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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
02 January 2025 (02.01.2025)

WIPO | PCT

(10) International Publication Number
WO 2025/003863 A1

(51) International Patent Classification:
A61J 3/07 (2006.01)

(21) International Application Number:
PCT/IB2024/056130

(22) International Filing Date:
24 June 2024 (24.06.2024)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
102023000013107 27 June 2023 (27.06.2023) IT

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

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: APPARATUS AND METHOD FOR WEIGHING AND FEEDING CAPSULES

(57) Abstract: A feeding and weighing apparatus (1) associable to a filling machine (200) comprises a hopper (20) to contain a plurality of capsules (100) each formed by a cap (101) and a body (102) coupled to each other; a feeding duct (2) to convey the capsules (100) aligned and in contact one after the other to form a row from the hopper; orientation means (3, 4) to orient and transfer one capsule (100) at a time from the feeding duct (2) to a respective seat (202) of transfer means (201) of the filling machine; a weighing unit (6) provided with a weighing plate (8) to receive a capsule (100) to be weighed; the orientation means (3, 4) comprise first orientation means (3) arranged to receive one capsule (100) at a time from the feeding duct (2) and to rotate it and transfer it to the weighing plate (8) and second orientation means (4) arranged to withdraw the capsule (100) from the weighing plate (8), further rotate it and then transfer it to the respective seat (202) of the transfer means (201) with a predefined orientation (A) having a predefined position of the cap (101) with respect to the body (102).

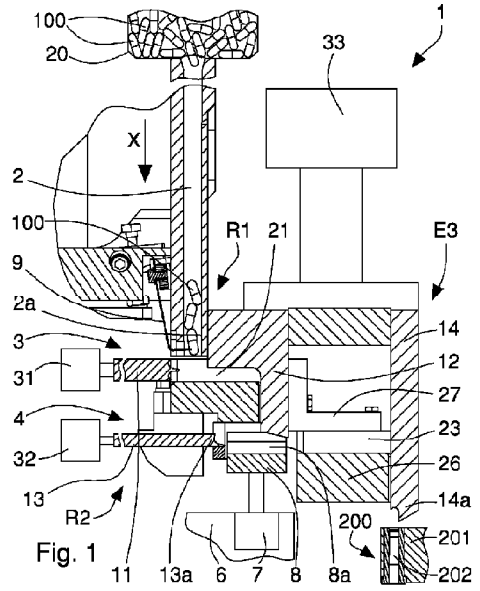

Fig. 1

WO 2025/003863 A1

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Published:

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

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

Apparatus and method for weighing and feeding capsules

The present invention concerns automatic machines for filling capsules or opercula or similar elements with pharmaceutical and food products, and in particular it refers to an apparatus and a method for feeding and weighing capsules in an automatic filling machine.

Various types of filling machines are known, which are arranged to fill capsules, in particular cap-body capsules made of hard gelatin, with pharmaceutical or food products in liquid form, in powder, granules, tablets, micro-tablets, pellets, etc.

The known filling machines typically comprise transfer means that move the capsules through the different operating stations.

Filling machines are known in which the transfer means comprise a transfer turret or wheel, rotating about a vertical axis and provided with seats suitable for receiving the capsules, and a plurality of operating stations arranged around the transfer turret to perform operations on the capsules. The transfer turret by rotating moves the capsules through said operating stations, which comprise a feeding station, a station for opening the capsules, one or more dosage stations for the product, a capsule closing station and a reject station for non-compliant capsules.

In the feeding station there is provided a feeding apparatus that picks the empty capsules from a magazine or hopper and, after having correctly oriented them, typically with the cap above the body with reference to a vertical feeding direction, inserts the capsules in the seats of the transfer turret. In the opening station, suitable means provide for opening the capsules by separating the caps from the bodies.

The feeding apparatus generally comprises one or more feeding ducts parallel to each other and vertical or inclined downwards, which receive the capsules from the above hopper, where the capsules are stored in bulk, and convey them to the seats of the transfer turret. In the feeding ducts the capsules are arranged aligned one above the other to form individual respective rows and descend by gravity.

Orientation means are associated with each feeding duct to orient the capsules so that they are inserted in the corresponding seats with the correct orientation, i.e. with the cap at the top and the body at the bottom.

The orientation means typically comprise horizontal and vertical pusher elements that act on the capsules that remain blocked inside the feeding ducts at a narrowing of the duct section. More precisely, the width of the feeding duct at the narrowing is slightly less than the width of the cap of the capsule which, in the absence of external forces, thus remains blocked.

However, due to the slight interference thus created and the elasticity of the material (hard gelatin) with which the capsule is made, the latter can be easily rotated and then moved by the horizontal and vertical pusher elements that act in sequence inside the respective sections of the duct. The shape of abutment portions of horizontal and vertical pusher elements allows each capsule to be rotated so that it is inserted into the seat of the transfer turret with the cap at the top and the body at the bottom.

The filling machines are generally also provided with weighing apparatus or devices located downstream of the dosage station or at the exit of the filling machine to measure the weight of the product dosed in the capsules.

Weight control is necessary to discard non-compliant capsules from production because they contain a quantity of product outside the allowed dosage tolerance range, and to correct any excesses or defects in the product dosage, acting in feedback on the filling station. In fact, especially in the pharmaceutical sector it is very important to verify that the quantity of product dosed in the individual capsules is exactly that which is required, with very narrow tolerance ranges.

Generally capsules are only weighed once at the end of the dosing, since the weight of the empty capsules is known and contained within a defined tolerance range, indicated and guaranteed by the suppliers/producers of the capsules. In this way, from the measurement of the weight of the filled capsule (gross weight), subtracting the known weight of the empty capsule (tare) it is possible to calculate the weight of the dosed product (net weight) with a certain degree of precision.

However, in filling processes in which the quantity of product to be dosed in the capsules is very small, for example a few milligrams (so-called "micro-doses"), and the tolerance range required for the dosage of the product is limited, for example ±10%, the normal weight variations of the empty capsules strongly influence and affect the weight measurement. Indeed, since the weight of the empty capsules is comparable to that of the dosed product, these weight variations can be larger than the tolerance range of the allowed dosage. In this case, checking only the weight of the filled capsule is insufficient for guaranteeing that the quantity of dosed product is within the required limits and it is necessary to weigh the empty capsule beforehand and calculate the difference in weight of the dosed product.

Solutions are therefore known which provide a first weighing station, upstream of the filling machine or of the dosage station, which measures the weight of the empty capsules (tare), and a second weighing station, downstream of the filling machine or of the dosage station,

which measures the weight of the filled capsules (gross weight). The difference of the two measured weights allows the net weight of the dosed product to be precisely calculated.

The weighing apparatuses that perform this type of direct measurement comprise electronic scales typically provided with a plurality of measurement cells, or load cells, each of which is equipped with a respective support (plate) on which the capsule must be positioned for the time necessary for the correct measurement.

The weight check can be of the total type, i.e. performed on all the capsules filled with the product from the filling station (so-called 100% weight control) or a partial, statistical type check carried out on a randomly chosen sample of filled capsules.

In certain types of pharmaceutical production, however, the control of all the filled capsules is required and in general this solution is widely preferred by pharmaceutical companies in order to guarantee a better quality of the packaged product.

To perform the total weight control, filling machines are known in which the first weighing station is arranged outside the machine and/or upstream of the capsule feeding station to detect the weight of all the empty capsules before their entry into the machine or into the operating stations.

Suitable conveying and transfer means are provided to withdraw the empty capsules from the hopper, transfer them individually to the scales plates of the first weighing station and then convey the capsules, once weighed, to the next feeding station for correct orientation.

This configuration, if it provides an appropriate number of electronic scales and/or load cells, allows measuring the weight of all the empty capsules introduced into the filling machine without the need to reduce the speed of the machine itself to guarantee an adequately long measurement time to achieve a high precision and accuracy of the measurement.

However, this solution is complex and expensive since specific means of conveying and transferring the capsules are required, which also increase the overall size of the filling machine, which is more bulky.

One object of the present invention is to provide a feeding and weighing apparatus that allows orientating and at the same time weighing the empty capsules taken from a hopper and to be fed to a filling machine.

Another object is to realize a feeding and weighing apparatus that allows weighing in a precise and accurate way all the empty capsules subject to orientation.

Another object is to provide a feeding and weighing apparatus that is compact and not bulky, and has simple and reliable structure and operation.

In a first aspect of the invention, a feeding and weighing apparatus according to claim 1 is provided.

In a second aspect of the invention there is provided a method for weighing and feeding capsules according to claim 13.

The invention can be better understood and implemented with reference to the attached drawings which illustrate an exemplary and non-limiting embodiment thereof, wherein:

- figures 1 to 6 are schematic sections of the feeding and weighing apparatus of the invention in respective steps of orientation and weighing of a capsule;
- figure 7 is a front view of two capsules with cap and body coupled and arranged respectively with a first and a second orientation.

With reference to figures 1 to 6, the feeding and weighing apparatus 1 according to the invention configured to weigh capsules 100 and feed and supply the weighed capsules 100 to transfer means 201 of a filling machine 200 is schematically illustrated, in particular each capsule 100 being made of hard gelatin, extending along a longitudinal axis W and formed by a cap 101 and a body 102 coupled to each other.

The transfer means 201 comprise, for example, a transfer wheel or turret of a known type and partially illustrated in the figures, provided with seats 202 suitable for receiving capsules 100 from the feeding apparatus 1.

The feeding apparatus 1 comprises a hopper 20 adapted to hold a plurality of capsules 100 and at least one feeding duct 2 for withdrawing the capsules 100 from the hopper 20 and conveying them towards the transfer means 201. The capsules 100 in the feeding duct 2 are aligned one after the other in contact along a feeding direction X to form a single row. More precisely, the feeding direction X is almost vertical and the capsules 100 are arranged in the feeding duct 2 with the respective longitudinal axis W (axis of symmetry of the capsule along the dimension of greater length) parallel to the feeding direction X and can freely slide, in particular go down, by gravity along the feeding duct 2 from the hopper 20.

The capsules 100 inside the hopper 20 are in fact inserted in the feeding duct 2 with random orientation, i.e. with the bodies 102 facing the transfer means 201, i.e. downwards in a first position relative to the cap 101 with respect to the body 102, or with the caps 101 facing the transfer means 201, i.e. downwards in a second position relative to the cap 101, with respect to body 102.

Typically, the relative position of the capsules 100 required in the filling machines is the first, with the bodies 102 facing downwards to allow an easier detachment (and subsequent

coupling) of the caps 101.

For this purpose, the feeding apparatus 1 comprises orientation means 3, 4 configured to receive one capsule 100 at a time from the feeding duct 2 and then orient it and transfer it with a predefined orientation A in a respective seat 202 of the transfer means 201, i.e. with the respective longitudinal axis W aligned vertically and the respective cap 101 arranged above the respective body 102 (first relative position).

The feeding apparatus 1 of the invention further comprises a weighing unit 6, comprising for example at least one measurement cell or load cell 7, and provided with a weighing plate 8 adapted to receive a capsule 100 to be weighed. In particular, the weighing plate 8 comprises a housing 8a shaped so as to house a capsule 100 arranged horizontally (i.e. with its longitudinal axis W horizontal) or slightly inclined on the longest side.

The orientation means 3, 4 arranged under an outlet opening of the feeding duct 2 comprise first orientation means 3 arranged to receive one capsule 100 at a time from the feeding duct 2 and configured to rotate it and transfer it to the weighing plate 8, and second orientation means 4 arranged to withdraw the capsule 100 from the weighing plate 8 and further rotate it and then transfer it to a respective seat 202 of the transfer means 201 with the established first orientation A.

In more detail, the first orientation means 3 comprise at least one first orientation element 11 provided with an orienting end 11a configured to rotate one capsule 100 at a time in a first rotating direction or in a second rotating direction, opposite to the first rotating direction, based on the relative position of the cap 101 with respect to the body 102 of the respective capsule 100 coming from the feeding duct 2 so as to change the position of the cap 101 with respect to the body 102 so as to align said capsule according to said predefined orientation A in the transfer means 201 after being transferred into the transfer means 201.

In particular, the first orientation element 11, for example movable linearly, is configured to rotate one capsule 100 at a time in the first direction of rotation or in the second direction of rotation of 90° about a rotation axis Y orthogonal to the feeding direction X, and push the rotated capsule 100 along a first transfer duct 21, in particular towards a second transversal transfer duct 22, in particular orthogonal to the first transfer duct 21.

The first transfer duct 21 is transversal, in particular almost orthogonal, to the feeding duct 2, in particular the latter being almost vertical.

The orienting end 11a of the first orientation element 11, of known type, comprises a central wedge or tooth 15 that separates and defines on the orienting end 11a two concavities, upper

15a and lower 15b, intended to abut the cap 101 of the capsule 100, depending on the relative position of the latter. More precisely, the central tooth 15 is shaped and dimensioned in such a way that when it abuts a capsule 100, descending from the feeding duct 2, it rotates in the first rotation direction or in the second rotation direction of 90° about the rotation axis Y so as to always arrange it in a horizontal position (i.e. with the respective longitudinal axis W parallel to the direction of movement of the first orientation element 11 and the first transfer duct 21) and with the cap 101 abutted and pushed by the lower concavity 15b (if the capsule 100 descends from the feeding duct 2 in the second relative position with the cap 101 under the body 102) or by the upper concavity 15a (if the capsule 100 descends from the feeding duct 2 in the first operative position with the cap 101 above the body 102) of the orienting end 11a.

It should be noted that the capsule 100 is able to rotate about the rotation axis Y, under the action of the orienting end 11a, because it is slightly blocked inside the first transfer duct 21, at the exit from the feeding duct 2. The first transfer duct 21 has a first portion, below the feeding duct 2, wide enough to freely drop the capsule 100, and a second narrower portion, adjacent to the first portion, and sized so that when the first orientation element 11 pushes the capsule 100, the pushed capsule rotates around the cap due to the interference with the second narrower portion. Therefore, as is known, due to the slight interference thus created and the elasticity of the material (hard gelatin) with which the capsule 100 is made, the latter can be easily rotated and then moved inside the first transfer duct 21 by the first orientation element 11.

Thus each capsule 100, which was arranged vertically in the feeding duct 2 (i.e. with the respective longitudinal axis W parallel to the feeding direction X) and with random orientation, is then rotated in a horizontal position (i.e. with the respective longitudinal axis W parallel to the movement direction of the first orientation element 11 and to the first transfer duct 21) and with the cap 101 abutted and pushed by the shaped end 11a of the first orientation element 11.

The first orientation means 3 also comprise a corresponding first pushing element 12 configured to transfer the capsule 100 rotated by the first rotation element 11 to the weighing plate 8. The first pushing element 12 is movable, in particular linearly, along the second transfer duct 22.

The first pushing element 12 also has an elongated shape and comprises a respective end 12a shaped so as to abut and push the capsule 100, in particular arranged horizontally, along the

second transfer duct 22 until it is deposited on the underlying weighing plate 8 of the load cell 7 of the weighing unit 6.

In this second duct 22, the capsule 100 is pushed, as it is inserted by interference, to the vicinity of the weighing plate 8, on which the capsule is deposited.

The first transfer duct 21 and the second transfer duct 22 are made of a first support element 25 of the feeding apparatus 1.

The second orientation means 4 comprise at least a second pushing element 13 and a respective second orientation element 14. The second pushing element 13 is movable and configured to withdraw the capsule 100 from the weighing plate 8 (after weighing) and push it along a third transfer duct 23 towards a fourth transversal transfer duct 24, in particular orthogonal to the third transfer duct 23. The second orientation element 14 is movable along the fourth transfer duct 24 to further rotate, in particular by at least 90°, and then transfer the capsule 100 with the predefined orientation A to a respective seat 202 of the transfer means 201.

The third transfer duct 23 is transversal, in particular almost orthogonal, to the feeding duct 2, i.e. parallel to the first transfer duct 21.

The second pushing element 13 has an elongated shape and comprises a respective end 13a shaped so as to withdraw the capsule 100 from the weighing plate 8 and push it, keeping it horizontal or inclined along the third transfer duct 23.

The second orientation element 14 has an elongated shape and comprises a respective end 14a shaped so as to rotate the capsule 100 by 90° about the rotation axis Y, substantially orthogonal to the respective longitudinal axis W of the capsule 100 and in a defined direction of rotation.

For this purpose, the fourth transfer duct 24 has, at least at its initial portion downstream of the third feeding duct 23, a width slightly less than the width of the cap 101 of the capsule 100 which is slightly blocked and is therefore able to rotate about the rotation axis Y by 90°.

In particular, since the capsule 100 has previously been correctly oriented by the first orientation element 11 so as to present the respective body 102 exiting from the third transfer duct 13, the second orientation element 14 is configured so as to rotate the capsule 100 about the rotation axis Y, always in the same rotation direction (clockwise with reference to the view of Figures 5 and 6) so as to move along the fourth transfer duct 24 and insert the capsule 100 in the respective seat 202 of the transfer means with the required defined orientation A.

The third transfer duct 23 and the fourth transfer duct 24 are made in a second support

element 26 of the feeding apparatus 1, connected to the first support element 25 by a connection element 27.

The feeding apparatus 1 also comprises first actuating means 31 and second actuating means 32, of known type and not illustrated in detail in the figures, arranged to move respectively the first orientation element 11 and the second pushing element 13.

More precisely, the first actuating means 31 are configured to move the first orientation element 11 between a first retracted position R1, in which it is disengaged from the first transfer duct 21 to allow the entry of a capsule 100 coming from the feeding duct 2, and a first extended position E1, in which said first orientation element 11 transfers the capsule 100 into the second transfer duct 22.

Similarly, the second actuating means 32 are configured to move the second pushing element 13 between a second retracted position R2, in which it is spaced apart from the weighing plate 8 to allow the positioning thereon of a capsule 100 and its subsequent weighing, and a second extended position E2, in which the second pushing element 13 transfers the capsule 100 into the fourth transfer duct 24.

The feeding apparatus 1 comprises third actuating means 33, of known type and not illustrated in detail in the figures, arranged to move the first pushing element 12 and the second orientation element 14.

More precisely, the third actuating means 33 are configured to move the first pushing element 12 and the second orientation element 14 between respective raised positions R3, in which they are disengaged respectively from the second transfer duct 22 and from the fourth transfer duct 24 to allow the entry of a capsule 100 coming from the first feeding duct 22 and from the third feeding duct 23, and respective lowered positions E3, in which the first pushing element 11 transfers the capsule 100 on the weighing plate 8 and the second orientation element 14 transfers the capsule in the respective seat 201 of the transfer means 201.

The feeding apparatus 1 comprises stopping means 9 associated to the feeding duct 2 and positioned at one end, in particular of an outlet opening 2a thereof, selectively activatable to block the capsules 100 inside the feeding duct 2, in particular by obstructing the outlet opening 2a, or to release, that is to allow one capsule 100 at a time to escape from the feeding duct 2 towards the orientation means 3, 4, in particular by releasing the outlet opening 2a for the time necessary for the exit of a single capsule 100. The stopping means 9 therefore act as means for singularising or separating the capsules 100.

It is envisaged that the feeding apparatus 1 of the invention can comprise a plurality of feeding ducts 2, in particular arranged adjacent to each other and parallel, fed from the same hopper 20 and the first orientation means 3 can comprise a plurality of first orientation elements 11 and first pushing elements 12 and the second orientation means 4 can comprise a plurality of second orientation elements 14 and second pushing elements 13.

Similarly, the weighing unit 6 comprises at least a plurality of measuring cells or load cells 7 provided with respective weighing plates 8.

The number of the first orientation elements 11 and that of the first pushing elements 12, second orientation means 4, second pushing elements 13 and load cells 7 is equal to the number of the feeding ducts 2.

The operation of the feeding apparatus 1 of the invention associated with a filling machine 200 for capsules 100 provided with transfer means 201 (for transferring the capsules 100 through the various operating stations not illustrated of the filling machine 200) provides in a first initial step to arrange in the feeding duct 2 a plurality of capsules 100 coming from the hopper 20 aligned and in contact one after the other to form a row along the feeding direction X. The capsules 100 are kept inside the feeding duct 2 by the stopping means 9 arranged so as to close the outlet opening 2a of the feeding duct 2.

In a subsequent step, a capsule 100 is released to the underlying orientation means 3, 4, in particular by operating the stopping means 9 so as to open the outlet opening 2a of the feeding duct 2 for the time necessary for the passage of a single capsule 100. In particular, the capsule 100 descends by gravity from the feeding duct 2 and is positioned with vertical alignment (in a first relative position or in a second relative position of the cap 101 with respect to the body 102) in an initial portion of the first transfer duct 21.

In this step the first orientation element 11 is in the first retracted position R1 so as not to interfere with the descent of the capsule 100.

The first orientation element 11 is then actuated by the first actuation means 31 from the first retracted position R1 to the first extended position E1 so as to abut, rotate by 90° and then push the capsule 100 along the first transfer duct 21 to the second transfer duct 22.

In particular, the shaped orienting end 11a of the first orientation element 11 abutting the capsule 100 rotates it about the rotation axis Y in a first rotation direction if the capsule 100 comes from the feeding duct 2 in the first relative position (the cap 101 above the body 102) or in a second opposite rotation direction if the capsule 100 comes from the feeding duct 2 in the second relative position (the body 102 above the cap 101). More precisely, the

orienting end 11a, due to the central tooth 15 that separates and defines two concavities, upper 15a and lower 15b, is able to rotate the capsule 100 in a horizontal position in the first transfer duct 21 always with the body 102 directed and closer to the second transfer duct 22.

Thereafter, the first pushing element 12 is moved by the third actuating means 33 from the respective raised position R3 to the respective lowered position E3 so as to push the capsule 100 along the second transfer duct 22 and on the weighing plate 8 of the load cell 7.

While the capsule 100 is being weighed by the load cell 7 of the weighing unit 6 the first pushing element 12 (and with it the second orientation element 14) is returned by the third actuating means 33 to the respective raised position E3.

Once the capsule 100 has been weighed, the second pushing element 13 is moved by the second actuating means 32 from the respective second retracted position R2 to the second extended position E2 so as to abut and remove the capsule 100 from the weighing plate 8 and transfer it through the third duct 23 to the fourth transfer duct 24.

It should be noted that in the first and in the second transfer ducts 21, 22 the capsule 100 is moved horizontally, i.e. with the respective longitudinal axis W that is horizontal, orthogonal to the feeding direction X, while in the third transfer duct 23 the capsule 100 is moved horizontally or inclined on the longer side.

Once the capsule 100 is positioned in the fourth transfer duct 24, the second orientation element 14 is moved by the third actuating means 33 from the respective raised position R3 to the respective lowered position E3 so as to abut, rotate by 90° and then push the capsule 100 along the fourth transfer duct 24 until it is transferred into the respective seat 202 of the transfer means 201 in particular with the first orientation A.

The operational steps described above are repeated for all the capsules 100 present in the hopper 100.

It should be noted that two capsules 100 can be oriented by the feeding apparatus 1 simultaneously, in particular one capsule 100 oriented and moved by the first orientation means 3 and one capsule 100 oriented and moved by the second orientation means 4. More precisely, while a capsule 100 to be weighed is pushed along the second transfer duct 22 on the weighing plate 8 by the first pushing element 12, an already weighed capsule 100 is pushed along the fourth transfer duct 24 to the respective seat 201 of the transfer means 3 by the second orientation element 14.

Thanks to the feeding and weighing apparatus 1 of the invention which comprises orientation means 3, 4 and a weighing unit 6, it is therefore possible to orient and at the same time weigh

all the empty capsules 100 with which to feed a filling machine 200. More precisely, the feeding and weighing apparatus 1 of the invention, in addition to allowing the transfer means 201 of the filling machine 200 to be fed with capsules 100 having the required orientation (in particular the defined orientation A in which each capsule 100 is arranged with the respective longitudinal axis W vertical and the cap above the body 102, i.e. the latter facing downwards), also allows all the capsules 100 supplied to be weighed accurately and precisely. In this way, it is possible to measure the weight of each empty capsule (tare) necessary to accurately calculate the actual weight of the dosed product (net) once the filled capsule is weighed (gross).

Since the detection of the weight of the capsules 100 takes place during the step of orientation and transfer of the capsules, the feeding apparatus 1 of the invention allows feeding even filling machines having high production speeds.

Furthermore, the feeding apparatus 1 of the invention is particularly compact and not bulky due to the weighing unit 6 being integrated between the first and second orientation means 3, 4.

The method according to the invention for weighing and feeding capsules 100 to transfer means 201 of a filling machine 200 by means of the feeding and weighing apparatus 1 described above comprises the steps:

a) arranging in the feeding duct 2 of the apparatus 1 a plurality of capsules 100 coming from the hopper 20 aligned and in contact one after the other to form a row along a feeding direction X (step a);

b) releasing one capsule 100 at a time from said feeding duct 2 towards first orientation means 3 (step b);

c) rotating and transferring the capsule 100 by means of the first orientation means 3 onto a respective weighing plate 8 of a weighing unit 6 (step c);

d) weighing the capsule 100 on said weighing plate 8 by means of the weighing unit 6 (step d);

e) further rotating and transferring the capsule 100 from the weighing plate 8 to a respective seat 202 of the transfer means 201 with a predefined orientation A by means of second orientation means 4 (step e);

wherein it is provided during step c) that each capsule 100 coming from the feeding duct 2 is rotated in a first rotation direction or in a second rotation direction, opposite to the first rotation direction, based on the relative position of the cap 101 with respect to the body 102,

wherein the rotation is performed by the first orientation means 3 to adjust the position of the cap 101 with respect to the body 102 so as to align the capsule according to the predefined orientation A in the transfer means 201 after being transferred to said transfer means 201.

The method comprises in step c) rotating the capsule 100 by 90° about the rotation axis Y in the first direction of rotation if the capsule 100 comes from the feeding duct 2 with a first relative position of the cap 101 with respect to the body 102 or in the second direction of rotation, opposite to the first direction of rotation, if the capsule 100 comes from the feeding duct 2 with a second relative position of the cap 101 with respect to the body 102.

According to the method, transferring the capsule 100 by means of the first orientation means 3 comprises, after said rotating, successively moving the capsule 100 transversely, in particular almost orthogonally, to the feeding direction X by means of a first orientation element 11 and then parallel to the feeding direction X by means of a first pushing element 12.

According to the method, further rotating and transferring by means of said second orientation means 4 comprises in succession withdrawing the capsule 100 from the weighing plate 8 and moving it transversely, in particular almost orthogonally, to the feeding direction X by means of a second pushing element 13, and further rotating the capsule 100 by 90° about the rotation axis Y according to a defined direction of rotation and then moving it parallel to the feeding direction X by means of a second orientation element 14.

According to the method the predefined orientation A consists in having each capsule 100 positioned in the transfer means 201 with the respective longitudinal axis W aligned vertically and the respective cap 101 arranged above the respective body 102.

CLAIMS

1. Feeding and weighing apparatus (1) for weighing capsules (100) and feeding the weighed capsules (100) to transfer means (201) of a filling machine (200), each capsule (100) extending along a longitudinal axis (W) and having a cap (101) and a body (102) coupled to each other, said feeding apparatus (1) comprising:
   - a hopper (20) configured to contain a plurality of capsules (100);
   - at least one feeding duct (2) configured to convey said capsules (100) aligned in contact one after the other in a single row from said hopper (20) along a feeding direction (X);
   - orientation means (3, 4) configured to orient and transfer one capsule (100) at a time from said feeding duct (2) toward a respective seat (202) of said transfer means (201);
   - at least one weighing unit (6) provided with a weighing plate (8) configured to receive a capsule (100) to be weighed;

   wherein said orientation means (3, 4) comprise:
   - first orientation means (3) arranged to receive one capsule (100) at a time from the at least one feeding duct (2) and configured to rotate the capsule (100) and transfer it to said weighing plate (8); and
   - second orientation means (4) arranged to withdraw said capsule (100) from said weighing plate (8) and to further rotate it and then to transfer it to said seat (202) of said transfer means (201) with a predefined orientation (A) having a predefined position of the cap (101) with respect to the body (102),

   characterized in that said first orientation means (3) comprise at least one first orientation element (11) provided with an orienting end (11a) configured to rotate one capsule (100) at a time either in a first rotating direction or in a second rotating direction, opposite to the first rotating direction, depending on the relative position of the cap (101) with respect to the body (102) of the respective capsule (100) coming from the at least one feeding duct (2), so as to adjust the position of the cap (101) with respect to the body (102) in order to have said capsule aligned according to said predefined orientation (A) into said transfer means (201) after being transferred by said transfer means (201).

2. Feeding and weighing apparatus (1) according to claim 1, wherein said first orientation element (11) is configured to rotate either in the first rotating direction or in the second rotating direction one capsule (100) at a time by 90° about a rotation axis (Y) orthogonal to the feeding direction (X), and to push the rotated capsule (100) along a first transfer

duct (21).

3. Feeding and weighing apparatus (1) according to any one of the preceding claims, wherein said first orientation means (3) further comprise a respective first pushing element (12) configured to transfer the capsule (100) rotated by the first orientation element (11) onto said weighing plate (8).

4. Feeding and weighing apparatus (1) according to claim 3 when depending on claim 2, wherein said first pushing element (12) is movable along a second transfer duct (22) arranged substantially orthogonal to said first transfer duct (21).

5. Feeding and weighing apparatus (1) according to claim 2, wherein said first transfer duct (21) is arranged substantially perpendicular to said feeding duct (2).

6. Feeding and weighing apparatus (1) according to any one of the preceding claims, wherein said orienting end (11a) comprises a central tooth (15) separating and defining on said orienting end (11a) an upper concavity (15a) and lower concavity (15b) that are configured to abut the cap (101) of capsule (100) according to a relative position thereof, when the capsule (100) is rotated by said central tooth (15) of 90° about a rotation axis (Y), substantially orthogonal to the feeding direction (X), in the first rotating direction or in the second rotating direction.

7. Feeding and weighing apparatus (1) according to any one of the preceding claims, wherein said feeding duct (2) is arranged substantially vertical.

8. Feeding and weighing apparatus (1) according to any one of the preceding claims, wherein said second orientation means (4) comprise at least one second pushing element (13) and a respective second orientation element (14), wherein said second pushing element (13) is movable to withdraw said capsule (100) from said weighing plate (8) and to push said capsule (100) along a third transfer duct (23) toward a fourth transfer duct (24), said fourth transfer duct (24) being arranged downstream and orthogonal to said third transfer duct (23), and wherein said second orientation element (14) is movable along said fourth transfer duct (24) to further rotate the capsule (100) by 90°, and then to transfer said capsule (100) having said predefined orientation (A) into the respective seat (202) of said transfer means (201).

9. Feeding and weighing apparatus (1) according to claim 8, wherein said third transfer duct (23) is arranged substantially orthogonal to said feeding duct (2).

10. Feeding and weighing apparatus (1) according to claim 8 or 9, wherein said second orientation element (14) comprises a respective end (14a) configured and shaped to

rotate said capsule (100) by 90° in a predefined rotation direction about a rotation axis (Y) orthogonal to the feeding direction (X).

11. Feeding and weighing apparatus (1) according to any one of the preceding claims, further comprising stopping means (9) positioned at an end of said feeding duct (2) and configured to be selectively activated to let one capsule (100) at a time to escape the feeding duct (2) toward the first orientation means (3).

12. Feeding and weighing apparatus (1) according to any one of the preceding claims, wherein said predefined orientation (A) consists in having each capsule (100) placed in said transfer means (201) with the longitudinal axis (W) vertically aligned and the respective cap (101) placed upper to the respective body (102).

13. Method for weighing and feeding capsules (100) to transfer means (201) of a filling machine (200) by means of a feeding and weighing apparatus (1), each capsule (100) extending along a longitudinal axis (W) and having a cap (101) and a body (102) coupled to each other, said method comprising the steps of:

a) arranging in at least one feeding duct (2) of said apparatus (1) a plurality of capsules (100) coming from a hopper (20), said plurality of capsules (100) being aligned and in contact one after the other to form a row along a feeding direction (X);

b) releasing one capsule (100) at a time from said feeding duct (2) toward first orientation means (3);

c) rotating and transferring said capsule (100) by means of said first orientation means (3) onto a respective weighing plate (8) of a weighing unit (6);

d) weighing said capsule (100) on said weighing plate (8) by means of said weighing unit (6);

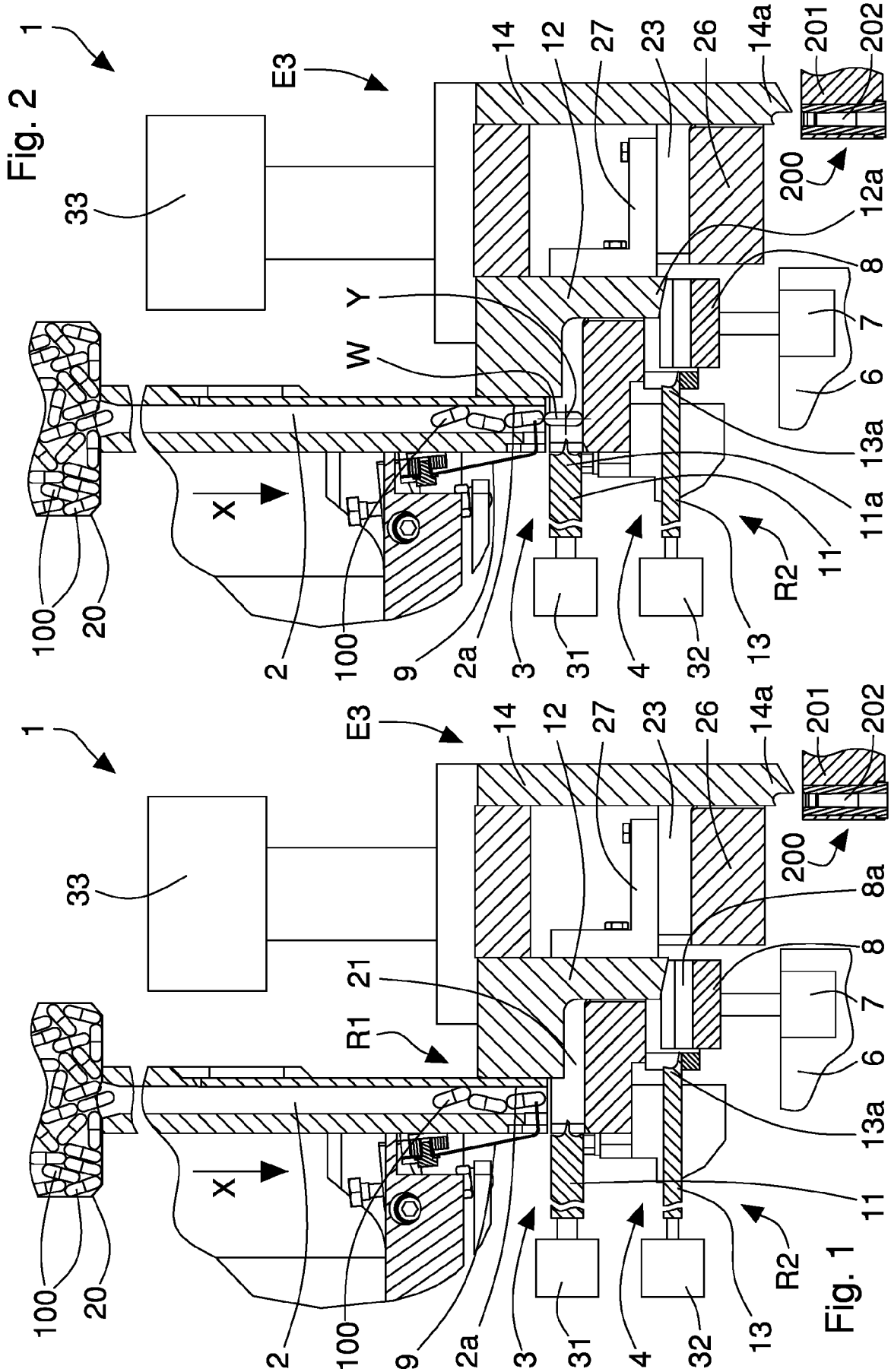
e) further rotating and transferring said capsule (100) from said weighing plate (8) into a respective seat (202) of said transfer means (201) with an alignment according to a predefined orientation (A) by means of second orientation means (4),

said method being **characterized in that** during the step c) each capsule (100) coming from the feeding duct (2) is rotated either in a first rotating direction or in a second rotating direction, opposite to the first rotating direction, depending on the relative position of the cap (101) with respect to the body (102), wherein the rotation is carried out by said first orientation means (3) to adjust the position of the cap (101) with respect to the body (102) in order to have said capsule aligned according to said predefined orientation (A) into said transfer means (201) after being transferred by said transfer

means (201).

14. Method according to claim 13, wherein said step c) comprises rotating said capsule (100) by 90° about a rotation axis (Y) substantially orthogonal to the longitudinal axis (W) of the capsule (100), in the first rotation direction if said capsule (100) comes from said feeding duct (2) with a first relative position of the cap (101) with respect to the body (102) or in the second rotation direction, opposite to said first rotation direction, if said capsule (100) comes from said feeding duct (2) with a second relative position, opposite to said first relative position, of the cap (101) with respect to the body (102).

15. Method according to claim 13 or 14, wherein said predefined orientation (A) consists in having each capsule (100) placed in said transfer means (201) with the longitudinal axis (W) vertically aligned and the respective cap (101) placed upper to the respective body (102).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E3
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14
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26
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201
202
200
12a
8
Y
W
7
6
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11a
11
R2
X
100
20
2
9
2a
3
31
4
32
13
1
E3
33
14
12
27
23
26
14a
201
202
200
8a
8
21
R1
7
6
13a
11
R2
X
100
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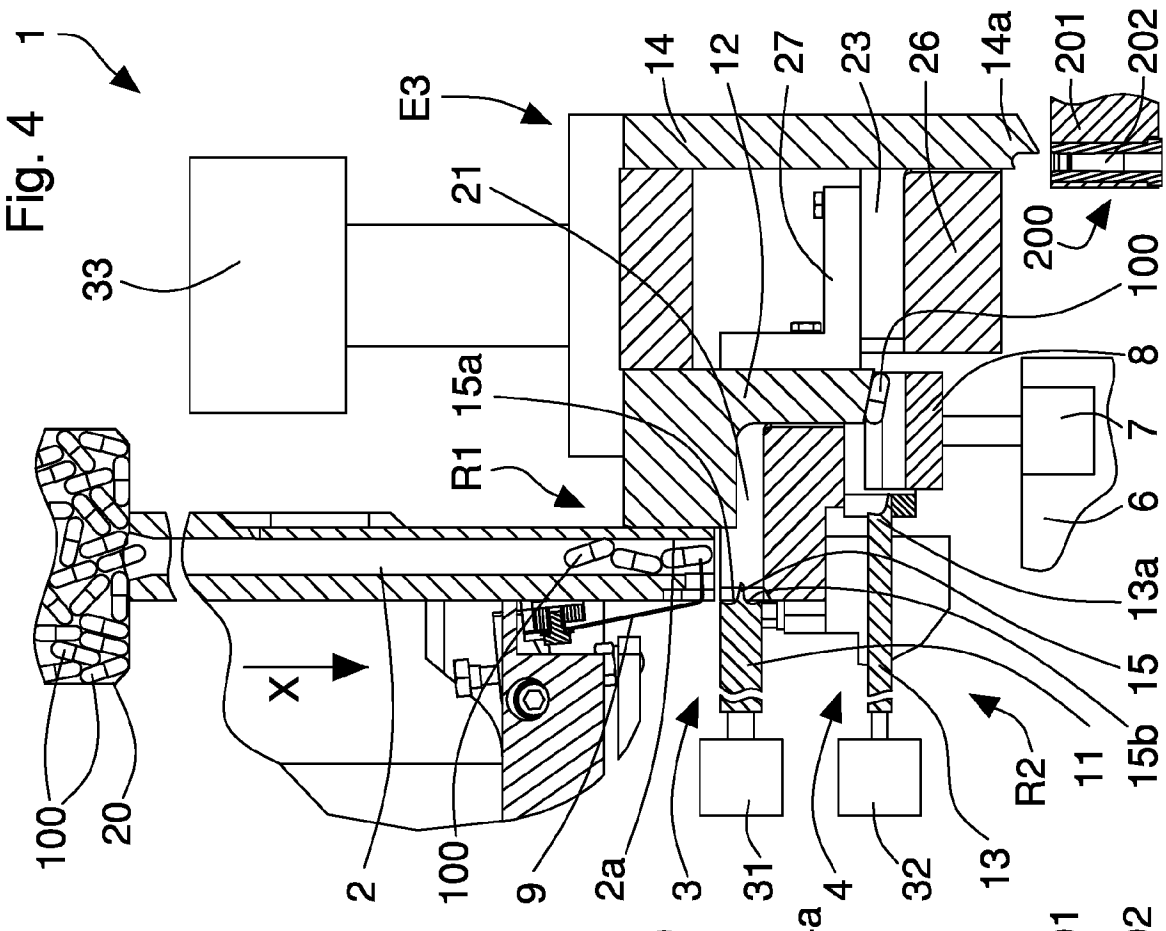
Fig. 2

Fig. 1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201
202
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8
7
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15
15b
11
R2
21
33
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R1
X
100
20
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100
9
2a
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31
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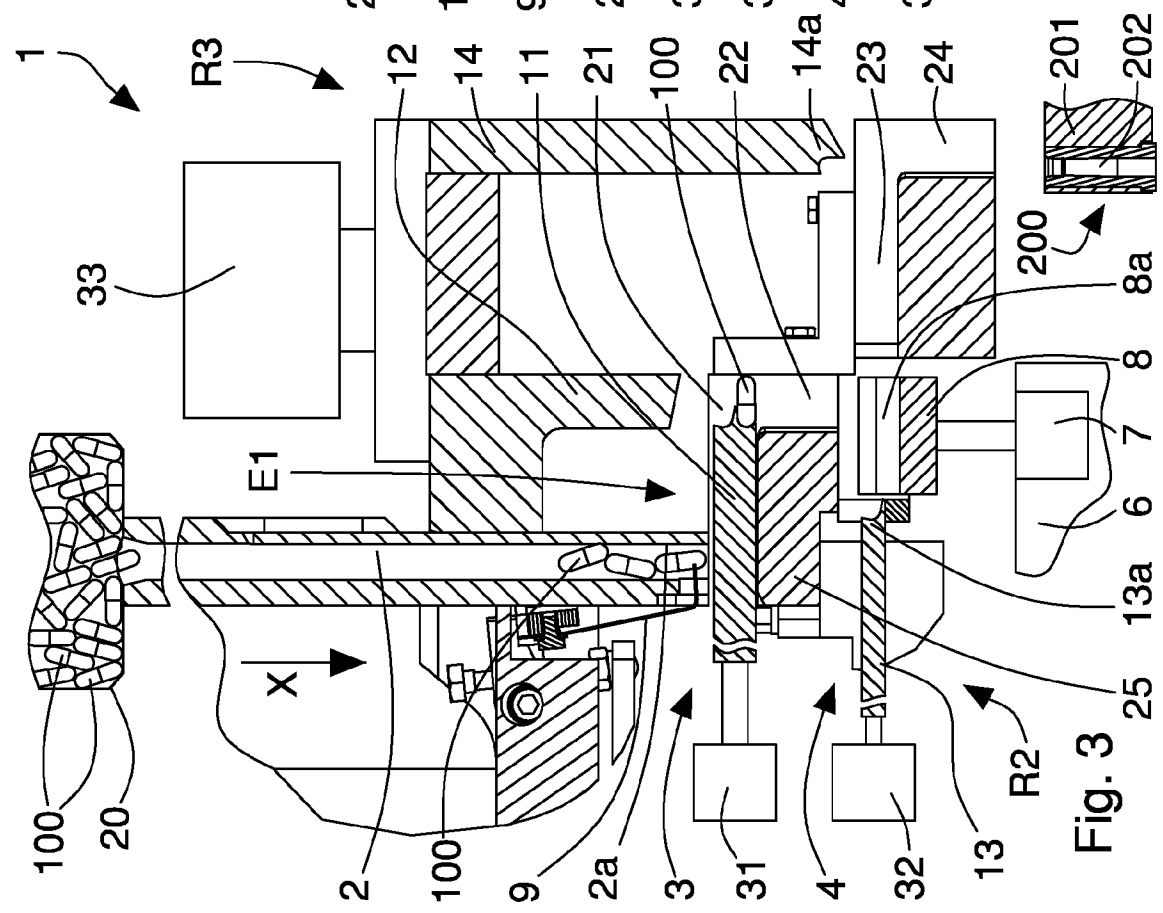
32
13

Fig. 4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11
21
100
22
14a
23
24
201
202
200
8a
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7
6
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100
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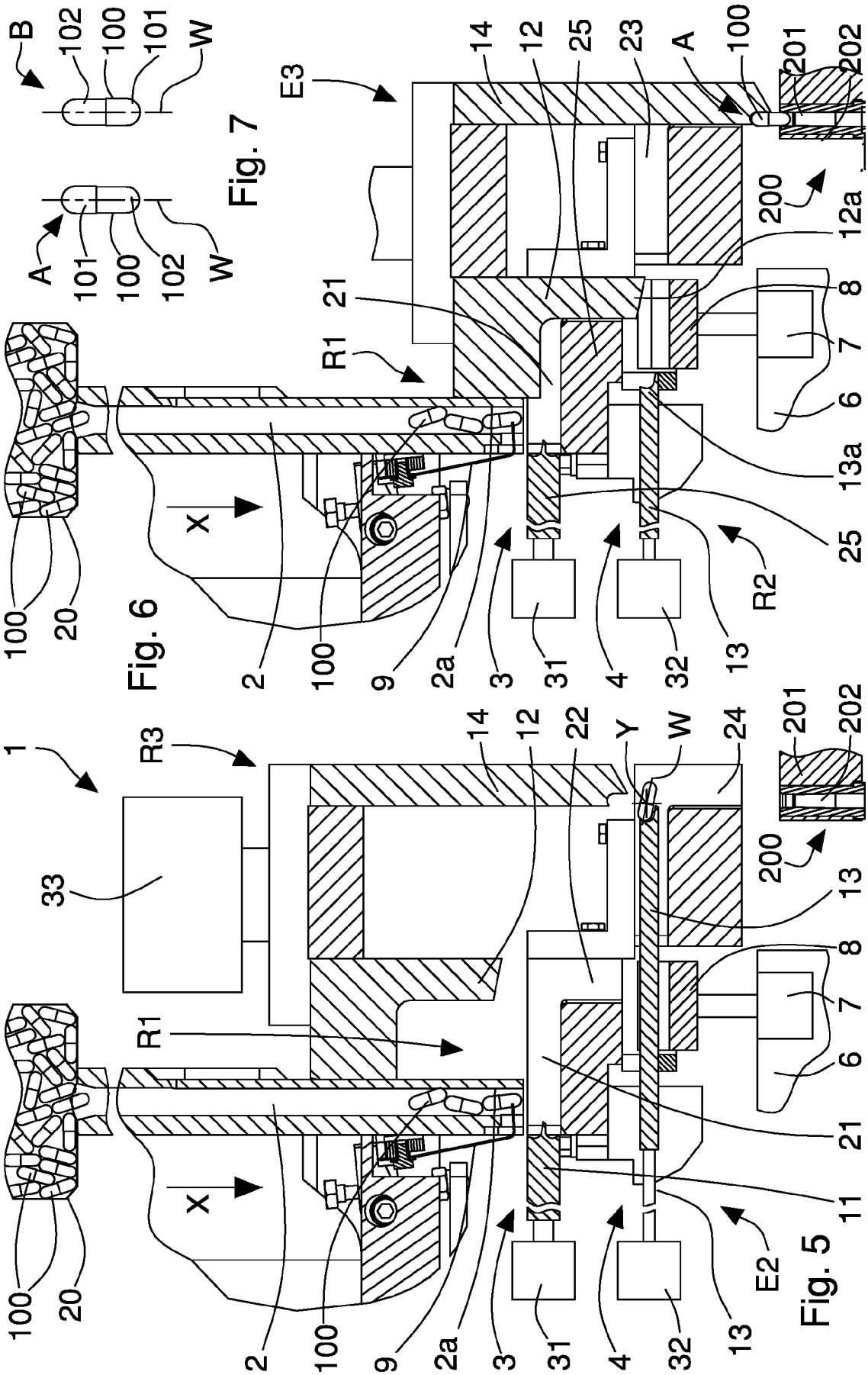
2a
3
31
4
32
13

Fig. 3


B
102
100
101
W
A
101
100
102
W
Fig. 7
E3
14
12
25
23
A
100
201
202
200
12a
21
R1
8
7
6
13a
25
R2
100
20
Fig. 6
X
2
100
9
2a
3
31
4
32
13
1
R3
33
14
12
22
Y
W
24
201
202
200
13
8
7
6
R1
21
11
E2
100
20
X
2
100
9
2a
3
31
4
32
13
Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2024/056130

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61J3/07
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61J

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 practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 162 998 A (WURST REINER [DE] ET AL) 19 December 2000 (2000-12-19) column 3, lines 23-58; figure 1	1-15
A	US 6 114 636 A (CANE ARISTIDE [IT] ET AL) 5 September 2000 (2000-09-05) figure 1	1-15
A	US 2013/206484 A1 (CONSOLI SALVATORE FABRIZIO [IT] ET AL) 15 August 2013 (2013-08-15) figures 1-4	1-15
A	US 6 877 611 B2 (SHIONOGI QUALICAPS CO LTD [JP]) 12 April 2005 (2005-04-12) figures 1-9	1-15

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

☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 October 2024	24/10/2024

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

INTERNATIONAL SEARCH REPORT

Information on patent family members

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