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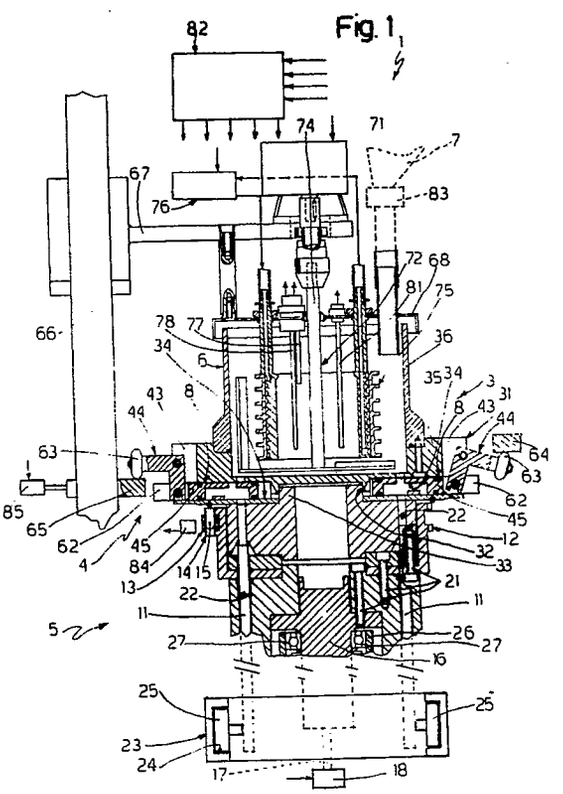
(54) Machine for metering pharmaceutical products, particularly into capsules.

(57) A machine (1) comprising:
a rotary bottom portion (5) in which are formed holes (22) engaged by mobile pistons (11);
a belt (13) conveying capsules (15);
a rotary top portion (3) having a container (6) for a pharmaceutical product;
a rotary center portion (4) integral with the bottom portion (5) and top portion (3);
holes (34) formed in the center portion (4);
valves (8) designed, at each turn, to travel along a respective hole (34) between a first position wherein the container (6) communicates with a hole (22) and the respective piston (11) moves down to draw in the product, and a second position wherein the piston (11) moves up, and an opening (51) is opened for feeding a given quantity of the product into a capsule (15) underneath; and a mechanism (44, 64, 65) for controlling displacement of the valves (8).

Fig. 1



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The present invention relates to a machine for metering pharmaceutical products in liquid or paste form into hard gelatine capsules or bottles.

Known machines for metering pharmaceutical products currently differ in design according to the nature of product, i.e. powder, liquid, paste, granules, etc. Those currently used for metering liquid products operate on an indexing basis, and substantially present an indexing body radially supporting a number of capsules; a feeder filled with liquid; a second internally-channelled body rotating between two operating positions; and a number of hydraulic pistons. Said second body, in a first position, connects the feeder to the pistons for withdrawing a given amount of liquid, and, in a second position, connects the pistons to respective capsules arrested underneath the second body for a given period of time in which the pistons inject the liquid into the capsules.

Liquid metering machines of the aforementioned type present numerous drawbacks.

In particular, for a given overall size, indexing machines provide for lower output as compared with continuous types. Moreover, each operating step is accompanied by severe vibration resulting, not only in wear of the machine components, but also in spillage of the liquid from the capsules. This, in turn, results in further equally serious drawbacks, such as inaccurate filling of the capsules and fouling of the machine to the extent that it eventually grinds to a halt. Finally, due to the high cost and complexity of such machines, control devices for ensuring the presence of the capsules inside their seats are often dispensed with, thus resulting in possible further spillage and arrest of the machine.

Current paste metering machines present a screw for feeding the paste to a nozzle from which a thread of paste emerges and is cut by a blade so as to drop inside the capsule. Machines of this sort may be indexed, with all the disadvantages already mentioned, or operated continuously, in which case, they require a complex feed nozzle and cutting mechanism. In either case, machines of this sort can only be used for products in paste form.

The aim of the present invention is to provide a machine for metering pharmaceutical products, designed to overcome the aforementioned drawbacks, i.e. which operates continuously; features straightforward, reliable devices for detecting the presence of the capsules; and is easily adaptable for metering both liquid and paste products.

Further aims and advantages of the present invention will be disclosed in the following description.

With this aim in view, according to the present invention, there is provided a machine for metering, particularly into capsules, a predetermined quantity of a pharmaceutical product in substantially liquid or paste form, characterised by the fact that it comprises:

a bottom portion connected to a drive shaft so as to rotate about a vertical longitudinal axis;

at least a first vertical axial hole open at the top and formed in said bottom portion;

at least one piston moved back and forth by a first cam along said first hole;

a conveyor belt supporting said capsules, meshing with a portion of said bottom portion, and traveling along the entire plant of which said machine forms part;

a rotary top portion having a container fed with said pharmaceutical product;

a rotary center portion coaxial and angularly integral with said bottom portion and said top portion;

at least a second hole associated with said first hole and formed radially along said center portion;

at least one valve housed inside said second hole, having an inner chamber with three openings, and designed, for each turn of said center portion, to travel along said second hole between a first position, wherein said inner chamber communicates at the top with said container via a first opening and at the bottom with said first hole via a second opening, and the respective said piston of said first hole is moved downwards so that said first hole is engaged by said product, and a second position wherein said chamber communicates with said first hole via said second opening, the respective said piston of said first hole is moved upwards, and a third opening is opened at the bottom for feeding a predetermined quantity of said product into said capsule underneath;

and

a mechanism for controlling the reciprocating movement of said valve.

Two preferred, non-limiting embodiments of the present invention will be described by way of examples with reference to the accompanying drawings, in which:

Fig.1 shows a section of a machine for metering liquid products;

Fig.2 shows a larger-scale section of a center portion of the Fig.1 machine;

Fig.3 shows a section of a machine for metering products in paste form;

Fig.4 shows a larger-scale section of a portion of the

Fig.3 machine;

Fig.s 5 and 6 show plan views of two details on the Fig.3 machine;

Fig.7 shows a view of a third detail on the Fig.3 machine.

Number 1 in Fig.1 indicates a continuously-operating machine for metering liquid pharmaceutical products in general into hard gelatine capsules.

The term liquid products is intended to mean actual liquids, thixotropic liquids, heat-melt liquids (fed in the form of paste or very thick liquids) and liquids with suspended particles. Schematically, machine 1 can be divided along its vertical longitudinal axis into three coaxial, substantially cylindrical, rotary portions 3, 4 and 5. Top portion 3 comprises a cylindrical container 6 fed with liquid by a feeder 7 at the top, as shown partially by the dotted line. Center portion 4 comprises a number of substantially slide type valves 8 designed, for each turn of machine 1, to receive a given quantity of liquid from container 6 and then feed it to a respective capsule. Bottom portion 5 comprises a number of hydraulic pistons 11, one for each valve 8, for generating the thrust required for feeding the liquid to the capsule. Bottom portion 5 also presents a toothed portion 12 with which meshes a belt 13 having a number of bushes 14 engaged by respective bottoms 15 of said capsules. Machine 1 normally forms part of a system comprising various types of machines, e.g. for supplying the capsules, positioning and separating the top and bottom halves of the capsules, metering pharmaceutical products of various types and/or in other forms, closing and packing the capsules, etc.. All these machines are usually driven by one means, e.g. belts, pulleys or direct gearing, present a toothed portion similar to 12, and are usually tangent to one another so that belt 13 runs through the entire system.

Bottom portion 5 is driven by a vertical shaft 16 connected in known manner to the output shaft 17 of a motor 18 as shown schematically by the dotted line in Fig.1. To facilitate assembly, bottom portion 5 is formed in a number of coaxial parts connected integral with one another by means of screws 21. Bottom portion 5 is in the form of a rotary drum having an intermediate ring of equally-spaced through holes 22 inside each of which a respective piston 11 slides in reciprocating manner. Travel of piston 11 is controlled by a fixed cylindrical cam 23 in which is formed an annular track 24 engaged by a wheel 25 supported on the bottom end portion of piston 11 projecting downwards from portion 5. The above is a known control system used on various machines in this particular field, though normally for controlling the operation of pins performing different functions from those of pistons 11, and as such is shown only schematically in Fig.1. Bottom portion 5 and consequently all the rotary parts of machine 1 are supported on a fixed column 26 (shown partially) located inside portion 5 and housing shaft 16 via bearings 27.

As shown in Fig.2, center portion 4 comprises a substantially cylindrical body 31, the center portion of the bottom face of which presents a cylindrical recess 32 engaged by the cylindrical top end 33 of portion 5. Body 31 is secured to portion 5 by means of screws (not shown), and presents a number of cylindrical radial holes 34 each housing a valve 8. The top face of body 31 constitutes the bottom wall of container 6, which presents a lateral wall composed of a bottom portion consisting of a ring 35 extending coaxially upwards from the top face of body 31, and a longer top portion consisting of an annular body 36 supported coaxially on ring 35 by means of screws 37. At each hole 34, the top and bottom faces of body 31 present respective vertical holes 38 and 41 coming out inside hole 34. Holes 38 and 41 are formed along the same ring, and are therefore coaxial with one other. Holes 38 constitute the outlets of container 6, and holes 41 connect the inside of valve 8 with hole 22 of respective piston 11, so that holes 41 are coaxial with holes 22.

At each hole 34, the lateral surface of body 31 presents a recess 42 open at the top and outwards of body 31. At each recess 42 of ring 35, there extends radially a flat vertical appendix 43. Valve 8 travels along respective hole 34, between two limit positions, by virtue of a lever 44 operated by cams described in detail later on. Valve 8 comprises a cylindrical body 45 having a horizontal longitudinal axis and inside which is defined, along said axis, a chamber 46 having three vertical openings 47, 48 and 51. For a given limit position of valve 8, top opening 47 provides for connecting respective hole 38 hydraulically to chamber 46. Wide bottom opening 48 provides for constantly connecting chamber 46 to respective hole 22. Opening 51 is also formed at the bottom but with its axis further outwards in relation to opening 48. On the bottom face of body 31, along a larger-diameter ring than that defined by holes 41, there is formed, at each hole 34, a further smaller-diameter hole 52 supporting a nozzle 53 the internal passage of which is defined by a capillary hole. The ring defined by holes 52 is the same as that defined by toothed portion 12, so that, on the portion of said portion 12 meshing with belt 13, each nozzle 53 is coaxial with a respective capsule bottom 15 underneath. In one limit position of valve 8, opening 51 is coaxial and communicates hydraulically with a respective hole 52. For reasons described in detail later on, at each hole 34, there is formed a passage 54 between hole 34 and recess 32.

Lever 44 is shaped in the form of a downturned L, and comprises a substantially vertical arm 55 extending downwards inside respective recess 42, and a substantially horizontal arm 56 extending radially outwards of center portion 4. The center portion of lever 44 pivots about a horizontal pin 57 on a respective appendix 43, and the end of arm 55 presents a recess 58 engaged by a horizontal pin 61 on an appendix 62 extending coaxially from

body 45. Rotation of lever 44 therefore causes respective valve 8 to slide along hole 34. On the end of arm 56, lever 44 is fitted with a wheel 63 designed to contact two cams 64 and 65. When wheel 63 contacts cam 64, lever 44 is turned (clockwise in Fig.1) so as to slide valve 8 towards the innermost portion of hole 34 corresponding to a first limit position, wherein hole 38 communicates with respective opening 47, thus enabling liquid input into chamber 46, and hole 52 is closed at the top by the outer surface of body 45, thus preventing liquid from flowing out through opening 51. In this connection, it should be pointed out that, at the axial ends of chamber 46, the outer lateral surface of body 45 presents respective hydraulic sealing assemblies. When wheel 63 contacts cam 65, lever 44 is turned (anticlockwise in Fig.1) so as to slide valve 8 towards the outermost portion of hole 34 corresponding to a second limit position, wherein chamber 46 is prevented from communicating with container 6, and opening 51 communicates with respective hole 52, thus enabling fluid to flow out of hole 52 into capsule 15.

Machine 1 also comprises a fixed column 66 supporting, over container 6, a plate 67 in turn supporting a second plate 68 covering container 6, and the casing of a variable-speed electric motor 71. Container 6 houses a mixing device 72 having blades 73 turned about the longitudinal axis of machine 1 by a shaft 74 connected mechanically to the output shaft of motor 71. Container 6 also houses a heating device 75 consisting, in the embodiment shown, of an annular, externally finned body inside which is formed a substantially helical heating fluid circuit. A system, shown schematically by block 76, provides for heating the fluid to a predetermined temperature and feeding it to device 75. Casing 6 also houses three sensors 77, 78 and 81 supported on plate 68, and which provide respectively for detecting the top and bottom level and the temperature of the liquid inside container 6.

Machine 1 also comprises an electronic control system for controlling motors 18 and 71 and system 76, and to which sensors 77, 78 and 81 are connected. Via a gate valve 83 (shown schematically in Fig.1), control system 82 also provides for controlling supply of said pharmaceutical product from feeder 7 to container 6. Finally, control system 82 is connected to a sensor 84 for detecting the presence of capsules 15 on belt 13, particularly prior to the capsule filling stage. For better illustrating operation of sensor 84, this is shown in Fig.1 to be located to the side of belt 13 meshing with machine 1, whereas, in actual fact, it is preferably installed upstream from machine 1. A device 85 (e.g. consisting of a piston or rack) provides for moving or at any rate varying the position of cam 65 so as to prevent it from contacting and so turning lever 44. Device 85 is activated by control system 82 upon the latter detecting the absence of capsule 15, thus preventing liquid from being expelled from valve 8.

In actual use, at each turn of machine 1, contact between cam 64 and lever 44 axially displaces valve 8 so that, for a predetermined time, chamber 46 communicates hydraulically with container 6 and opening 51 is closed. At this stage, cam 23 moves piston 11 downwards so as to free the top portion of hole 22 and draw the liquid into body 45 and said top portion of hole 22. Piston 11 is then backed up slightly to expel any air in valve 8 into container 6, and, finally, contact between cam 65 and lever 44 axially displaces valve 8 so that, for a predetermined time, opening 47 is closed and opening 51 communicates hydraulically with nozzle 53. At this stage, a capsule 15 is aligned beneath nozzle 53, ready to receive a predetermined quantity of liquid, and respective piston 11 is moved upwards so as to expel the liquid from the top portion of hole 22. In other words, the liquid is forced towards the only possible outlet, i.e. opening 51, from which it is fed into capsule 15. For a given volume of valve 8, the amount of liquid fed into capsule 15 is directly proportional to the stroke of piston 11, i.e. to the length of the top portion of hole 22 filled with liquid at the drawing-in stage. Obviously, not all the liquid inside valve 8 is fed into capsule 15, due to the fact that the absence of pressure on the liquid at the end of the upstroke of piston 11 prevents the liquid from being fed through the capillary hole in nozzle 53. Consequently, at each turn of machine 1, piston 11 actually only draws in the amount of liquid for filling the top portion of hole 22 and which is then fed into capsule 15.

Control system 82 provides for overall control of machine 1, and particularly for maintaining a suitable liquid level inside container 6 via gate valve 83; for controlling the temperature of the liquid inside container 6, especially in the case of heat-melt liquids requiring a constant predetermined temperature (normally defined in a map stored in a memory block of system 82) during the metering process; and for controlling mixing device 72, which provides for both blending the product (e.g. liquids with suspended particles) and ensuring uniform temperature. The variable speed of motor 71 enables operation of mixer 72 to be regulated according to the current and predetermined characteristics of the product, for ensuring correct metering of the same. As already stated, upon detecting the absence of capsule 15, control system 82 provides for detaching cam 65 from lever 44 of respective valve 8, thus preventing the liquid from being expelled through opening 51, which remains

closed, while at the same time permitting upward movement of piston 11 for feeding the liquid back into container 6. As the amount of liquid fed into capsule 15 is proportional to the stroke of piston 11, said amount may obviously be varied by simply replacing cam 23 with another providing for a different stroke of piston 11, or by providing for an adjustable cam 23. Holes 54 provide for expelling any air inside holes 34 and so preventing it from obstructing travel of valves 8.

Number 101 in Fig.s 3 and 4 indicates a machine for metering pharmaceutical products in paste form. Like machine 1, machine 101 may be divided schematically, along its vertical longitudinal axis, into three coaxial, substantially cylindrical, rotary portions 102, 103 and 104. Top portion 102 comprises a container 105 fed with cubes 106 of paste on a conveyor belt 107 (shown partially). Center portion 103, which is similar to portion 4 of machine 1, comprises a number of valves 8 designed, at each turn of machine 101, to receive a given amount of paste from container 105 and feed it to a respective capsule 15. Bottom portion 104 is substantially similar to portion 5 of machine 1. Any other parts of machine 101 similar to those of machine 1 will be indicated using the same numbering system. Due to the paste form of the product, portion 103 differs from portion 4 of machine 1 substantially as regards two characteristics. Firstly, the portion of body 45 of valve 8 in which openings 48 and 51 are formed is flattened for better cutting the thread of paste issuing from opening 51, as described in more detail later on. Naturally, the corresponding portion of hole 34 is also flattened. Secondly, the bottom face of body 31 presents a smaller outside diameter than in Fig.1, and, instead of holes 52, an equal number of peripheral V-shaped radial recesses 108, as shown in Fig.5. As regards metering of the product into capsule 15, machine 101 operates in the same way as machine 1, except that the product issuing from opening 51 is in the form of a thread of paste which, as valve 8 travels inwards of hole 34, is cut by virtue of the flat design of the mating surfaces of bodies 31 and 45. As explained in detail later on, during the metering and cutting stages, capsule 15 is pressed against the edge of opening 51, at respective recess 108, and is lifted from respective bush 14 into recess 108. Subsequently, the upward thrust on capsule 15 is removed, and contact between the walls of recess 108 and capsule 15 prevents this from adhering to valve 8 (as a result of the "adhesive" effect of the paste). In fact, at a certain point in the rotation of machine 101, capsule 15 is carried off by belt 13 as this abandons machine 101 tangentially to mesh with a follow-up machine, and it is precisely at this point that capsule 15, if still attached to valve 8, is detached from the same by virtue of contacting the walls of recess 108.

As shown in Fig.4, portion 104 differs in only one respect from portion 5 of machine 1, which characteristic, however, may and is preferably also adopted on machine 1. Portion 104 comprises an annular flange 111 in which are formed a number of vertical through holes 112 equal in number to valves 8 and coaxial with a respective capsule 15. Each hole 112 is engaged by a cylindrical sleeve 113 along which a vertical pin 115 slides by virtue of a cam 114 similar to cam 23. Pin 115 is formed in two coaxial parts 116 and 117 with a spring 118 in between. As the thread of paste issues from opening 51, pin 115 moves upwards to press capsule 15 against the edge of opening 51 and through respective recess 108, thus ensuring the paste thread centers capsule 15. When applied to machine 1, the above system provides for avoiding spillage of the liquid outside capsule 15.

As shown in Fig.3, container 105 presents a bottom wall defined by the top face of body 31, and a lateral wall defined by an annular body 121 secured coaxially to body 31 by screws 122, and by a funnel-shaped body 123 secured coaxially to the top end of body 121 by screws 124. A fixed plate 125, over container 105, is fitted integral with a hollow, cylindrical, vertical column 126 coaxial with container 105 and the bottom portion of which is actually housed inside the same. The bottom end of column 126 is fitted coaxially, by means of screws 127, with a centrally-drilled, cylindrical body 128, the lateral surface of which presents a downward-winding channel 131. Body 128 is located close to the top face of body 31, and presents an outside diameter slightly smaller than the inside diameter of body 121. Body 128 therefore acts as a short-pitch screw for determining a constant paste pressure inwards of valves 8. Shaft 16 is connected angularly and coaxially in known manner (not shown) with a second rotary shaft 132 extending vertically upwards through body 31 and, via the interposition of bearings 133, through body 128. Via the interposition of further bearings 134, shaft 132 extends through the whole of column 126 and, on the top end outside column 126, is fitted with a gear 135. Via the interposition of bearings 136, column 126 is housed inside a second rotary column 137, the lateral surface of a portion of which, inside container 105, is fitted integral with a screw 138, and the top end of which is fitted with a gear 141. A reduction device 142 on plate 125 transmits motion from gear 135 to gear 141 and from shaft 16 to screw 138, which therefore turns at a slower speed than shaft 16.

As shown in Fig.3, machine 101 also presents an electronic control system 143 for controlling overall operation of machine 101. In particular, system 143 controls means 144 (shown by the dotted

line) for driving conveyor belt 107, motor 18 and device 85. System 143 is connected to sensor 84 already described in connection with machine 1; a temperature sensor 145 on a cooling fin 146 extending radially from the outer lateral surface of body 121; and a microswitch 147 activated by a built-in device on reduction device 142, for detecting an increase in pressure inside container 105 over and above a predetermined threshold. As a container housing a screw is inevitably subject to overheating, provision is made for a known system 148 (shown schematically) for blowing cold air on to the outer surface of container 105. System 148 is controlled by system 143 on the basis of the temperature detected by sensor 145, so as to maintain the temperature inside container 105 at a level acceptable by both the container components and the paste housed inside the same.

As shown in Fig.s 3, 6 and 7, reduction device 142 comprises a vertical rotary shaft 151 fitted centrally, via the interposition of bearings 152, with a gear 153 meshing with gear 135; fitted integrally at the bottom with a gear 154 meshing with gear 141; and fitted in idle manner, over gear 153, with an axially-sliding annular body 155. The top face of gear 153 is fitted integrally and coaxially with a ring 156 about which are formed a number of equally-spaced notches 157. Body 155 supports, at the bottom, a number of horizontal rollers 158 cooperating with notches 157 (Fig.7). The top face of body 155 presents an integral ring 161 having two diametrically-opposed, open-topped recesses 162. Over body 155, shaft 151 is connected integral, via a pin (Fig.6), with a block 163 from which two arms 164 extend radially in opposite directions, and are fitted with respective horizontal rollers 165 engaging respective recesses 162. The assembly consisting of block 163, arms 164 and rollers 165 is housed inside an axially-sliding, upside down cup-shaped body 166 mounted in idle manner on shaft 151 and secured to ring 161 and body 155 by means of screws 167 (shown by the dotted lines in Fig.3). The top end of shaft 151 outside body 166 is threaded and engaged by a nut 168, and spring means 171 are provided between nut 168 and the top face of body 166. A fixed plate 172, integral with plate 125, supports microswitch 147, the operating stem 173 of which is normally pressed downwards by an outer annular shoulder 174 formed on body 166.

In actual use, the motion of shaft 16 is transmitted by gear 135 to gear 153, which, via the connection of notches 157 and rollers 158, drives body 155. This in turn drives body 166 directly, and block 163 together with shaft 151 via the connection of recesses 162 and rollers 165. Finally, shaft 151 drives screw 138 via the connection of gears 154 and 141. The transmission ratio of gear pairs 135-153 and 154-141 determines the rotation speed of screw 138 which, as stated, is less than that of container 105.

In use, an undesired increase in pressure may occur inside container 105, mainly due to an excessive number of cubes 106 or to the hardness of the paste. When the pressure inside container 105 exceeds a given value determined by the setting of spring means 171, the rotation speed of screw 138 is gradually slowed down by the pressure exerted by the same on the paste. Consequently, shaft 151 also tends to turn at a slower speed than that imposed by gear 153, which speed is also imposed on body 155. In the event of a difference in speed between gear 153 and body 155, rollers 158 travel up the mating surface of respective notches 157, which surface (Fig.7) is inclined for facilitating upward travel of rollers 158. This therefore results in upward travel of body 155 which, against the action of spring means 171, also pushes up body 166, the shoulder 174 of which releases stem 173 of microswitch 147 so as to vary the electrical status of the same and, via control system 143, arrest operation of belt 107 transporting cubes 106.

The advantages of the present invention will be clear from the foregoing description.

In particular, it provides for a continuously operating machine, the major advantages of which include greater output, as compared with indexing machines of comparable overall size, reduced vibration and, consequently, reduced wear of machine components. In the case of machine 1, said reduction in vibration also prevents fouling of the machine and ensures correct, accurate metering of the product into capsules 15. Moreover, a continuously operating machine enables troublefree, low-cost installation of sensors for detecting the presence of capsules 15, thus preventing possible spillage of the liquid from valves 8, as well as for performing other, e.g. temperature control, functions. In short, the machine according to the present invention provides for a greater degree of reliability as compared with currently used types. In the case of machine 101, this is more straightforward in design as compared with current machines, especially as regards the paste metering mechanism, and features a stop device for arresting the cube conveyor in the event of an increase in pressure inside container 105. Finally, an important point to note is that machines 1 and 101 differ solely as regards the top portion, which may easily be changed for switching from one product to another.

To those skilled in the art it will be clear that changes may be made to machines 1 and 101 as described and illustrated herein without, however, departing from the scope of the present invention.

Claims

1. A machine for metering, particularly into capsules (15), a predetermined quantity of a pharmaceutical product in substantially liquid or paste form, characterised by the fact that it comprises:
a bottom portion (5 or 104) connected to a drive shaft (16, 17) so as to rotate about a vertical longitudinal axis;
at least a first vertical axial hole (22) open at the top and formed in said bottom portion (5 or 104);
at least one piston (11) moved back and forth by a first cam (23) along said first hole (22);
a conveyor belt (13) supporting said capsules (15), meshing with a portion (12) of said bottom portion (5 or 104), and traveling along the entire plant of which said machine forms part;
a rotary top portion (3 or 102) having a container (6 or 105) fed with said pharmaceutical product;
a rotary center portion (4 or 103) coaxial and angularly integral with said bottom portion (5 or 104) and said top portion (3 or 102);
at least a second hole (34) associated with said first hole (22) and formed radially along said center portion (4 or 103);
at least one valve (8) housed inside said second hole (34), having an inner chamber (46) with three openings (47, 48, 51), and designed, for each turn of said center portion (4 or 103), to travel along said second hole (34) between a first position, wherein said inner chamber (46) communicates at the top with said container (6 or 105) via a first opening (47) and at the bottom with said first hole (22) via a second opening (48), and the respective said piston (11) of said first hole (22) is moved downwards so that said first hole (22) is engaged by said product, and a second position wherein said chamber (46) communicates with said first hole (22) via said second opening (48), the respective said piston (11) of said first hole (22) is moved upwards, and a third opening (51) is opened at the bottom for feeding a predetermined quantity of said product into said capsule (15) underneath; and
a mechanism (44, 64, 65) for controlling the reciprocating movement of said valve (8).

2. A machine as claimed in Claim 1, characterised by the fact that it comprises:
a number of said first holes (22) equally spaced in said bottom portion (5 or 104);
a number of said pistons (11), one for each of said first holes (22);
a number of said second holes (34) equal in number to and associated with said first holes (22), and equally spaced along said center portion (4 or 103); and
a number of said valves (8), one for each said second hole (34).

3. A machine as claimed in Claim 2, characterised by the fact that the bottom wall of said container (6 or 105) presents a coaxial ring of a number of third holes (38), one for each of said second holes (34); each of said third holes (38) communicating with said chamber (46) of said respective valve (8) when said valve (8) is in said first position, and being closed when said valve (8) is in said second position.

4. A machine as claimed in Claim 3, characterised by the fact that each said valve (8) is assigned a lever (44) moved between two positions by a second (64) and third (65) cam; each position of said lever (44) corresponding to a position of said valve (8).

5. A machine as claimed in Claim 4, characterised by the fact that said valve (8) comprises a first body (45) in which is formed said chamber (46); and an appendix (62) connected to said lever (44).

6. A machine as claimed in Claim 5, characterised by the fact that said lever (44) pivots on a first horizontal pin (57) on said center portion (4 or 103), is shaped in the form of a downturned L, and comprises a first substantially vertical arm (55) extending downwards, and a second substantially horizontal arm (56) extending radially outwards of said center portion (4 or 103); the end of said first arm (55) presenting a recess (58) engaged by a second horizontal pin (61) on an appendix (62) extending coaxially from said first body (45); and the end of said second arm (56) being fitted with a wheel (63) designed to contact said first and second cams (64, 65) for turning said lever (44) and so moving said valve (8).

7. A machine as claimed in at least one of the foregoing Claims from 4 to 6, characterised by the fact that it comprises an electronic control system (82 or 143) controlling overall operation of said machine and to which is connected a sensor (84) for detecting the presence of said capsules (15) on said belt (13); said control system (82 or 143) being designed, in the absence of said capsule (15) and via means (85), to move said third cam (65) in such a manner as to prevent it from contacting said respective lever (44) and so maintain said

valve (8) in said first position preventing the outflow of said product.

8. A machine as claimed in at least one of the foregoing Claims from 2 to 7, characterised by the fact that it comprises a number of third vertical pins (115) supported on said bottom portion (5 or 104), equal in number to and associated with said valves (8), and sliding axially by virtue of a fourth cam (114); each said third pin (115) being designed, when said valve (8) is in said second position, to move upwards and press a respective said capsule (15) against said third opening (51).

9. A machine as claimed in Claim 7 and/or Claim 8 dependent on Claim 7, characterised by the fact that said product is in liquid form, by which is meant actual liquid, thixotropic liquid, heat-melt liquid (fed in the form of paste or very thick liquid) and liquid with suspended particles; characterised by the fact that it comprises, inside said container (6), a mixing device (72) controlled by said control system (82); a temperature sensor (81); two sensors (77, 78) for respectively detecting the top and bottom level of said product; and a device (75) for heating said product and also controlled by said control system (82); said sensors (81, 77, 78) being connected to said control system (82).

10. A machine as claimed in Claim 9, characterised by the fact that it comprises a feeder (7) for feeding said container (6) via a gate valve (83) controlled by said control system (82).

11. A machine as claimed in the foregoing Claims, characterised by the fact that said center portion (4 or 103) presents a number of fourth holes (52), one for each said second hole (34), through which said liquid pharmaceutical product is fed downwards from said third opening (51) in said second position of said valve (8).

12. A machine as claimed in Claim 11, characterised by the fact that each said fourth hole (52) houses a nozzle (53) with a capillary hole.

13. A machine as claimed in Claim 7 and/or Claim 8 dependent on Claim 7, characterised by the fact that said product is in paste form; and by the fact that said container (105) houses a screw (138) rotating about the vertical longitudinal axis of said container at a slower speed than the same.

14. A machine as claimed in Claim 13, characterised by the fact that a second fixed, short-pitch screw (128) is installed between said screw (138) and said bottom wall of said container (105).

15. A machine as claimed in Claim 13 and/or 14, characterised by the fact that it comprises: a belt (107) conveying cubes (106) of paste which drop down into said container (105); means (144) for driving said cube conveyor belt (107) and controlled by said control system (143); and a device for detecting a pressure increase inside said container (105) over and above a given threshold, and activating a microswitch (147) connected to said control system (143) so that said system (143) arrests said means (144) driving said cube conveyor belt (107).

16. A machine as claimed in Claim 15, characterised by the fact that said pressure detecting device is incorporated in a reduction device (142) for transmitting motion from the drive shaft (16) of said container (105) to said rotary screw (138).

17. A machine as claimed in at least one of the foregoing Claims from 12 to 16, characterised by the fact that it comprises a sensor (145) connected to said control system (143) and designed to detect the temperature inside said container (105); and a system (148) activated by said control system (143) in the event of the temperature inside said container (105) exceeding a given threshold, and designed to blow cold air on to the outer surface of said container (105).

18. A machine as claimed in at least one of the foregoing Claims from 12 to 17, characterised by the fact that the bottom face of said center portion (103) presents a number of V-shaped peripheral radial recesses (108), one for each said second hole (34), and coaxial with said third opening (51) when said respective valve (8) is in said second position.

19. A machine as claimed in Claims 8 and 18, characterised by the fact that said recess (108) is engaged by the top portion of said capsule (15) when this is pushed upwards by said respective third pin (115).

Fig. 1

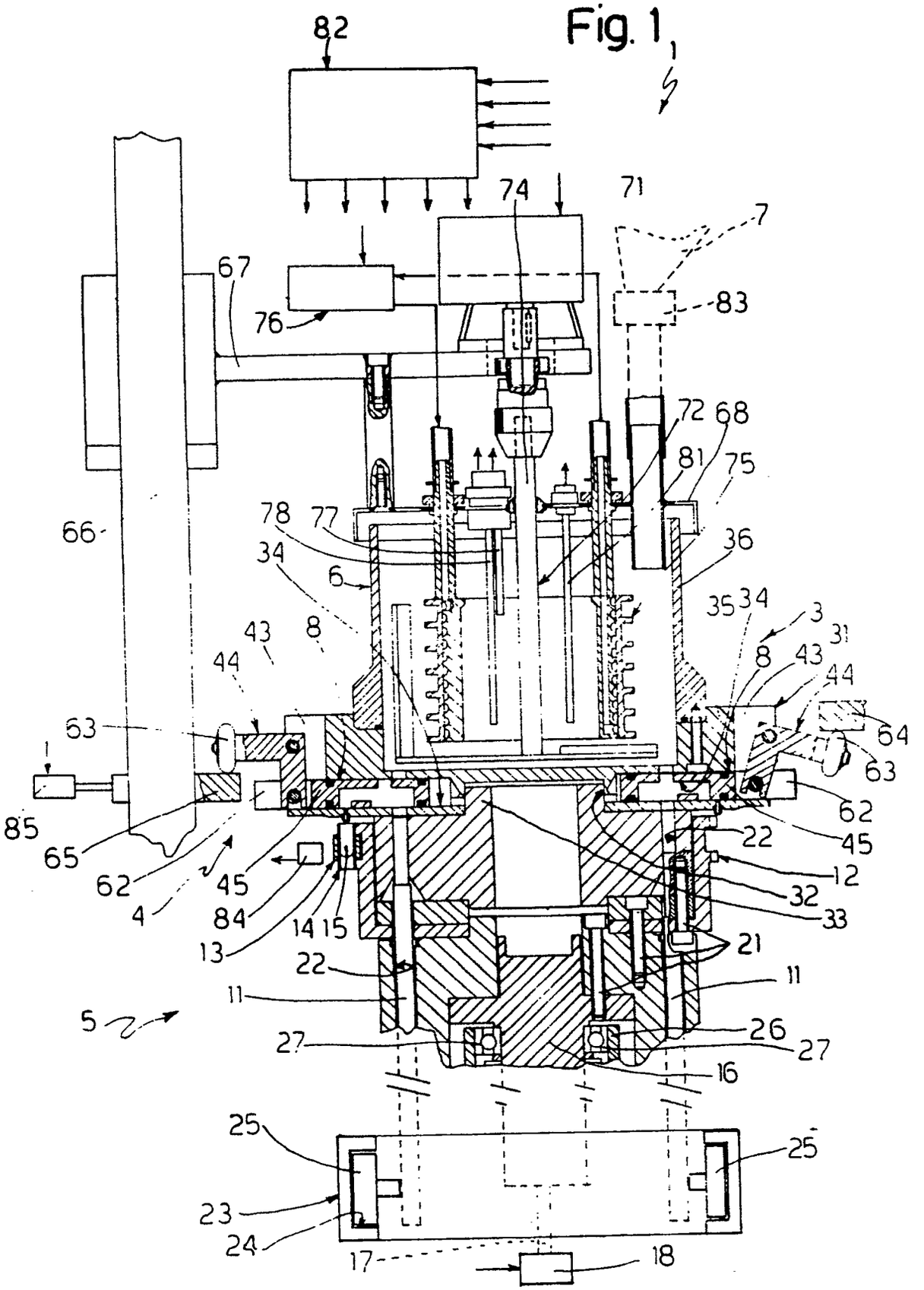
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Fig. 2

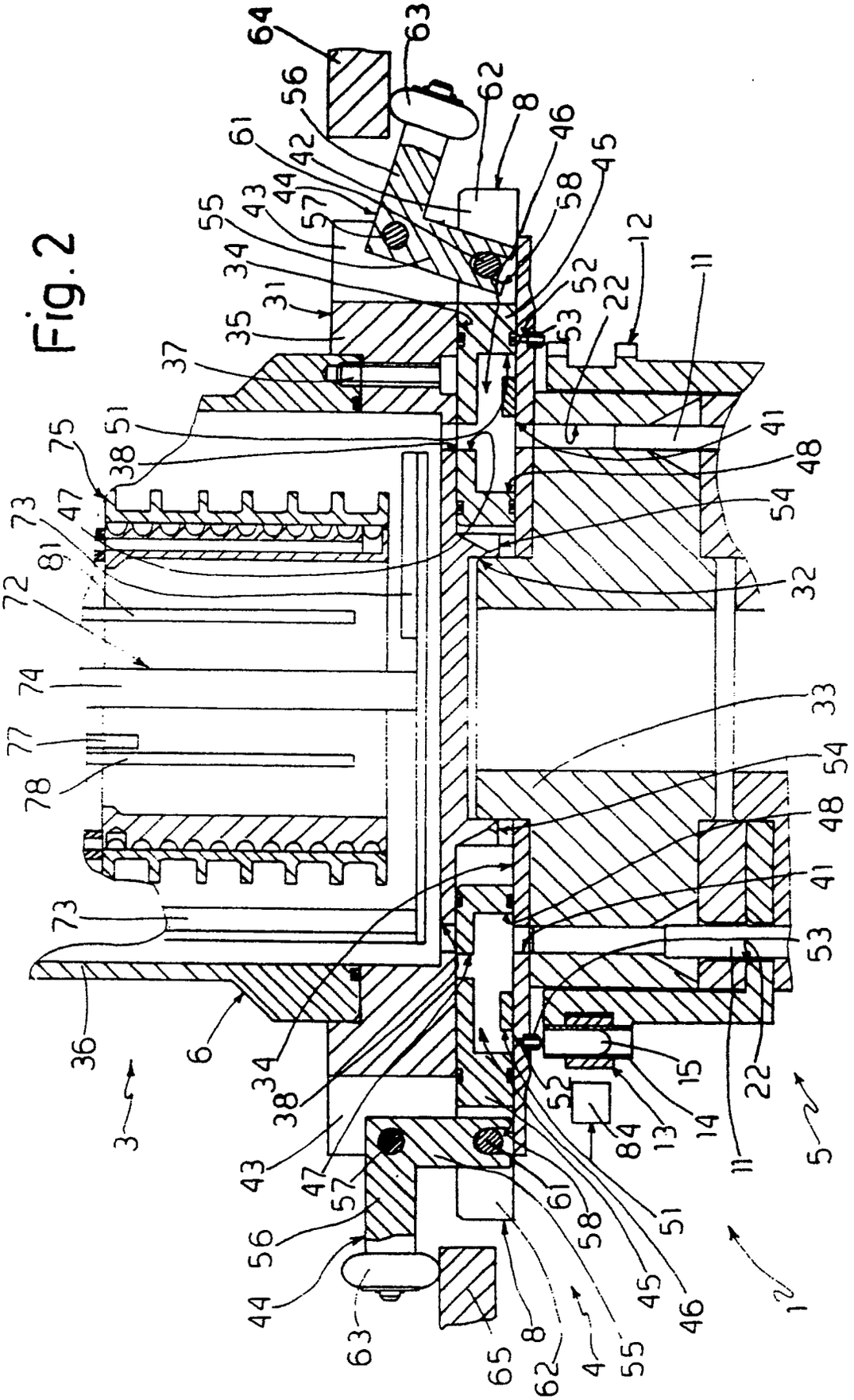
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Fig. 3

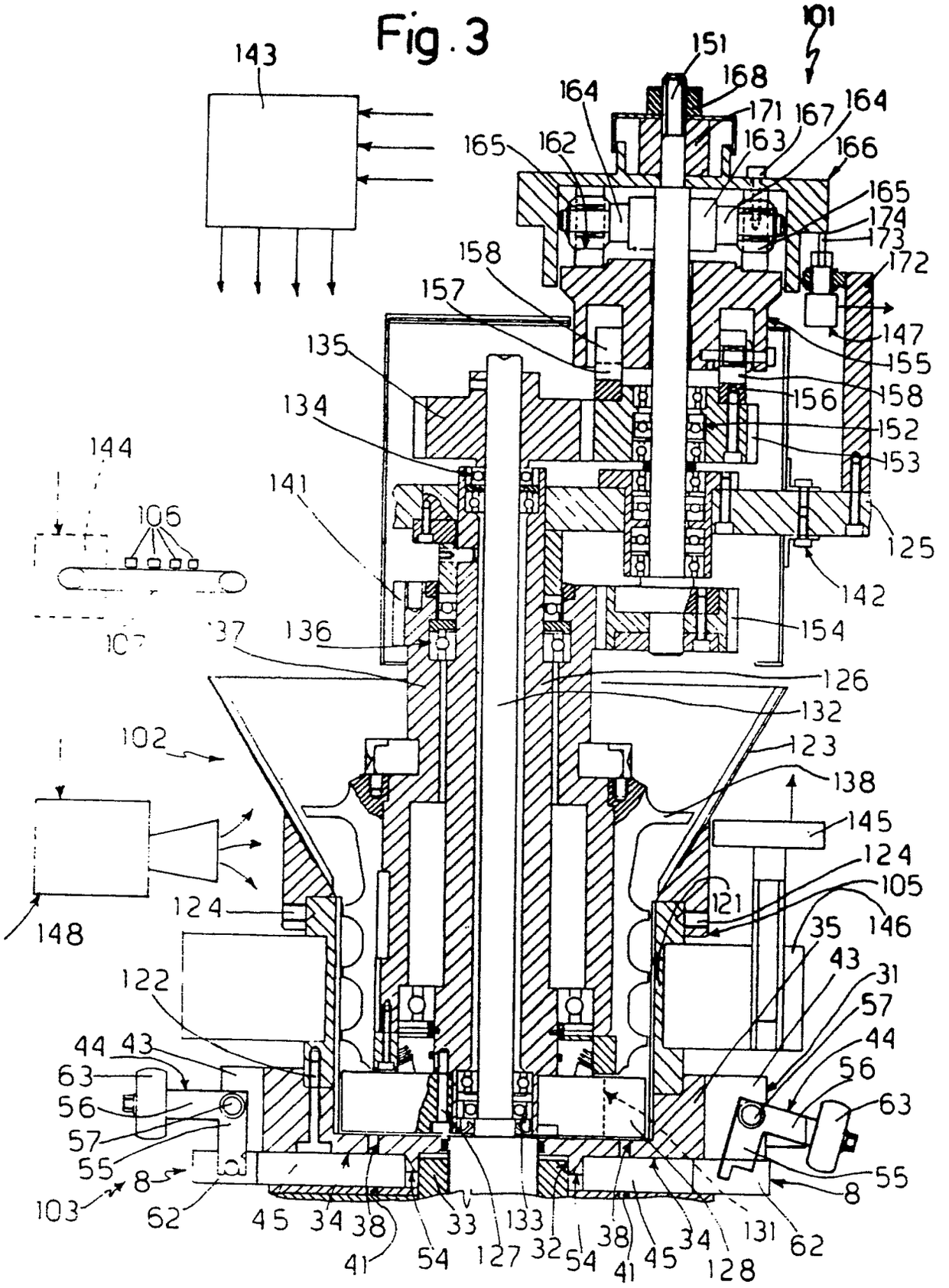
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Fig. 4

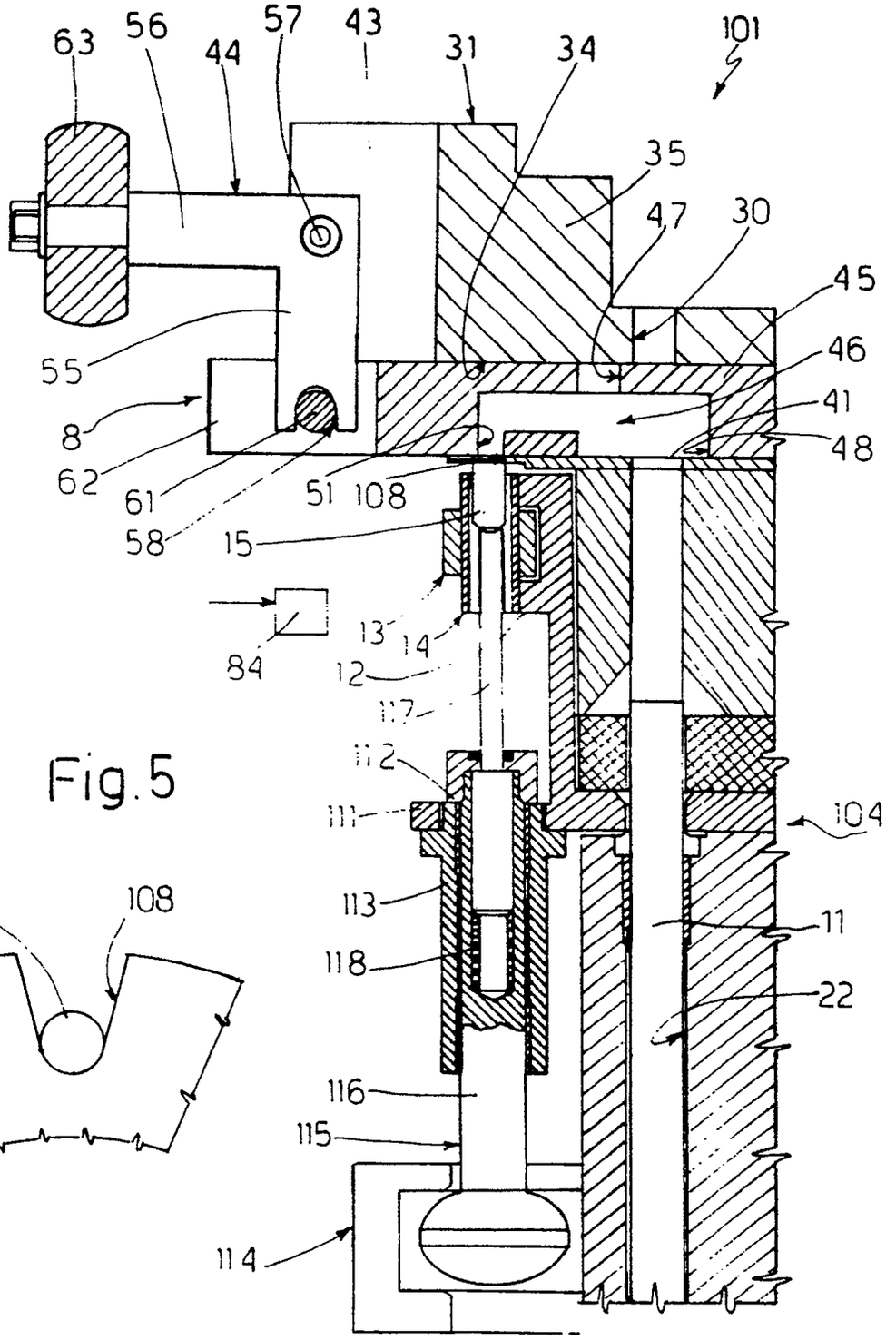
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Fig. 5

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Fig.6

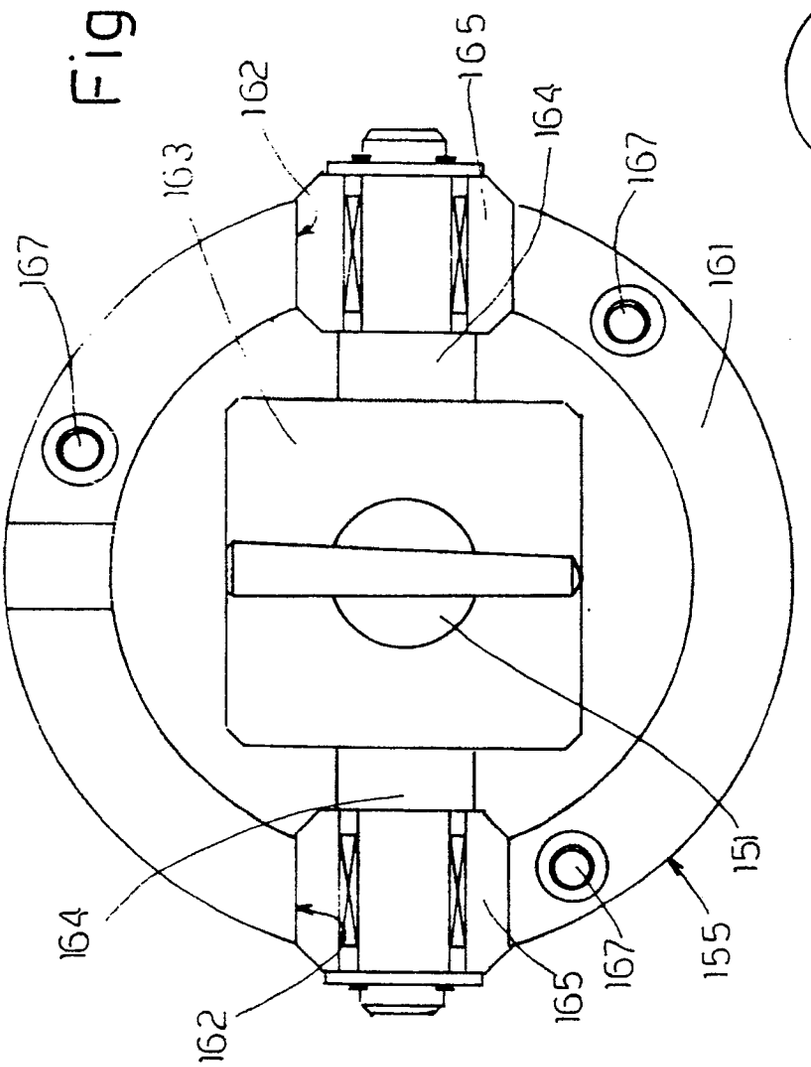
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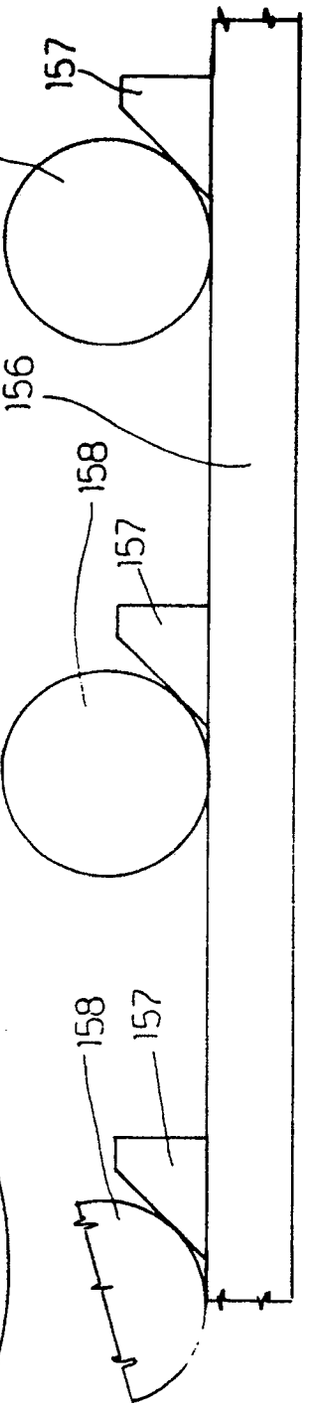
Fig.7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European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 10 5443

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	DE-A-3 432 992 (MG 2 S.P.A.) * claim 1; figures 1-3 *	1	A 61 J 3/07
A	FR-A-2 403 471 (ROBERT BOSCH G.M.B.H.) * page 3, line 20 - page 4, line 3 * * figures 1,2 *	1	
A	DE-A-3 318 810 (MG 2 S.P.A.) * claim 1; figures 1-5 *	1	
P,A	WO-A-9 007 695 (UNISABI S.A.) * page 6, line 2 - page 8, line 2; figures 1-5 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

A 61 J
B 65 B
G 01 F

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	26 June 91	GODOT T.G.L.

CATEGORY OF CITED DOCUMENTS

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D: document cited in the application
L: document cited for other reasons

&: member of the same patent family, corresponding document