (the 4/16 month time period) or if one of the exceptions in 37 CFR 1.55 (i.e., certified copy in a prior-filed nonprovisional application under 37 CFR 1.55(h), priority document exchange under 37 CFR 1.55(i), or interim copy under 37 CFR 1.55(j) is applicable. The 4/16 month time period does not apply to design applications.

571-272-4200 or 1-888-786-0101
Application Assistance Unit
Office of Patents Stakeholder
Experience (OPSE)
Stakeholder Support Division (SSD)

U.S. Patent and Trademark Office
PTOL-147 (Rev. 08-2021)

K-FEE SYSTEM GMBH, EX2012, page 2452
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/383,951	07/23/2021	Marc KRUGER	1859.029USC10

CONFIRMATION NO. 6871

25215
The Dobrusin Law Firm P.C.
29 W. Lawrence Street
Suite 210
Pontiac, MI 48342

PUBLICATION NOTICE

OC000000130669164

Title:PORTION CAPSULE HAVING AN IDENTIFIER

Publication No.US-2021-0395000-A1
Publication Date:12/23/2021

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

K-FEE SYSTEM GMBH, EX2012, page 2453
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/383,951	07/23/2021	Marc KRÜGER	1859.029USC10	6871

25215 7590 01/26/2022

The Dobrusin Law Firm P.C.
29 W. Lawrence Street
Suite 210
Pontiac, MI 48342

EXAMINER
JENNISON, BRIAN W

ART UNIT	PAPER NUMBER
3761	

NOTIFICATION DATE	DELIVERY MODE
01/26/2022	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

dobrusin_PAIR@firsttofile.com
patmail@patentco.com
rmasquelier@patentco.com

K-FEE SYSTEM GMBH, EX2012, page 2454
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

Corrected ***Notice of Allowability***	**Application No.** 17/383,951	**Applicant(s)** KRÜGER, Marc	
	Examiner BRIAN W JENNISON	**Art Unit** 3761	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to 12/6/2021.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 21 and 24-35 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information , please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☑ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 7/28/2021.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/BRIAN W JENNISON/
Primary Examiner, Art Unit 3761

K-FEE SYSTEM GMBH, EX2012, page 2455
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

Notice of References Cited	Application/Control No. 17/383,951	Applicant(s)/Patent Under Reexamination KRÜGER, Marc	
	Examiner BRIAN W JENNISON	Art Unit 3761	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20070181005-A1	08-2007	Kirschner; Jonathan	A23F3/06	99/295
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

K-FEE SYSTEM GMBH, EX2012, page 2456
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

Filed via EFS @ USPTO.gov on July 28, 2021
Practitioner's Docket No. 1859.029USC10 (KRU0022-WO-US-T11)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Marc Krüger	Art Unit: 3761
Application No.: 17/383,951	Examiner: TBA
Filed: July 23, 2021	Conf. No.: 6871

For: PORTION CAPSULE HAVING AN IDENTIFIER

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

INFORMATION DISCLOSURE STATEMENT

Applicant submits this statement in accordance with its duty of disclosure under 37 C.F.R. §§ 1.56, 1.97, and 1.98. The submission made herewith is in no way intended as an admission that the cited items constitute material prior art or otherwise would render the claims unpatentable in any way. The submission also is in no way intended to substitute for the Examiner's own independent investigation.

Form PTO/SB/08a is submitted herewith. Copies of foreign patent documents and non-patent literature have not been provided due to their presence in the parent application to this application (see MPEP 609.02(A)(2)), and Applicant notes that this section requires the Examiner to consider all of the references previously submitted to the USPTO even if not listed in any Information Disclosure Statement filed in this application. Applicant is resubmitting these references on the attached form PTO/SB/08a so that all of the references are listed on the face of the patent. However, to the extent that any references have been inadvertently overlooked, or otherwise are not resubmitted on this form, Applicant respectfully requests consideration of the previously submitted references as is set forth in MPEP 609.02(A)(2) and inclusion of such references on the face of the patent. Applicant respectfully solicits the Examiner's consideration of the cited references and entry thereof into the record of this application.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.W.J/

This Information Disclosure Statement is being submitted prior to the mailing of a first Office Action or Notice of Allowance. No fees are believed to be due; however, if any fee is due with the filing of this paper, please charge the amount to Deposit Account 50-1097.

Date: July 28, 2021

/Paul J. Palinski/

Paul J. Palinski
Reg. No. 71,080
Attorney for Applicant
The Dobrusin Law Firm, P.C.
29 W. Lawrence Street - Suite 210
Pontiac, MI 48342
(248) 292-2920

Customer No. 25215

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.W.J/

K-FEE SYSTEM GMBH, EX2012, page 2458
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17/383,951
	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
	Art Unit	3761
	Examiner Name	TBA/BRIAN W JENNISON/
	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

U.S. PATENTS					
Examiner Initials*	Cite No.	Patent Number	Kind Code	Issue Date	Name of Patentee or Applicant of cited Document
	1.	2,778,739		01/22/1957	Rodth
	2.	3,183,096		05/11/1965	Hiscock
	3.	3,501,896	A	03/24/1970	Stoeser et al.
	4.	3,631,793		06/23/1969	Bednartz
	5.	3,640,727		02/08/1972	Heusinkveld
	6.	4,136,202		01/23/1979	Favre
	7.	4,389,925		06/28/1983	Piana
	8.	4,534,985		08/13/1985	Gasau
	9.	4,540,595		09/10/1985	Acitelli et al.
	10.	4,644,151	A	05/12/1987	Piet
	11.	4,676,482	A1	11/04/1987	Marvin et al.
	12.	4,742,645		05/10/1988	Johnston
	13.	4,859,337		08/22/1989	Woltermann
	14.	4,860,645	A	08/29/1989	Van Der Lijn et al.
	15.	4,867,993		09/19/1989	Nordskog
	16.	4,976,179		12/11/1990	Lacrouts-Cazenave
	17.	5,012,629		05/07/1991	Rehman et al.
	18.	5,028,769	A	07/02/1991	Claypool et al.
	19.	5,108,768	A	04/28/1992	So
	20.	5,194,553	A	03/16/1993	Freeburne et al.
	21.	5,242,702	A	09/07/1993	Fond
	22.	5,243,164	A	09/07/1993	Erickson et al.
	23.	5,251,758	A	10/12/1993	Kolacek
	24.	5,285,041	A	02/08/1994	Wright
	25.	5,402,707	A	04/04/1995	Fond et al.
	26.	5,460,078	A	10/24/1995	Weller
	27.	5,496,573	A	03/05/1996	Tsuji et al.
	28.	5,501,945	A	03/26/1996	Kanakkanatt
	29.	5,535,765	A	07/16/1996	Takashima
	30.	5,601,716	A	02/11/1997	Heinrich et al.
	31.	5,637,850	A	06/10/1997	Honda
	32.	5,656,311	A	08/12/1997	Fond
	33.	5,656,318	A	08/12/1997	Fond et al.
	34.	5,677,522	A	10/14/1997	Rice et al.
	35.	5,725,261	A	03/10/1998	Rahn
	36.	5,840,189	A	11/24/1998	Sylvan et al.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.W.J/

K-FEE SYSTEM GMBH, EX2012, page 2459
NESPRESSO USA, INC. v. K-FEE SYSTEM GMBH
IPR2023-00485, U.S. PATENT 11,230,430

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17/383,951
	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
	Art Unit	3761
	Examiner Name	TBA
	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

	37.	5,888,549	A	03/30/1999	Buchholz et al.
	38.	5,895,672	A	04/20/1999	Cooper
	39.	5,897,899	A	04/27/1999	Fond
	40.	5,917,165	A	06/29/1999	Platt et al.
	41.	5,941,055	A	08/24/1999	Coates
	42.	5,948,455	A	09/07/1999	Schaeffer et al
	43.	5,980,743	A	11/09/1999	Bairischer
	44.	5,994,677	A	11/30/1999	Akerlind
	45.	6,153,026	A	11/28/2000	Michotte
	46.	6,199,780	B1	03/13/2001	Görlitz
	47.	6,202,929	A	03/20/2001	Verschuur et al.
	48.	6,213,326	B1	04/10/2001	Denner et al.
	49.	6,299,926	B1	10/09/2001	Balakrishnan et al.
	50.	6,440,256	B1	08/27/2002	Gordon et al.
	51.	6,451,332	B1	09/17/2002	Tanaka et al.
	52.	6,589,577	B2	07/08/2003	Lazaris et al.
	53.	6,598,800	A1	07/29/2003	Schmit et al.
	54.	6,607,762	B2	08/19/2003	Lazaris et al.
	55.	6,627,244	B2	09/30/2003	Omura
	56.	6,645,537	B2	11/11/2003	Sweeney et al.
	57.	6,655,260	B2	12/02/2003	Lazaris
	58.	6,817,538	B2	11/16/2004	Afzali-Ardakani et al.
	59.	6,861,086	B2	03/01/2005	Buckingham et al.
	60.	6,948,420	B2	09/27/2005	Kirschner et al.
	61.	6,994,879	B2	02/07/2006	Cirigliano et al.
	62.	7,408,094	B2	08/05/2008	Little et al.
	63.	7,444,925	B2	02/07/2006	Cirigli
	64.	7,464,518	B2	12/16/2008	Ansinn
	65.	7,543,527	B2	06/09/2009	Schmed
	66.	7,552,672	B2	06/30/2009	Schmed
	67.	7,595,870	B2	09/29/2009	Ringlien
	68.	7,673,558	B2	03/09/2010	Panesar et al.
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	Application Number	17/383,951
	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
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	First Named Inventor	Marc Krüger
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	Examiner Name	TBA
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	Application Number	17/383,951
	Filing Date	July 23, 2021
	First Named Inventor	Marc Krüger
	Art Unit	3761
	Examiner Name	TBA
	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

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	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

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	Attorney Docket Number	1859.029USC10 (KRU0022-WO-US-T11)

EXAMINER SIGNATURE			
Examiner Signature	/BRIAN W JENNISON/	Date Considered	01/20/2022
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.			

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ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

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