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(54) **DEVICE AND METHOD FOR FILLING CAPSULES**

VORRICHTUNG UND VERFAHREN ZUR FÜLLUNG VON KAPSELN

DISPOSITIF ET PROCÉDÉ DE REMPLISSAGE DE CAPSULES

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Description

Field of the invention

[0001] The present invention relates to a filling device and a method for filling capsules with products, in particular solid forms for pharmaceutical, alimentary and/or cosmetic use.

[0002] The invention is particularly applicable in an automatic machine for packaging capsules for pharmaceutical, alimentary and/or cosmetic use.

Background of the invention

[0003] Machines for packaging tablets within hard gelatin capsules are known. European patent EP 0 825 846 B1 shows, for example, an automatic machine for packaging gelatine capsules of bottom-lid type, each including a tablet. The automatic machine shown in EP 0 825 846 is intermittently movable and includes groups of housings moved to cooperate with a plurality of stations in succession: a first station that feeds the bottoms of the capsules to respective housings; a second station that feeds a tablet within a respective bottom, a third station that feeds the lids of the capsules above a respective tablet; a fourth station that checks whether respective bottom, tablet and lid are present in the housings; a fifth station that closes bottom and lid with interposed tablet; a sixth station that expels the capsules containing the tablet and rejects, by means of a rejection device, the capsules found faulty.

[0004] The second station that feeds the tablet within the bottom of the capsule includes a vertical store within which the capsules are aligned. A pneumatic system for retaining the capsules includes two suction holes arranged transversally to the store and cooperating with a transferring drawer, movable horizontally for retaining and transferring one tablet at the time from the store to the bottom of the capsule. The suction holes are arranged with respect to the transferring drawer at a height such as a proper functioning of the station is assured, even when broken tablets are present. In other words, the pneumatic system in cooperation with the transferring drawer guarantees not to break all of the capsules that follow a first broken tablet during transfer from the store to the bottom of the capsule. In any case, in the fourth station, it is checked, by means of sensors connected to movable rods, whether bottom, tablet and lid are present, and whether the tablet is entire or damaged.

[0005] The machine illustrated above achieves excellent results in terms of certainty of checking in case of one tablet per capsule, but it could be ineffective in case of capsules fed with more than one product (tablets, granules, ecc) of relatively small dimensions with respect to relatively large bottoms, because the movable rods might not detect all of the products contained in the bottom. Moreover, the machine results relatively costly and complicated because of the transferring drawer, the movable rods, and the pneumatic system that retains the tablets.

[0006] There are also known from US 5 329 749 A packaging machines for packaging a predetermined number of tablets into a body of a hard gelatine capsule, comprising a feeding conduit divided in three not-aligned sections, within which the tablets can slide. Between the three sections of the feeding conduit, a carrying plate and a shutter plate are arranged. The carrying plate transfers the tablets from a first section of the feeding conduit to a second section of the feeding conduit. No checking means is disclosed in US 5 329 749 A to check whether or not tablets are properly fed to hard gelatine capsule.

[0007] EP 2 019 040 discloses a filling unit for filling capsules with tablets including a filling disk provided with containing holes adapted to contain a predetermined number of tablets. The filling disk receives the tablets from a counting disk and transfer in rotation the tablets to a capsule body. EP 2 019 040 mentions the possibility to provide the filling unit with a displacement sensor, but the overall filling unit results in a relatively costly and complex structure.

[0008] To overcome the above mentioned disadvantages, it is known to omit the movable rods and associated sensors and to weight all of the capsules packaged in the automatic machine in order to check whether or not the capsules have been properly filled, but such solution involves additional costs for a weight checking station and, above all, a reduction in productivity of the machine, as the weighting operations are relatively slow.

[0009] It is an aim of the present invention to fill capsules with products with high productivity, in a relatively simple and inexpensive way, and with guarantee of detecting capsules not properly filled.

Summary of the invention

[0010] This and other aims are achieved by a filling device according to claim 1 and by a filling method according to claim 8.

Detailed description of embodiments

[0011] The invention will be described with reference to the figures, given by way of nonlimiting examples and for illustrative purpose only, wherein:

- figures 1 - 7 are a schematic illustration of a filling device according to the invention during successive steps of a filling method according to the invention for filling capsules with products;
- figure 8 is a schematic illustration of the filling device of the invention during a step of the filling method according to the invention in case of failure in feeding of products;
- figures 9 - 11 are schematic illustrations of the filling device of the invention during successive steps of the filling method according to the invention in case of partial feeding of product

- figures 12 - 13 are schematic illustrations of the filling device of the invention during successive steps of the filling method according to the invention for filling capsules with oblong products;
- figure 14 - 15 are schematic illustrations of the filling device of the invention during successive steps of the filling method according to the invention for filling capsules with oblong products, one of which broken and incomplete.

[0012] With particular reference to figures 1 to 7, there is shown a filling device 1 adapted to fill a bottom 3 of a capsule with one or more products 2. In figures 1 - 7 there is schematically shown the case in which two products 2 of substantially spherical shape are fed within each bottom 3. The products 2 may be, for example, tablets, granules, pellets, different types of multiparticulate systems or other solid forms for pharmaceutical, food, and/or cosmetic use.

[0013] The filling device 1 may advantageously be part of an automatic packaging machine of known type, not illustrated, intermittently movable, including groups of housings 4 radially arranged on a moving carousel that moves the housings 4 to cooperate with a plurality of operative stations arranged in succession, among which: a first feeding station for feeding the bottoms 3 to the housings 4; a second filling station including the filling device 1 for feeding the products 2 to the bottoms 3, in particular one or more products 2 per bottom 3; a third feeding station for feeding lids to the housings 4; a fourth closing station for closing the bottom 3 with a respective lid to form a capsule filled with one or more products 2; finally, and a fifth expelling station for expelling the filled capsules from the housings 4. The automatic packaging machine further includes rejection devices, for rejecting faulty capsules, associated with any one of the stations downstream of the second filling station.

[0014] The filling device 1 includes a feeding conduit 5, adapted to slidably contain a row 6 of products 2, and a blocking and feeding system 7, for blocking the row 6 of products 2 and feeding a group 8 of products 2, including a predefined number of products 2, to a bottom 3 of the capsule arranged below. The group 8 of products 2 may comprise one or more products, for example two, three or more products 2.

[0015] The feeding conduit 5 defines a feeding direction 9 for the products 2 and includes a bottom end portion 15 that slidably houses, below the row 6 of products 2, the group 8 of aligned products 2.

[0016] The blocking and feeding system 7 is of the escapement type and includes a first blocking and feeding element 10 and a second blocking and feeding element 11.

[0017] The first blocking and feeding element 10 is positioned below the second blocking and feeding element 11.

[0018] The first blocking and feeding element 10 is movable, advantageously onto a horizontal plane, be-

tween an operative position, wherein it closes the feeding conduit 5, and an inoperative position, far away from the feeding conduit 5, wherein the feeding conduit 5 at the bottom end portion 15 results inferiorly open.

[0019] In the embodiment shown in figures 1-7, the first blocking and feeding element 10 includes a first lamina 12, advantageously flat, arranged below the bottom end portion 15 of the feeding conduit 5. In operative position, the first blocking and feeding element 10, in particular the first lamina 12, is adapted to support and blocking a first product 18 of the group 8 of products 2 and, therefore, all of the products 2 positioned within the feeding conduit 5 above the first product 18.

[0020] The second blocking and feeding element 11 is movable between an operative position, close to the feeding conduit 5, and an inoperative position, far away from the feeding conduit 5. Advantageously, in the embodiment illustrated in figures 1-7, the second blocking and feeding element 11 includes a second lamina 13, "L" shaped, adapted to rotate about a fulcrum 14 between the operative position and the inoperative position. In particular, the second lamina 13 in operative position cooperates with a longitudinal slot 17 achieved in the feeding conduit 5 to block a further product 19 of the row 6 of products 2. Once the further product 19 has been blocked, the row 6 of products 2 results blocked, i.e. the products 2 positioned above the further product 19 result blocked. In other words, the second lamina 13 do not act onto the products 2 of the group 8 to be fed that are positioned below the row 6.

[0021] The second blocking and feeding element 11, in particular the second lamina 13, is further movable along the feeding direction 9 in order to be suitably positioned along the feeding conduit 5, in such a way that a distance between the first lamina 12 and the second lamina 13 be adjustable. Such distance defines the bottom end portion 15 of the feeding conduit 5 that houses the products 2 of the group 8. In other words, by suitably positioning the second blocking and feeding element 11 along the feeding conduit 5, the distance between the first lamina 12 and the second lamina 13 can be varied and, consequently, the predefined number of products 2 of the group 8 to be fed to the below bottom 3 can be varied.

[0022] The products 2 of the group 8 are housed within the bottom end portion 15, aligned from the first product 18, lowermost positioned, to a last product 20, uppermost positioned at an upper zone 21 of the bottom end portion 15 of the feeding conduit 5, immediately below and in contact with the further product 19. In case the predefined number of products be one, the first product 18 and the last product 20 coincide.

[0023] The filling device 1 further includes a detecting device 16, advantageously a photo detecting device including a photocell 22 of the barrier type, positioned transversally to the feeding conduit 5 at the upper zone 21 of the bottom end portion 15 intended to house the last product 20 of the group 8.

[0024] The detecting device 16, in particular the photocell 22, is therefore adapted to detect whether or not the last product 20 of the group 8 is present within the bottom end portion 15 of the feeding conduit 5, or, in other words, whether or not the group 8 consists of the predefined number of products 2. As the products 2 are slidably housed within the feeding conduit 5 and, if not retained, are destined to fall by gravity, by verifying whether or not a single product (the last product 20 of the group 8) is present in the upper zone 21, it can be immediately derived whether or not the group 8 of products 2 to be fed to the below bottom 3 of the capsule is complete.

[0025] Therefore, the filling device 1 according to the invention detects in an extremely simple, fast and inexpensive, but at the same time extremely reliable, way, not only cases of non-filling, but also partial and incomplete filling (see figures 9 - 11), with no need to weight all of the capsules 2 downstream of the forth closing station (100% check weight).

[0026] The case of non-filling is schematically illustrated in figure 8, where products 2 of lenticular shape are shown, one of which is stuck in the feeding conduit 5 and blocks the entire row of products 2. Cases of non-filling can happen because of other reasons as well, for example because of interruption of the production.

[0027] In case the last product 20 be not present in the upper zone 21 of the bottom end portion 15, the detecting device 16 emits a suitable rejection signal to rejection devices for rejecting the below bottom 3 only, or the entire capsule formed by the below bottom 3. Such rejection devices may advantageously be coupled to, or integral with, the same filling device 1, or successive operative stations.

[0028] The detecting device 16, in particular the photocell 22, is advantageously coupled to the second blocking and feeding element 11, in particular to the second lamina 13, and is movable therewith along the feeding direction 9 in order to be suitably positioned along the feeding conduit 5, so as to detect the presence of the last product 20 for any predefined number of products 2 of the group 8. In other words, the detecting device 16, in particular the photocell 22, is adapted to be positioned immediately below the second lamina 13 for a whatsoever distance between the first blocking and feeding element 10 and the second blocking and feeding element 11, or, in an equivalent manner, for a whatsoever predefined number of products 2 of the group 8.

[0029] Alternatively to photo detecting devices with photocells 22, the detecting devices 16 may include ultrasound, proximity, or contact sensors adapted to detect the presence of one product 2 in the upper zone 21 of the bottom end portion 15 of the feeding conduit 5 only, or, in other words, the presence of the last product 20 of the group 8 only.

[0030] In embodiments not illustrated, pneumatic systems may be foreseen to promote the fall of the products 2 along the feeding conduit 5 towards the bottom 3 of the

capsule.

[0031] More filling devices 1 of the type illustrated may be arranged side by side and mutually integrated in an automatic packaging machine for filling more capsules simultaneously.

[0032] The blocking and feeding system 7 described before achieves an escapement system. In other words, the first blocking and feeding element 10 and the second blocking and feeding element 11 cooperates in proper phase for blocking and releasing the row 6 of products 2 and defining, blocking and releasing the group 8 of products 2 to be fed to the bottom 3.

[0033] In detail, the filling device 1 carries out a filling method including the following steps:

- a first step (see fig. 1), with the first blocking and feeding element 10 in operative position and the second blocking and feeding element 11 in inoperative position, for feeding the products 2 downwards within the feeding conduit 5. The products will result aligned one over the other within the feeding conduit 5, with a first product 18 resting on the first blocking and feeding element 10;
- a second step (see fig. 2), with the first blocking and feeding element 10 in operative position, for moving the second blocking and feeding element 11 in operative position to block a further product 19 and to form a row 6 of products 2. In such second step, therefore, a group 8 of products 2, below the row 6, to be fed to a below bottom 3 of a capsule housed in a housing 4, is defined. Such group 8 consists of a predefined number of products 2 (one, two, or more products 2) housed and aligned in a bottom end portion 15 of the feeding conduit 5 defined by a distance between the first blocking and feeding element 10 and the second blocking and feeding element 11;
- a third step (see figs. 3 and 4), with the second blocking and feeding element in operative position to block the further product 19 and thus the row 6 of products 2, for moving the first blocking and feeding element 10 in inoperative position to inferiorly open the bottom end portion 15 of the feeding conduit 5 and allow the group 6 of products 2 to fall within the below bottom 3;
- a forth step (see figs. 5 and 6), once the bottom 3 has been filled with the predefined number of products 2 of the group 8, for carrying the first blocking and feeding element 10 in operative position to close the bottom end portion 15 of the feeding conduit 5, transferring the housing 4 containing the bottom 3 that has been filled to a successive station, and positioning a successive housing 4 with an empty bottom 3 below the feeding conduit 5;
- a fifth step (see fig. 7), with the first blocking and feeding element 10 in operative position, for moving the second blocking and feeding element 11 in inoperative position to unblock the further product 19 and let the products 2 of the row 6 fall towards the

first blocking and feeding element 10 to form a successive group 8 of products 2 to be fed to an empty bottom 3 of a successive housing 4 according to the steps previously illustrated.

[0034] The method further includes, during the second step, a detecting step to detect, by means of a detecting device 16, advantageously a photo detecting device including a photocell 22, whether the group 6 is complete.

[0035] In detail, the method provides for a detecting step to detect, by means of the detecting means 16, arranged laterally to the feeding conduit 5, at an upper zone 21 of the bottom end portion 15 of the feeding conduit 5 intended to house a last product 20 of the group 8, whether or not such last product 20 is present in such upper zone 21. Advantageously, the method provides for detecting whether or not just one single product 2 is present in the upper zone 21 only, with no need to detect other products in other zones of the bottom end portion 15 of the feeding conduit 5.

[0036] The group 8 may comprise one or more products 2, for example two, three, or more products.

[0037] If the group 8 consists of one product 2 only, the first product 18 and the last product 20 coincide and the detecting device 16 detects whether the entire group 8 is fed to the bottom 3 of the capsule.

[0038] If the group 8 consists of two or more products 2, i.e. the first product 18 is distinct from the last product 20, the detecting device 16 detects whether or not the group 8 is complete.

[0039] The method further provides for, in case the detecting device 16 detects that the group 8 is absent or incomplete, sending a rejection signal to rejection devices to reject the below bottom 3 only, or the entire capsule formed by the below bottom 3, as it contains a group 8 at least incomplete, even not completely absent, and therefore faulty. Advantageously, the rejection devices may be arranged downstream of the filling device 1, for example integrated in any one of the successive operative stations.

[0040] It has to be noted that, by means of the filling device 1, there can be checked the correct filling of the bottoms 3 at a very early stage, i.e. during, and not after, the same filling, so allowing for a simpler, more reliable and flexible checking than checking available in the prior art methods.

[0041] Thanks to the device and method according to the invention, it is therefore possible to identify and reject, as soon as possible in the automatic packaging machine, the capsules that have not been filled, or that have been incompletely filled, without the need to weight all of the capsules exiting the automatic packaging machine, thus the properly filled capsules as well.

[0042] Notwithstanding that the invention has been illustrated in case the capsules are filled with two products, i.e. in case the group 8 consists of two products, it is possible to carry out the invention even in case the capsule must be filled with a predefined number of products

2 different from two, i.e. in case the group 8 consists of one, three, four, five, or more products 2.

[0043] In case the group 8 consists of one product 2 only, the second blocking and feeding element 11, in particular the second lamina 13, should be moved and positioned lower than illustrated in case of group 8 consisting of two products 2, at a distance from the first blocking and feeding element 10, in particular the first lamina 12, such as to define a bottom end portion 15 of the feeding conduit 5 adapted to house one product 2 only.

[0044] On the contrary, in case the capsule should be filled with three or more products 2, i.e. in case the group 8 consists of more than two products 2, the blocking and feeding element 11, in particular the second lamina 13, should be moved and positioned upper than illustrated in case of group 8 consisting of two products 2, at a distance from the first blocking and feeding element, in particular from the first lamina 12, such as to define a bottom end portion 15 of the feeding conduit 5 adapted to house respective three or more products 2.

[0045] Whether the second blocking and feeding element 11, in particular the second lamina 13, be lowered or raised to diminish, or to increase, respectively, the distance from the first blocking and feeding element 10, in particular the first lamina 12, to diminish, or to increase, respectively, the predefined number of products 2 constituting the group 8 with respect to the embodiment illustrated in the figures, the detecting device 16, in particular the photocell 22, is moved downwards, or upwards, respectively, along with the second blocking and feeding element 11 along the feeding direction 9 to check only the upper zone 21 of the bottom end portion 15 of the feeding conduit 5 and to detect whether or not the last product 20 of the group 8 is present.

[0046] In figures 12 - 15 there is illustrated the filling device 1 of the invention for feeding capsules with products 2 with oblong shape in groups 8 of one single product 2. In other words, in the embodiments of figures 12 - 15, the first product 18 and the last product 20 of the group 8 coincide.

[0047] It is certainly possible to feed groups 8 of two or more products 2 with oblong shape to bottoms 3 with suitable dimensions, by suitably adjusting the distance between the first blocking and feeding element 10 and the second blocking and feeding element 11 according to what has been described before with reference to figures 1 - 11.

[0048] Advantageously, in case of products 2 with oblong shape, it is possible, by means of the filling device 1 of the invention, to detect capsules filled with broken or incomplete products 2.

[0049] Indeed, as can be seen in figures 14 and 15, in case of groups 8 containing broken or incomplete products 2, the further product 19 is blocked by the second blocking and feeding element 11, in particular the second lamina 13, in a position such as to be detected by the detecting device 16, in particular the photocell 22, during the third step of the method of the invention, i.e. when

the first blocking and feeding element 10 is in inoperative position to inferiorly open the bottom end portion 15 of the feeding conduit 5 and the second blocking and feeding element 11 is in operative position to block the further product 19.

[0050] The detecting device 16, once a presence of a product 2 (necessarily the further product 19) has been detected during the third step, sends a rejection signal to reject the bottom 3 (or the entire capsule) that has been just filled, as such capsule contains a broken product 2 and thus is faulty.

[0051] On the contrary, if, in the third step of the method, the products 2 of the group 8 were all entire, the further product 19 would be blocked in such a position that the detecting device 16 would not detect the presence of any products (see for example figure 13) and consequently would not emit any rejection signal.

[0052] It has to be noted that, in case of products 2 with oblong shape and one of such products 2 of the group 8 is broken, the detecting device 16 would detect, during the second step, at the upper zone 21, the presence of a product 2, that would be the further product 19 that projects inferiorly, and not the last product 20 of the group 8. Therefore, the capsule that has been just filled will be rejected, without errors, because during the third phase the detecting device 16 would detect the presence of such further product 19.

Claims

1. Filling device for filling capsules of bottom (3) - lid type with products (2), advantageously solid forms for pharmaceutical, food, or cosmetic use, including:

- a feeding conduit (5) that defines a feeding direction (9) and is adapted to slidably housing a row (6) of products (2), said feeding conduit (5) including a bottom end portion (15) adapted to slidably house, below the row (6) of products (2), a group (8) including one or more products (2) aligned;
- a blocking and feeding system (7) for blocking the row (6) of products (2) and feeding each bottom (3) below with one group (8) of products (2); said blocking and feeding system (7) including a first blocking and feeding element (10) and a second blocking and feeding element (11); said first blocking and feeding element (10) being movable between an operative position, wherein it closes the feeding conduit (5) and is adapted to support and block a first product (18) of the group (8), and an inoperative position, wherein the feeding conduit (5) at the bottom end portion (15) is inferiorly open; said second blocking and feeding element (11) being movable between an operative position, wherein it is close to the feeding conduit (5) and is adapted

to block a further product (19) of the row (6), and an inoperative position, far away from the feeding conduit (5); said second blocking and feeding element (11) being positioned along the feeding direction (9) at a distance from the first blocking and feeding element (10) that defines said bottom end portion (15);

- a detecting device (16) adapted to detect, at an upper zone (21) of the bottom end portion (15) of the feeding conduit (5), when the first blocking and feeding element (10) and the second blocking and feeding element (11) are in respective operative positions, whether or not a product (2) is present, and, in case such a product (2) is absent, to send a rejection signal to a rejection device to reject the bottom (3) below, or the capsule formed by the bottom (3) below.

2. Filling device according to claim 1, wherein said detecting device (16) is coupled to the second blocking and feeding element (11) and is movable therewith along the feeding direction (9) to be suitably positioned along the feeding conduit (5) at the upper zone (21) of the bottom end portion (15), so as to detect whether a product (2) is present at said upper zone (21) for any predefined number of products (2) of the group (8).
3. Filling device according to any one of claims 1 and 2, for filling capsules with products (2) with oblong shape, wherein said detecting device (16) is adapted to detect, at the upper zone (21) of the bottom end portion (15) of the feeding conduit (5), when the first blocking and feeding element (10) is in inoperative position and the second blocking and feeding element (11) is in operative position, whether or not a product (2) is present and, in case such a product (2) is present, to send a rejection signal to a rejection device to reject the bottom (3) below, or the capsule formed by the bottom (3) below.
4. Filling device according to claim 1, wherein said detecting device (16) is adapted to detect, at the upper zone (21) of the bottom end portion (15) of the feeding conduit (5) only, whether or not one single product (2) is present.
5. Filling device according to any one of claims 1 to 4, wherein said detecting device (16) includes a photodetecting device with a photocell (22) positioned transversely to the feeding conduit (5).
6. Filling device according to any one of claims 1 to 5, wherein said group (8) includes two or more products (2).
7. Automatic packaging machine for packaging capsules of bottom (3) - lid type, the automatic packaging

machine being of intermittent type and including groups of **housings (4)** radially positioned on a moving carousel that moves the housings (4) to cooperate with a plurality of operative stations arranged in succession, among which:

- a first feeding station for feeding the bottoms (3) to the housings (4);
- a second filling station for filling the bottoms (3) with the products (2) in number of one or more products (2) per bottom (3);
- a third feeding station for feeding lids to the housings (4);
- a fourth closing station for closing the bottom (3) with a respective lid to form a capsule filled with one or more products (2); and
- a fifth discharge station for discharging filled capsules from the housings (4);

the automatic packaging machine further including rejecting devices for rejecting faulty capsules and being **characterized in that** the second filling station includes a filling device (1) according to any one of the preceding claims.

8. Filling method for filling bottoms (3) of capsules with a group (8) formed by a predefined number of products (2) by means of a filling device (1) including a feeding conduit (5) adapted to slidably containing the products (2), a first blocking and feeding element (10) movable between an operative position and an inoperative position, and a second blocking and feeding element (11) movable between an operative position and an inoperative position, including the following step:

- a first step, with the first blocking and feeding element (10) in operative position to inferiorly close a bottom end portion (15) of the feeding conduit (5) and the second blocking and feeding element (11) in inoperative position, for feeding the products (2) downwardly within the feeding conduit (5), with a first product (18) resting on the first blocking and feeding element (10);
- a second step, with the first blocking and feeding element (10) in operative position, for moving the second blocking and feeding element (11) in operative position to block a further product (19) to form a row (6) of products (2) and to define a group (8) of products (2) to be fed to a bottom (3) below housed in a housing (4), said group (8) being positioned below the row (6) and being formed by a predefined number of products (2) housed and aligned in the bottom end portion (15) of the feeding conduit (5), said bottom end portion (15) being defined by a distance between the first blocking and feeding element (10) and the second blocking and feeding element (11);

- a third step, with the second blocking and feeding element (11) in operative position to block the further product (19) and thus the row (6) of products (2), for moving the first blocking and feeding element (10) in inoperative position to inferiorly open the bottom end portion (15) of the feeding conduit (5) and to allow the group (6) of products (2) to fall within the bottom (3) below;
- a fourth step, once the bottom (3) has been filled with the predefined number of products (2) of the group (8), for moving the first blocking and feeding element in operative position to inferiorly close the bottom end portion (15) of the feeding conduit (5), transferring the housing (4) containing the bottom (3) filled to a subsequent station, and positioning a subsequent housing (4) with an empty bottom (3) below the feeding conduit (5);
- a fifth step, with the first blocking and feeding element (10) in operative position, for moving the second blocking and feeding element (11) in inoperative position to unblock the further product (19) and allow the products (2) of the row (6) to fall towards the first blocking and feeding element (10) to form a subsequent group (8) of products (2) to be fed to an empty bottom (3) of a subsequent housing (4);

the method further including, during the second step, a detecting step to detect, by means of a detecting device (16), at an upper zone (21) of the bottom end portion (15) of the feeding conduit (5) adapted to house a last product (20) of the group (8), whether or not a product (2) is present and, in case such product (2) is not present in the upper zone (21) of the bottom end portion (15) of the feeding conduit (5), to send a rejection signal to a rejection device to reject the bottom (3) below, or the capsule formed by the bottom (3) below.

9. Method according to claim 8, wherein said detecting step provides for detecting, at the upper zone (21) of the bottom end portion (15) of the feeding conduit (5) only, whether or not one single product (2) is present.
10. Method according to any one of claims 8 and 9, wherein said products (2) have oblong shape, the method further providing for, during the third step, a further detecting step to detect, by means of the detecting device (16), at the upper zone (21) of the bottom end portion (15) of the feeding conduit (5), whether or not a product (2) is present and, in case such product (2) is present in the upper zone (21) of the bottom end portion (15) of the feeding conduit (5), to send a rejection signal to a rejection device to reject the bottom (3) below, or the capsule formed by the bottom (3) below.

Patentansprüche

1. Befüllvorrichtung zum Befüllen von Kapseln des Typs Unterteil (3) - Oberteil mit Produkten (2), vorzugsweise festen Formen für Pharma-, Lebensmittel- oder kosmetische Verwendung, einschließlich:
 - eines Zufuhrrohrs (5), das eine Zufuhrrichtung (9) definiert und geeignet ist, eine Reihe (6) von Produkten (2) gleitend unterzubringen, wobei das Zufuhrrohr (5) einen unteren Endabschnitt (15) einschließt, der geeignet ist, unterhalb der Reihe (6) von Produkten (2) eine Gruppe (8) beinhaltend ein oder mehrere ausgerichtete Produkte (2) gleitend unterzubringen;
 - eines Blockier- und Zufuhrsystems (7) zum Blockieren der Reihe (6) von Produkten (2) und Zuführen einer Gruppe (8) von Produkten (2) jedem Unterteil (3) darunter; das Blockier- und Zufuhrsystem (7) schließt ein erstes Blockier- und Zufuhrelement (10) und ein zweites Blockier- und Zufuhrelement (11) ein; das erste Blockier- und Zufuhrelement (10) ist bewegbar zwischen einer Betriebsstellung, worin es das Zufuhrrohr (5) schließt und dazu geeignet ist, ein erstes Produkt (18) der Gruppe (8) zu tragen und zu blockieren, und einer Ruhestellung, worin das Zufuhrrohr (5) am unteren Endabschnitt (15) gering geöffnet ist; das zweite Blockier- und Zufuhrelement (11) ist bewegbar zwischen einer Betriebsstellung, worin es sich nahe dem Zufuhrrohr (5) befindet und dazu geeignet ist, ein weiteres Produkt (19) der Reihe (6) zu blockieren, und einer Ruhestellung, weit entfernt von dem Zufuhrrohr (5); das zweite Blockier- und Zufuhrelement (11) ist entlang der Zufuhrrichtung (9) in einem Abstand von dem ersten Blockier- und Zufuhrelement (10) angeordnet, das den unteren Endabschnitt (15) definiert;
 - einer Erkennungsvorrichtung (16), die geeignet ist, an einem oberen Bereich (21) des unteren Endabschnitts (15) des Zufuhrrohrs (5) zu erkennen, wenn das erste Blockier- und Zufuhrelement (10) und das zweite Blockier- und Zufuhrelement (11) in jeweiligen Betriebsstellungen sind, ob ein Produkt (2) vorhanden ist oder nicht, und, falls ein solches Produkt (2) nicht vorhanden ist, ein Abweissignal an eine Abweisvorrichtung zu senden, um das Unterteil (3) darunter oder die durch das Unterteil (3) darunter gebildete Kapsel abzuweisen.
2. Befüllvorrichtung nach Anspruch 1, worin die Erkennungsvorrichtung (16) mit dem zweiten Blockier- und Zufuhrelement (11) gekoppelt ist und mit diesem entlang der Zufuhrrichtung (9) bewegbar ist, um in geeigneter Weise entlang des Zufuhrrohrs (5) am oberen Bereich (21) des unteren Endabschnitts (15) angeordnet zu werden, um zu erkennen, ob für jede vordefinierte Anzahl von Produkten (2) der Gruppe (8) ein Produkt (2) am oberen Bereich (21) vorhanden ist.
3. Befüllvorrichtung nach einem der Ansprüche 1 und 2, zum Befüllen von Kapseln mit Produkten (2) mit länglicher Form, worin die Erkennungsvorrichtung (16) geeignet ist, am oberen Bereich (21) des unteren Endabschnitts (15) des Zufuhrrohrs (5) zu erkennen, wenn das erste Blockier- und Zufuhrelement (10) in Ruhestellung ist und das zweite Blockier- und Zufuhrelement (11) in Betriebsstellung ist, ob ein Produkt (2) vorhanden ist oder nicht, und, falls ein solches Produkt (2) vorhanden ist, ein Abweissignal an eine Abweisvorrichtung zu senden, um das Unterteil (3) darunter oder die durch das Unterteil (3) darunter gebildete Kapsel abzuweisen.
4. Befüllvorrichtung nach Anspruch 1, wobei die Erkennungsvorrichtung (16) geeignet ist, nur am oberen Bereich (21) des unteren Endabschnitts (15) des Zufuhrrohrs (5) zu erkennen, ob ein einzelnes Produkt (2) vorhanden ist oder nicht.
5. Befüllvorrichtung nach einem der Ansprüche 1 bis 4, worin die Erkennungsvorrichtung (16) eine Photodetektorvorrichtung mit einer quer zum Zufuhrrohr (5) angeordneten Photozelle (22) beinhaltet.
6. Befüllvorrichtung nach einem der Ansprüche 1 bis 5, worin die Gruppe (8) zwei oder mehrere Produkte (2) einschließt.
7. Automatische Verpackungsmaschine zum Verpacken von Kapseln des Typs Unterteil (3) - Oberteil, wobei die automatische Verpackungsmaschine intermittierenden Typs ist und Gruppen von Gehäusen (4) einschließt, die radial auf einem sich bewegenden Karussell angeordnet sind, das die Gehäuse (4) bewegt, um mit einer Vielzahl von nacheinander angeordneten Betriebsstationen zusammenzuarbeiten, darunter:
 - eine erste Zufuhrstation zum Zuführen der Unterteile (3) zu den Gehäusen (4);
 - eine zweite Befüllstation zum Befüllen der Unterteile (3) mit den Produkten (2) mit einer Anzahl von einem oder mehreren Produkten (2) pro Unterteil (3);
 - eine dritte Zufuhrstation zum Zuführen von Oberteilen zu den Gehäusen (4);
 - eine vierte Verschleißstation zum Verschließen des Unterteils (3) mit einem entsprechenden Oberteil, um eine mit einem oder mehreren Produkten (2) gefüllte Kapsel zu bilden; und
 - eine fünfte Entladestation zum Entladen befüllter Kapseln aus den Gehäusen (4);

die automatische Verpackungsmaschine schließt ferner Abweisvorrichtungen zum Abweisen fehlerhafte Kapseln ein und ist **dadurch gekennzeichnet, dass** die zweite Befüllstation eine Befüllvorrichtung (1) nach einem der vorhergehenden Ansprüche einschließt.

8. Befüllverfahren zum Befüllen von Unterteilen (3) von Kapseln mit einer Gruppe (8), die aus einer vordefinierten Anzahl von Produkten (2) gebildet ist, mithilfe einer Befüllvorrichtung (1), die ein Zufuhrrohr (5), das geeignet ist, gleitend die Produkte (2) aufzunehmen, ein erstes Blockier- und Zufuhrelement (10), bewegbar zwischen einer Betriebsstellung und einer Ruhestellung, und ein zweites Blockier- und Zufuhrelement (11), bewegbar zwischen einer Betriebsstellung und einer Ruhestellung, beinhaltet, einschließlich des folgenden Schritts:

- ein erster Schritt, mit dem ersten Blockier- und Zufuhrelement (10) in Betriebsstellung, um einen unteren Endabschnitt (15) des Zufuhrrohrs (5) unten zu schließen und mit dem zweiten Blockier- und Zufuhrelement (11) in Ruhestellung, um die Produkte (2) innerhalb des Zufuhrrohrs (5) nach unten zuführen, wobei ein erstes Produkt (18) auf dem ersten Blockier- und Zufuhrelement (10) liegt;

- ein zweiter Schritt, mit dem ersten Blockier- und Zufuhrelement (10) in Betriebsstellung, um das zweite Blockier- und Zufuhrelement (11) in Betriebsstellung zu bewegen, um ein weiteres Produkt (19) zu blockieren, um eine Reihe (6) von Produkten (2) zu bilden und eine Gruppe (8) von Produkten (2) zu definieren, die einem in einem Gehäuse (4) darunter untergebrachten Unterteil (3) zuzuführen sind, wobei die Gruppe (8) unterhalb der Reihe (6) angeordnet ist und durch eine vordefinierte Anzahl von Produkten (2) gebildet wird, die in dem unteren Endabschnitt (15) des Zufuhrrohrs (5) untergebracht und ausgerichtet sind, wobei der untere Endabschnitt (15) durch einen Abstand zwischen dem ersten Blockier- und Zufuhrelement (10) und dem zweiten Blockier- und Zufuhrelement (11) definiert ist;

- ein dritter Schritt, mit dem zweiten Blockier- und Zufuhrelement (11) in Betriebsstellung, um die weiteren Produkte (19) und damit die Reihe (6) von Produkten (2) zu blockieren, um das erste Blockier- und Zufuhrelement (10) in Ruhestellung zu bewegen, um den unteren Endabschnitt (15) des Zufuhrrohrs (5) gering zu öffnen und es damit der Gruppe (6) von Produkten (2) zu erlauben, in das Unterteil (3) darunter zu fallen;

- ein vierter Schritt, nachdem das Unterteil (3) mit der vordefinierten Anzahl von Produkten (2) der Gruppe (8) befüllt worden ist, um das erste

Blockier- und Zufuhrelement in Betriebsstellung zu bewegen, um den unteren Endabschnitt (15) des Zufuhrrohrs (5) gering zu schließen, um das Gehäuse (4), das das gefüllte Unterteil (3) enthält, an eine nachfolgende Station zu übergeben, und um ein nachfolgendes Gehäuse (4) mit einem leeren Unterteil (3) unter dem Zufuhrrohr (5) anzuordnen;

- ein fünfter Schritt, mit dem ersten Blockier- und Zufuhrelement (10) in Betriebsstellung, um das zweite Blockier- und Zufuhrelement (11) in Ruhestellung zu bewegen, um das weitere Produkt (19) freizugeben und es den Produkten (2) der Reihe (6) zu erlauben, in Richtung des ersten Blockier- und Zufuhrelements (10) zu fallen, um eine nachfolgende Gruppe (8) von Produkten (2) zu bilden, die einem leeren Unterteil (3) eines nachfolgenden Gehäuses (4) zuzuführen sind;

wobei das Verfahren ferner, während des zweiten Schritts, einen Erkennungsschritt beinhaltet, um mithilfe einer Erkennungsvorrichtung (16) an einem oberen Bereich (21) des unteren Endabschnitts (15) des Zufuhrrohrs (5), das geeignet ist, ein letztes Produkt (20) der Gruppe (8) unterzubringen, zu erkennen, ob ein Produkt (2) vorhanden ist oder nicht, und, falls ein solches Produkt (2) nicht im oberen Bereich (21) des unteren Endabschnitts (15) des Zufuhrrohrs (5) vorhanden ist, ein Abweissignal an eine Abweisvorrichtung zu senden, um das Unterteil (3) darunter oder die durch das Unterteil (3) darunter gebildete Kapsel abzuweisen.

9. Verfahren nach Anspruch 8, worin der Erkennungsschritt nur am oberen Bereich (21) des unteren Endabschnitts (15) des Zufuhrrohrs (5) eine Erkennung vorsieht, ob ein einzelnes Produkt (2) vorhanden ist oder nicht.

10. Verfahren nach einem der Ansprüche 8 und 9, worin die Produkte (2) eine längliche Form aufweisen, wobei das Verfahren ferner während des dritten Schritts einen weiteren Erkennungsschritt vorsieht, um mithilfe der Erkennungsvorrichtung (16) an dem oberen Bereich (21) des unteren Endabschnitts (15) des Zufuhrrohrs (5) zu erkennen, ob ein Produkt (2) vorhanden ist oder nicht, und, falls ein solches Produkt (2) im oberen Bereich (21) des unteren Endabschnitts (15) des Zufuhrrohrs (5) vorhanden ist, ein Abweissignal an eine Abweisvorrichtung zu senden, um das Unterteil (3) darunter oder die durch das Unterteil (3) darunter gebildete Kapsel abzuweisen.

Revendications

1. Dispositif de remplissage pour remplir des capsules

de type couvercle au fond (3) avec des produits (2), avantageusement, des formes solides à usage pharmaceutique, alimentaire ou cosmétique, incluant :

- un conduit d'alimentation (5) qui définit une direction d'alimentation (9) et est adapté pour abriter en faisant glisser une rangée (6) de produits (2), ledit conduit d'alimentation (5) incluant une extrémité inférieure (15) adaptée pour abriter en faisant glisser, sous la rangée (6) de produits (2), un groupe (8) incluant un ou plusieurs produits (2) alignés ;
 - un système de blocage et d'alimentation (7) pour bloquer la rangée (6) de produits (2) et alimenter chaque fond (3) en dessous avec un groupe (8) de produits (2) ; ledit système de blocage et d'alimentation (7) incluant un premier élément de blocage et d'alimentation (10) et un second élément de blocage et d'alimentation (11) ; ledit premier élément de blocage et d'alimentation (10) étant mobile entre une position opérationnelle où il ferme le conduit d'alimentation (5) et est adapté pour soutenir et bloquer un premier produit (18) du groupe (8), et une position non-opérationnelle où le conduit d'alimentation (5) à l'extrémité inférieure (15) est ouverte par le dessous ; ledit second élément de blocage et d'alimentation (11) étant mobile entre une position opérationnelle où il est proche du conduit d'alimentation (5) et est adapté pour bloquer un autre produit (19) de la rangée (6), et une position non-opérationnelle loin du conduit d'alimentation (5) ; ledit second élément de blocage et d'alimentation (11) étant positionné le long de la direction d'alimentation (9) à une distance du premier élément de blocage et d'alimentation (10) qui définit ladite extrémité inférieure (15) ;
 - un dispositif de détection (16) adapté pour détecter, dans une zone supérieure (21) de l'extrémité inférieure (15) du conduit d'alimentation (5), quand le premier élément de blocage et d'alimentation (10) et le second élément de blocage et d'alimentation (11) sont dans leurs positions opérationnelles respectives, qu'un produit (2) soit présent ou non, et, au cas où un tel produit (2) est absent, pour envoyer un signal de rejet à un dispositif de rejet pour rejeter le fond (3) en dessous, ou la capsule formée par le fond (3) en dessous.
2. Dispositif de remplissage selon la revendication 1, où ledit dispositif de détection (16) est couplé au second élément de blocage et d'alimentation (11) et est mobile avec lui le long de la direction d'alimentation (9) pour être convenablement positionné le long du conduit d'alimentation (5) au niveau de la zone supérieure (21) de l'extrémité inférieure (15)

de façon à détecter si un produit (2) est présent au niveau de ladite zone supérieure (21) pour un nombre quelconque prédéfini de produits (2) du groupe (8).

3. Dispositif de remplissage selon l'une quelconque des revendications 1 et 2, pour remplir des capsules avec des produits (2) de forme oblongue, où ledit dispositif de détection (16) est adapté à détecter, dans une zone supérieure (21) de l'extrémité inférieure (15) du conduit d'alimentation (5), quand le premier élément de blocage et d'alimentation (10) est en position non-opérationnelle et le second élément de blocage et d'alimentation (11) est en position opérationnelle, qu'un produit (2) soit présent ou non, et, au cas où un tel produit (2) est présent, à envoyer un signal de rejet à un dispositif de rejet pour rejeter le fond (3) en dessous, ou la capsule formée par le fond (3) en dessous.
4. Dispositif de remplissage selon la revendication 1, où ledit dispositif de détection (16) est adapté à détecter, dans une zone supérieure (21) de l'extrémité inférieure (15) du conduit d'alimentation (5) uniquement, si un ou plusieurs produits (2) est présent ou non.
5. Dispositif de remplissage selon l'une quelconque des revendications de 1 à 4, où ledit dispositif de détection (16) inclut un dispositif de photo-détection avec une cellule photoélectrique (22) positionnée transversalement au conduit d'alimentation (5).
6. Dispositif de remplissage selon l'une quelconque des revendications de 1 à 5, où ledit groupe (8) inclut deux produits (2) ou plus.
7. Machine d'emballage automatique pour conditionner des capsules de type couvercle au fond (3), la machine d'emballage automatique étant de type intermittent et incluant des groupes de boîtiers (4) positionnés radialement sur un carrousel mobile qui déplace les boîtiers (4) pour coopérer avec une pluralité de stations opératoires arrangées en succession, parmi lesquels :
- une première station d'alimentation pour fournir les fonds (3) aux boîtiers (4)
 - une seconde station d'alimentation pour alimenter les fonds (3) avec les produits (2) au nombre de un ou plusieurs produits (2) par fond (3)
 - une troisième station d'alimentation pour fournir des couvercles aux boîtiers (4)
 - une quatrième station de fermeture pour fermer le fond (3) avec un couvercle respectif pour former une capsule remplie d'un ou plusieurs produits (2) ; et

- une cinquième station de déchargement pour décharger les capsules remplies des boîtiers (4) ;

la machine d'emballage automatique incluant en outre des dispositifs de rejet pour rejeter les capsules défectueuses, et étant **caractérisée en ce que** le la seconde station de remplissage inclut un dispositif de remplissage (1) selon l'une quelconque des revendications précédentes.

8. Méthode de remplissage pour remplir des fonds (3) de capsules avec un groupe (8) formé par un nombre prédéfini de produits (2) au moyen d'un dispositif de remplissage (1), incluant un conduit d'alimentation (5) adapté pour abriter en faisant glisser les produits (2), un premier élément de blocage et d'alimentation (10) mobile entre une position opérationnelle et une position non-opérationnelle, et un second élément de blocage et d'alimentation (11) mobile entre une position opérationnelle et une position non-opérationnelle, incluant les étapes suivantes :

- une première étape, avec le premier élément de blocage et d'alimentation (10) en position opérationnelle pour fermer par le dessous une extrémité inférieure (15) du conduit d'alimentation (5) et le second élément de blocage et d'alimentation (11) en position non-opérationnelle, pour fournir le produit (2) vers le bas à l'intérieur du conduit d'alimentation (5) avec un premier produit (18) reposant sur le premier élément de blocage et d'alimentation (10) ;
- une deuxième étape, avec le premier élément de blocage et d'alimentation (10) en position opérationnelle, pour déplacer le second élément de blocage et d'alimentation (11) en position opérationnelle pour bloquer un autre produit (19) pour former une rangée (6) de produits (2) et définir un groupe (8) de produits (2) à fournir à un fond (3) en dessous logé dans un boîtier (4), ledit groupe (8) étant positionné sous la rangée (6) et étant formé d'un nombre prédéfini de produits (2) logés et alignés dans une extrémité inférieure (15) du conduit d'alimentation (5), ladite extrémité inférieure (15) étant définie par une distance entre le premier élément de blocage et d'alimentation (10) et le second élément de blocage et d'alimentation (11) ;
- une troisième étape, avec le second élément de blocage et d'alimentation (11) en position opérationnelle pour bloquer l'autre produit (19), et partant de là la rangée (6) de produits (2), pour déplacer le premier élément de blocage et d'alimentation (10) en position non-opérationnelle pour ouvrir par le dessous l'extrémité inférieure (15) du conduit d'alimentation (5) et pour laisser la rangée (6) de produits (2) tomber dans

le fond (3) en dessous ;

- une quatrième étape, une fois le fond (3) a été rempli du nombre prédéfini de produits (2) du groupe (8), pour déplacer le premier élément de blocage et d'alimentation en position opérationnelle pour fermer par le dessous l'extrémité inférieure (15) du conduit d'alimentation (5), en transférant le boîtier (4) contenant le fond (3) rempli à une station subséquente, et en positionnant un boîtier (4) suivant avec un fond vide (3) sous le conduit d'alimentation (5) ;
- une cinquième étape, avec le premier élément de blocage et d'alimentation (10) en position opérationnelle, pour déplacer le second élément de blocage et d'alimentation (11) en position non-opérationnelle pour débloquer l'autre produit (19) et permettre aux produits (2) de rangée (6) de tomber vers le premier élément de blocage et d'alimentation (10) pour former un groupe suivant (8) de produits (2) à fournir à un fond (3) vide d'un boîtier (4) suivant ;

la méthode incluant en outre, pendant la deuxième étape, une étape de détection pour détecter, au moyen d'un dispositif de détection (16), au niveau d'une zone supérieure (21) de l'extrémité inférieure (15) du conduit d'alimentation (5) adapté pour héberger un dernier produit (20) du groupe (8) si un produit (2) est présent ou non et, au cas où ledit produit (2) n'est pas présent dans la zone supérieure (21) de l'extrémité inférieure (15) du conduit d'alimentation (5), pour envoyer un signal de rejet à un dispositif de rejet pour rejeter le fond (3) en dessous, ou la capsule formée par le fond (3) en dessous.

9. Méthode selon la revendication 8, où ladite étape de détection détecte, au niveau de la zone supérieure (21) de l'extrémité inférieure (15) du conduit d'alimentation (5) uniquement, si un unique produit (2) est présent ou non.
10. Méthode selon l'une quelconque des revendications 8 et 9, où ledit produit (2) a une forme oblongue, la méthode incluant en outre, pendant la troisième étape, une autre étape de détection pour détecter, au moyen d'un dispositif de détection (16), au niveau de la zone supérieure (21) de l'extrémité inférieure (15) du conduit d'alimentation (5), si un produit (2) est présent ou non et, dans le cas où un tel produit (2) est présent dans la zone supérieure (21) de l'extrémité inférieure (15) du conduit d'alimentation (5), pour envoyer un signal de rejet à un dispositif de rejet pour rejeter le fond (3) en dessous, ou la capsule formée par le fond (3) en dessous.

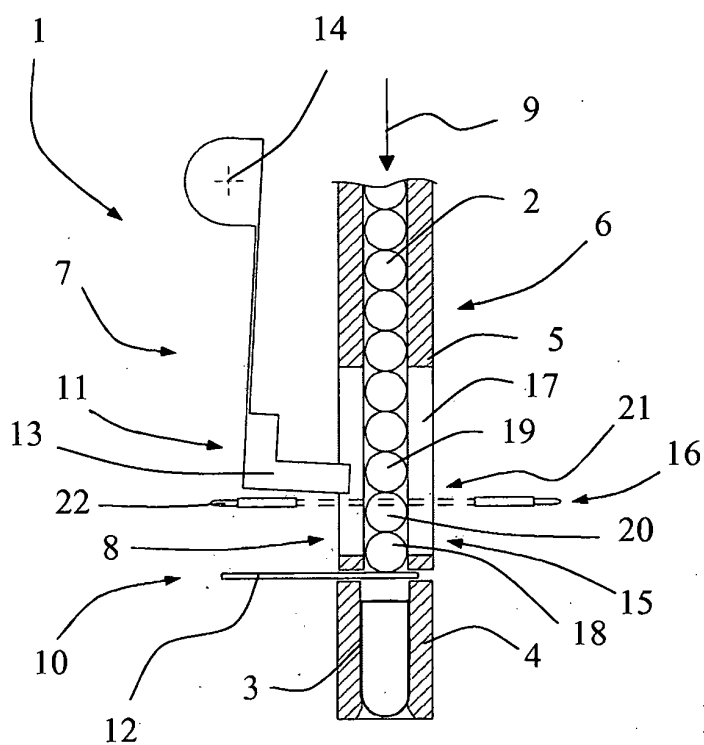


Fig. 1

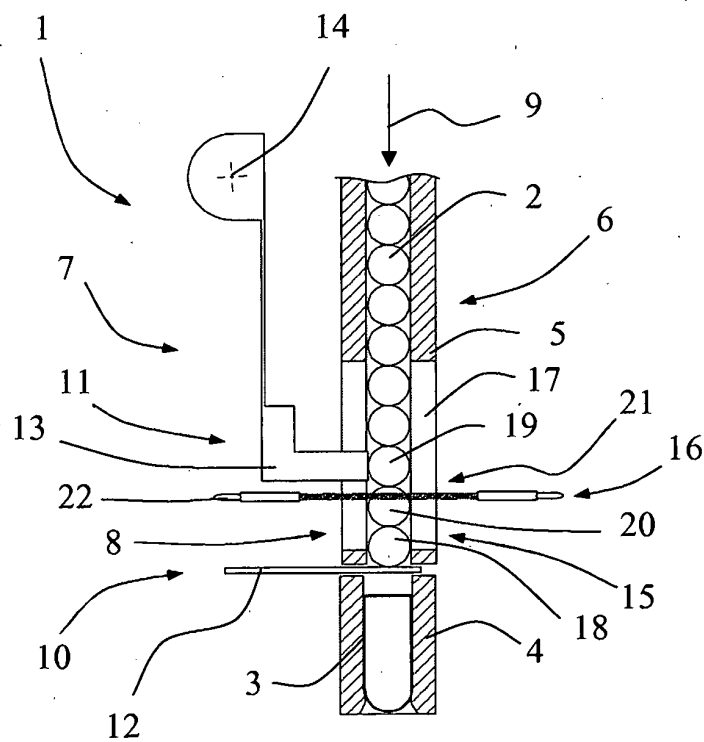


Fig. 2

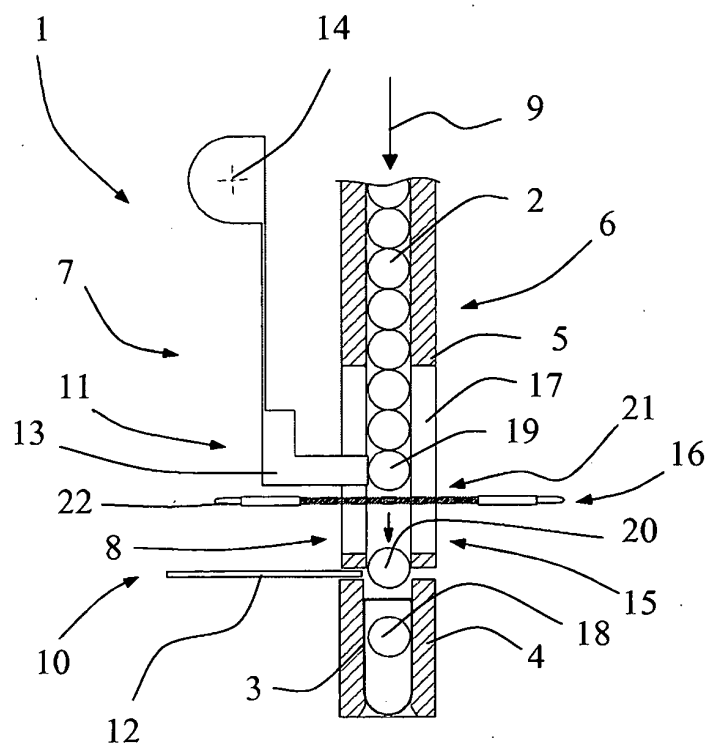


Fig. 3

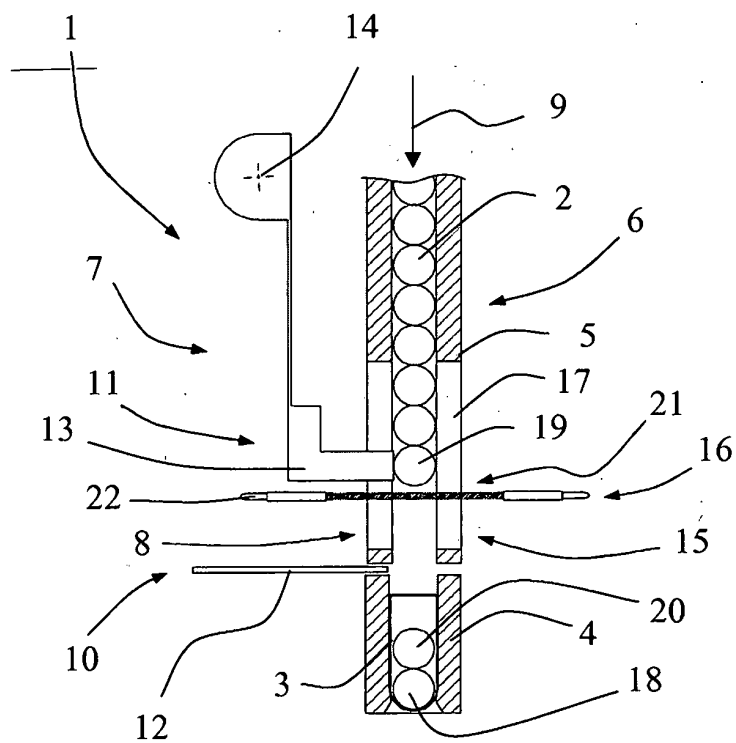


Fig. 4

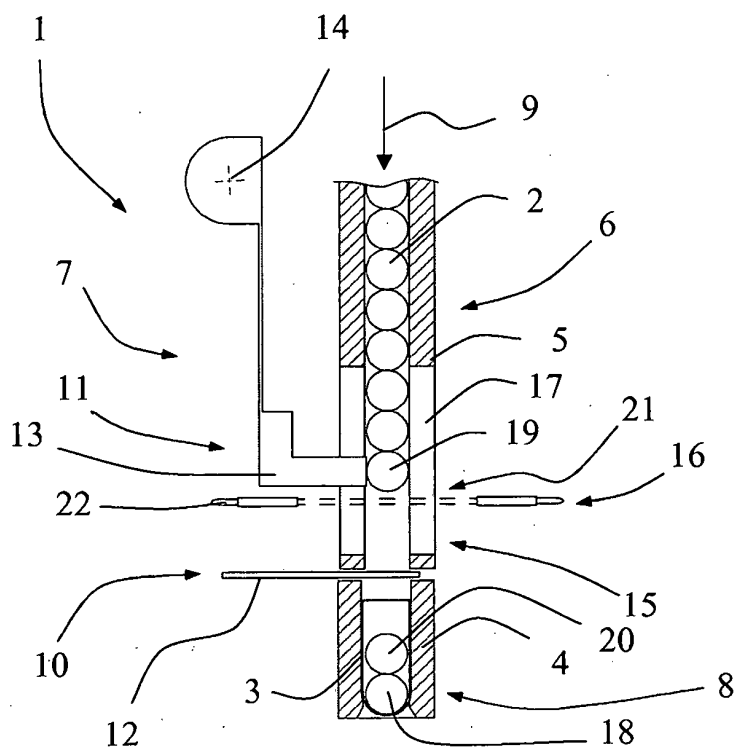


Fig. 5

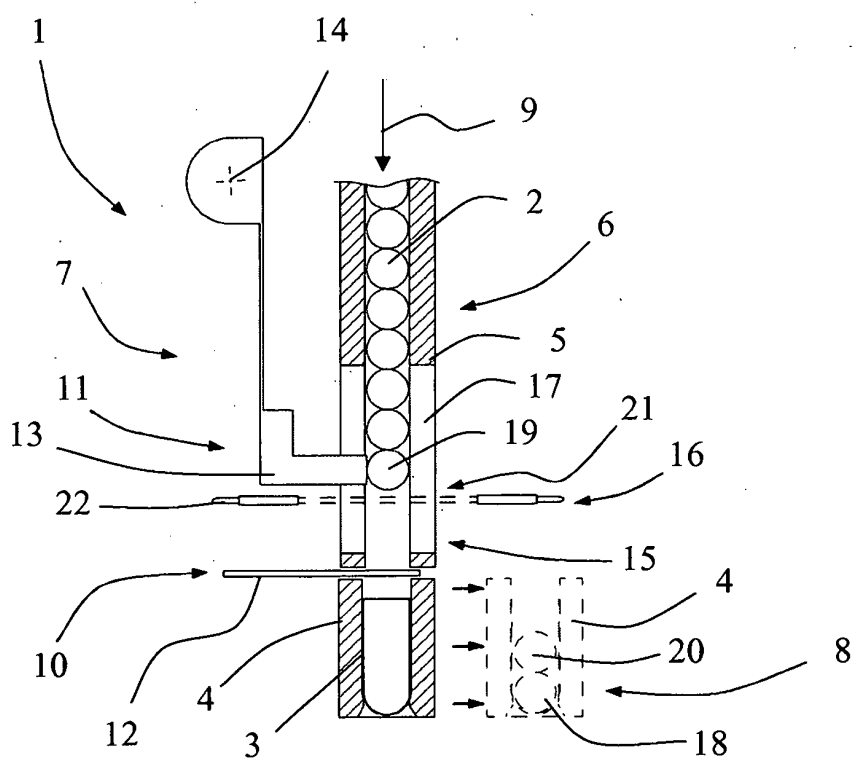


Fig. 6

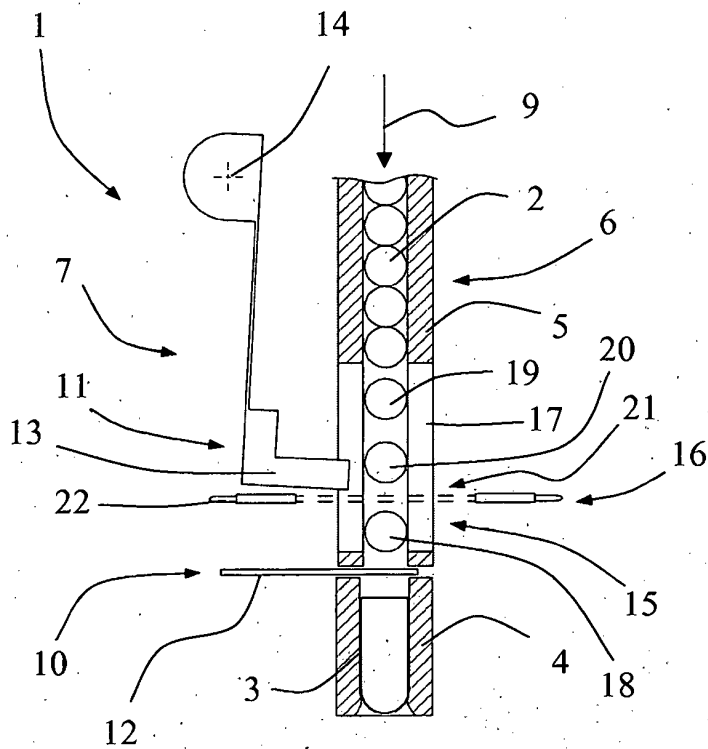


Fig. 7

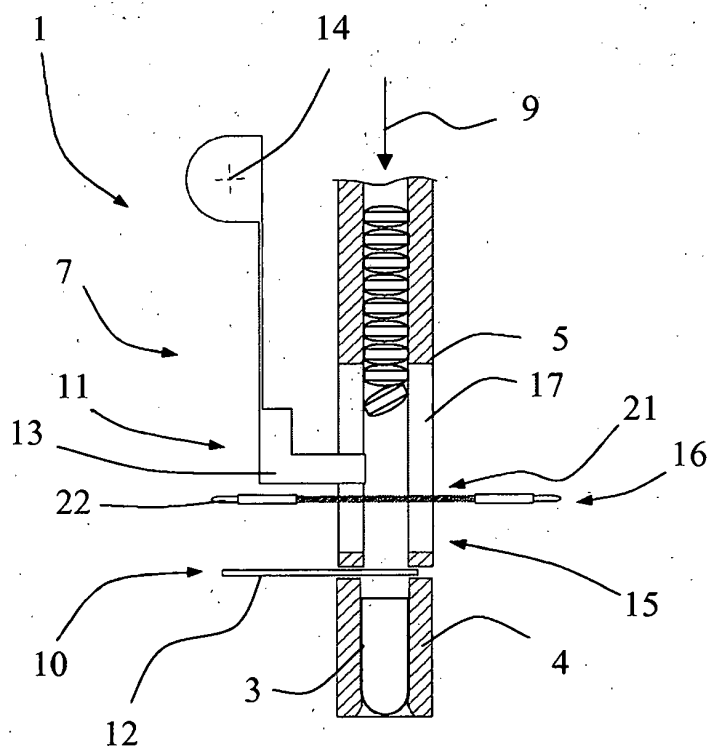


Fig. 8

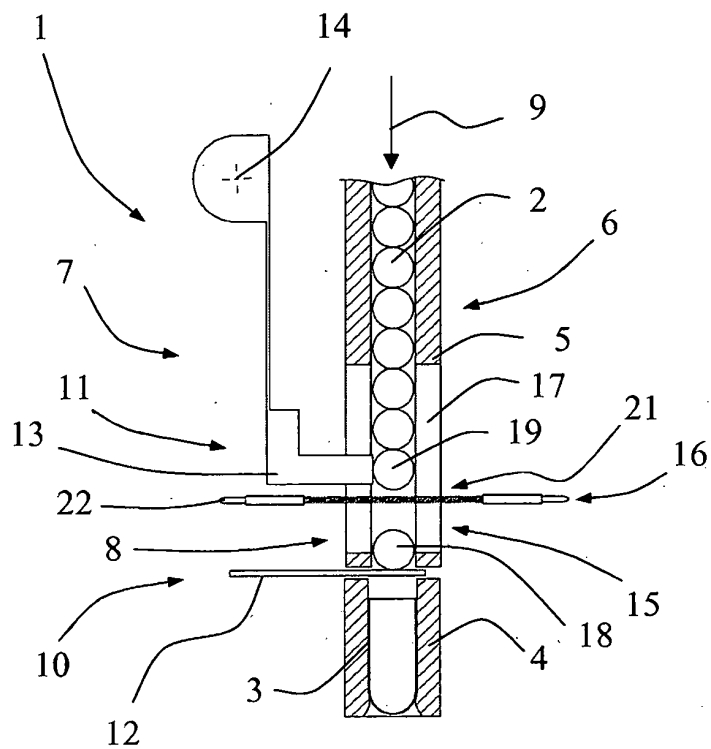


Fig. 9

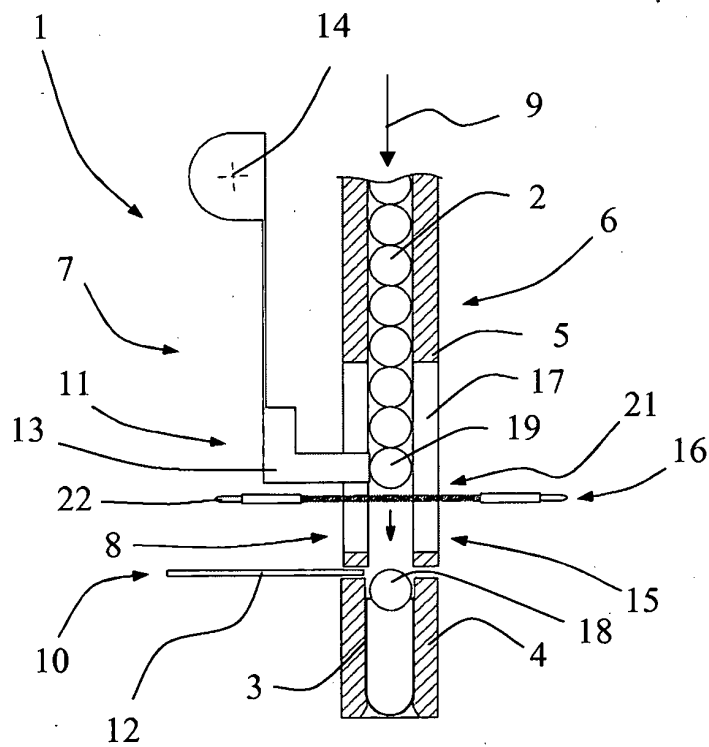


Fig. 10

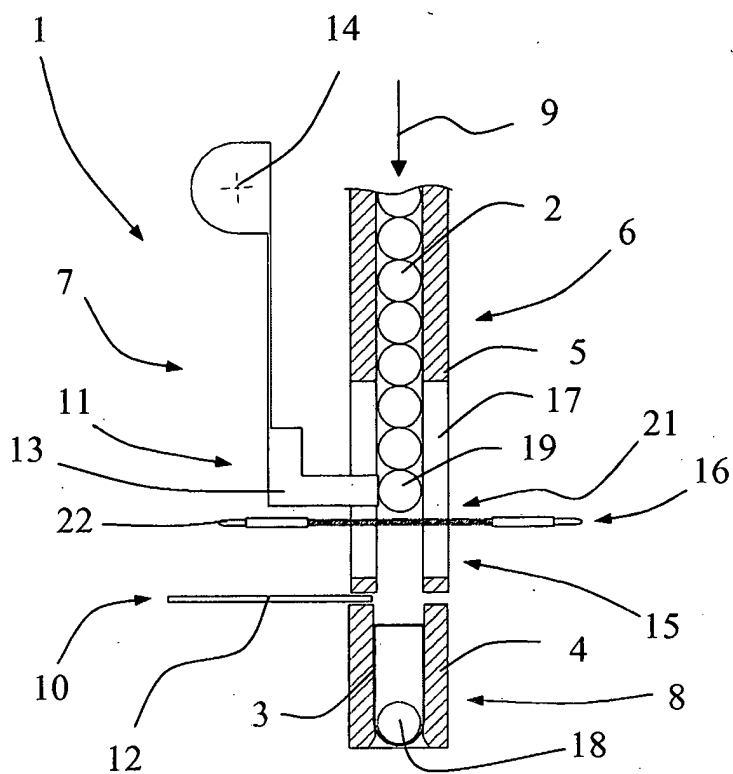


Fig. 11

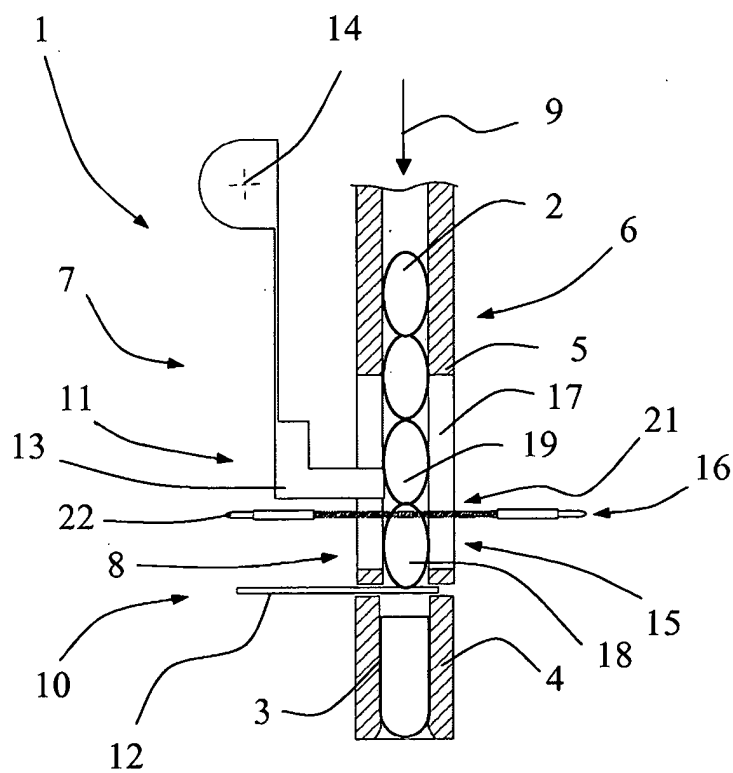


Fig. 12

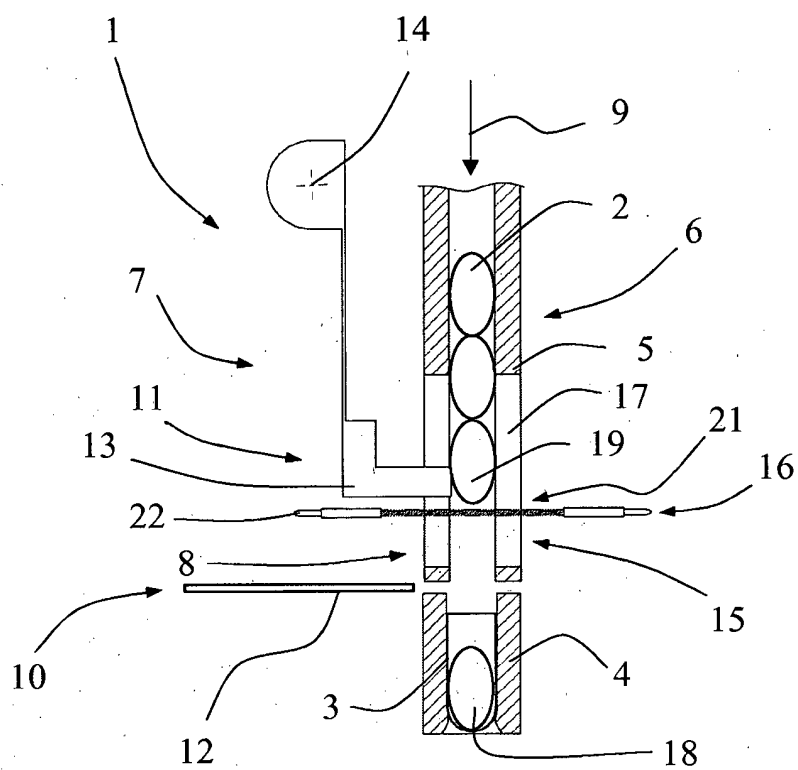


Fig. 13

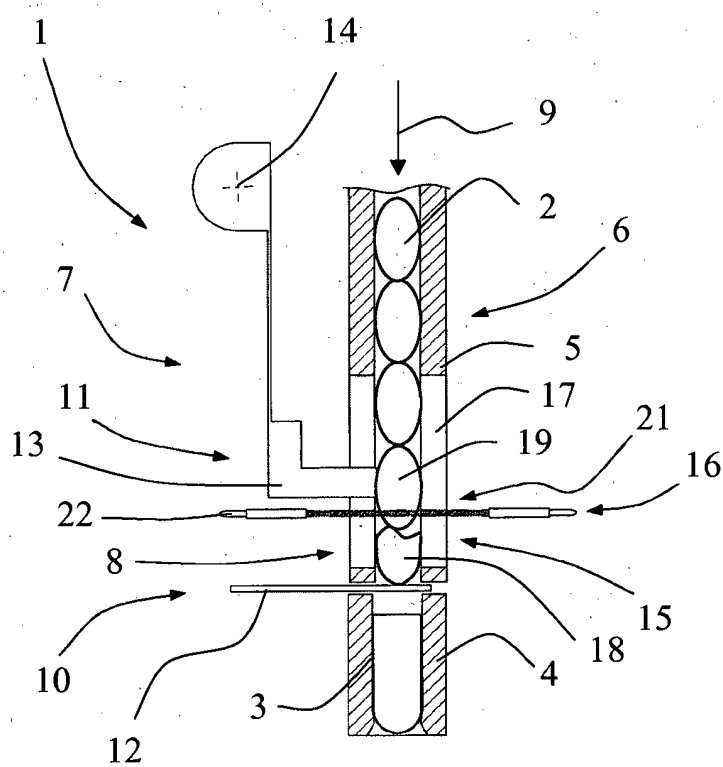


Fig. 14

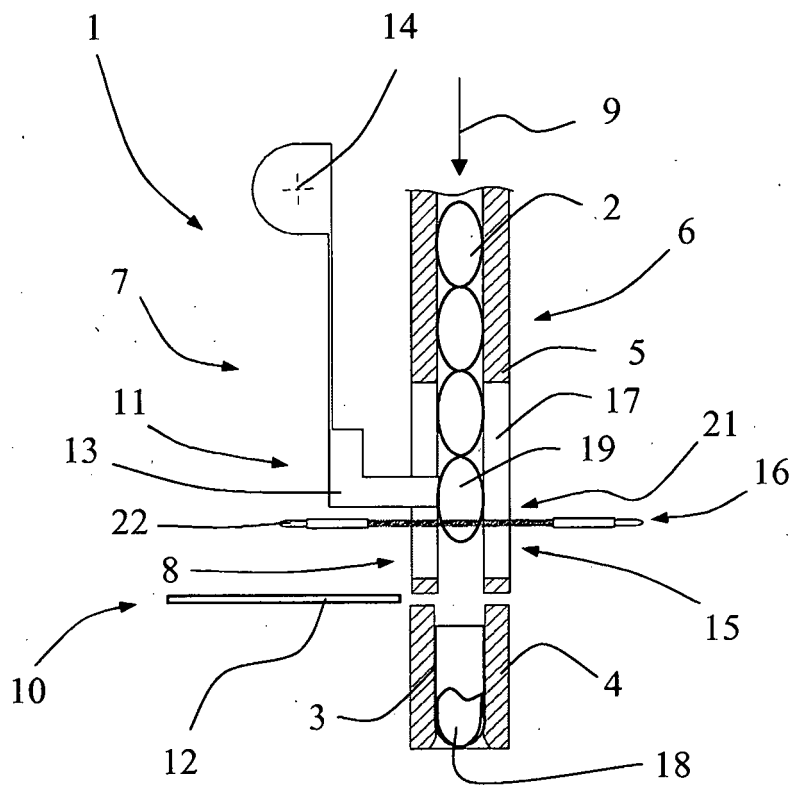


Fig. 15

REFERENCES CITED IN THE DESCRIPTION

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