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(54) Metering machine device for compacting pharmaceutical products in capsules.

(57) A device (3) for compacting pharmaceutical products in capsules (2) on a metering machine comprising a rotary body (6) supporting a container (7) housing the product. The device (3) comprises:
a block (17) inside which is formed a sealed chamber (21);
a pin (18) having a head (33) housed in mobile manner inside the chamber (21); and a portion (35) designed, through a hole (8) formed in the bottom (11) of the container (7), to compact the product inside the capsule (2) underneath the hole (8);
a pressurized fluid circuit (55, 54, 58, 22, 24) between a source (26) and the chamber (21), for exerting pressure on the head (33), and such that the extent to which the product is compacted depends on the pressure of the fluid; and
a piston (16) supporting the block (17) and designed to move back and forth along a hole (15) formed in the body (6).

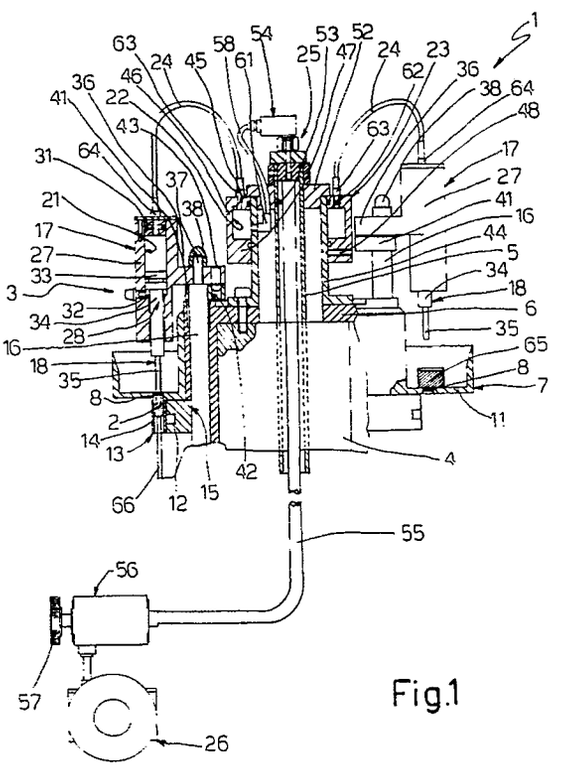

Fig.1

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The present invention relates to a device, installed on a metering machine, for compacting pharmaceutical products, preferably powders, inside preferably hard gelatine capsules.

Known metering machines feature a rotary annular container, the bottom of which presents a number of holes which, for each turn of the container, are opened at the bottom for a given period of time. Beneath the container, a conveyor belt supports a number of bottom capsule portions which, for said period, are arranged coaxial with said holes. The machine also comprises a rotary drum fitted with a number of rods moved axially by a cam and each fitted on the end with a block from which a pin extends inwards of the container. The compacting function is performed by said pin, which presses the powder inside the capsule once or several times for each turn of the machine. The pressure exerted by the pin is counteracted by a spring, the setting of which determines how much pressure is applied.

The above compacting system presents several drawbacks. Foremost of these is that, for ensuring the powder is compacted equally in all the capsules, the springs must be set one by one to the same value. Achieving an accurate setting is a painstaking job even in the case of one spring, let alone for several. What is more, the setting of the spring is what determines the extent to which the powder is compacted and, therefore, the amount of powder fed into the capsule. Consequently, any inaccuracy in the setting of the spring results in a corresponding inaccuracy in the amount of powder fed into the capsule. Last but not least is the fact that the springs cannot be set without first stopping the machine.

It is an object of the present invention is provide a metering machine device for compacting pharmaceutical products in capsules, designed to overcome the aforementioned drawbacks, i.e. which can be set easily and accurately without having to stop the machine.

According to the present invention, there is provided a device for compacting pharmaceutical products in capsules on a metering machine comprising a first drum type body designed to rotate a container filled with said product, characterised by the fact that it comprises: at least a second body above said container and in which is formed a first airtight chamber;

a vertical axially-mobile pin supported on said second body and having a top portion housed in said first chamber, and a bottom portion outside said second body and designed, in at least one operating stage, to engage a first hole formed in the bottom of said container, for compacting said product in a capsule underneath said first hole;

a pressurized fluid circuit between a source of said fluid and said first chamber, for exerting downward pressure on said top portion of said pin, and such that the extent to which said product is compacted is a function of the pressure of said fluid inside said first chamber; and

a vertical piston supporting said second body and designed to move back and forth along a second vertical hole formed in said first body.

A preferred non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Fig.1 shows a section of a compacting device installed on a metering machine (shown partially);

Fig.2 shows a plan view of the Fig.1 device.

Number 1 in Fig.1 indicates a machine for metering powdered pharmaceutical products into bottom capsule portions 2 normally made of hard gelatine. Machine 1 is described in Italian Patent Application n.3750 A/89 entitled "MACHINE FOR METERING POWDERED PHARMACEUTICAL PRODUCTS INTO A CONTAINER", filed on 6 December 1989 by the present Applicant, and the content of which is incorporated herein purely by way of reference as required. According to the present invention, machine 1 comprises a device 3 for compacting powder inside capsules and naturally differing from that illustrated in the above Italian patent application. Obviously, device 3 may also be employed on metering machines other that that described in said application.

Machine 1 substantially comprises:

a vertical column 4 rotated about its longitudinal axis by an electric motor (not shown);

a fixed vertical column 5 housed inside column 4 and extending upwards beyond the top end of the same;

a vertical drum type body 6 integral and therefore rotating with column 4;

an open-topped annular container 7 integral and therefore rotating with body 6;

an intermediate ring of equally-spaced vertical through holes 8 formed in the bottom wall 11 of container 7;

a flange 12 integral with body 6, located beneath container 7, and so formed as to engage a belt 13 defined by a number of bushes 14 each housing a capsule 2; and an intermediate ring of equally-spaced vertical through holes 15 equal in number to holes 8 and formed in body 6.

In use, belt 13 feeds capsules 2 from one end to the other of the system of which machine 1 forms part, said system presenting a number of machines, each having a flange or similar engaged by belt 13. Capsules 2 are of course arranged coaxial with respective holes 8.

As shown in Fig.s 1 and 2, device 3 comprises:

a number of vertical pistons 16 housed in respective holes 15, rotated by and about the longitudinal axis of body 6, and moved axially back and forth by a cam (not shown);
a number of blocks 17 fitted integral with the top ends, outside hole 15, of respective pistons 16;
a number of vertical pins 18, one for each block 17, extending from blocks 17 inwards of container 7 and coaxially with respective holes 8, for tamping the product once or repeatedly inside respective capsules 2;
a chamber 21 formed in each block 17 and containing pressurized fluid, preferably air, for counteracting upward travel of respective pin 18;
an annular chamber 22 formed in a body 23 integral with body 6;
a number of conduits 24 for constantly connecting chamber 22 to all of chambers 21; and
a member 25 for connecting chamber 22 to a pressurized fluid source 26.

Block 17 comprises a vertical body 27 in which is formed a vertical cylindrical through hole 28 having a top portion sealed by a cap 31, and a bottom portion smaller in diameter than said top portion and defining with the same an annular shoulder 32. Pin 18 comprises a wide head 33 housed in the top portion of hole 28 and supporting an annular seal; a central portion 34 housed in the bottom portion of hole 28; and a bottom portion 35 smaller in diameter than portion 34 and extending downwards outside hole 28. Chamber 21 is defined inside the top portion of hole 28, between head 33 and cap 31. Pin 18 is free to travel axially along hole 28 between cap 31 and shoulder 32, but is pressed constantly downwards by said pressurized fluid so that head 33 rests on shoulder 32. When compacting the product, the fluid in chamber 21 counteracts upward travel of pin 18 caused by the reaction of the product to the tamping operation.

A horizontal plate 36, extending from block 17, presents a vertical through hole engaged by the threaded top end 37 of respective piston 16, to which is screwed a nut 38. Each block 17 is centered quite simply in relation to respective hole 8. In particular, close to end 37 of piston 16, outside hole 15, piston 16 is fitted, in adjustable manner in relation to hole 8, with a plate 41 having a hole 42 engaged by a pin 43 extending downwards from plate 36.

As shown in Fig.1, from the top face of body 6, an integral cylindrical coupling 44 extends upwards, coaxially with column 4, and is fitted integrally on the top end with body 23, which presents a top annular wall 45, a cylindrical lateral wall 46 and an annular bottom wall 47. Chamber 22 is defined between said walls 45, 46 and 47, and by the outer surface of coupling 44, which thus constitutes the inner lateral wall of chamber 22. In use, body 23 is fitted on to coupling 44 and secured firmly to the same by threaded pins 48 fitted inside through holes formed in wall 47. As chamber 22 is obviously airtight, the edges of walls 45 and 47 cooperating with coupling 44 are fitted with respective annular seals.

Coupling 44 is closed at the top by a cap 52 having an axial hole 53 engaged by the top end of fixed column 5. Column 5 supports a known rotary coupling 54, such as that produced by ATLAS COPCO ITALIA S.p.A. and marketed by AUTOMAZIONE EMILIANA s.r.l. of Castenaso (Bologna) under catalogue number 303. The inlet of coupling 54 is fitted inside fixed column 5 and connected to source 26 by a conduit 55 extending along the whole of column 5 and coming out underneath a surface of machine 1 (not shown). A portion of conduit 55 outside machine 1 is fitted with a pressure regulator 56 having a knob 57 for manually regulating the pressure inside chamber 22 and, consequently, inside chambers 21. The outlet of coupling 54 presents a conduit 58 extending through cap 52 and connected to a fitting 61 supported on coupling 44 next to chamber 22. Wall 45 presents a number of equally-spaced holes 62, each housing a fitting 63 from which extends a respective conduit 24 connected to a second fitting 64 on cap 31 of respective block 17.

In use, rotation of column 4 about its longitudinal axis produces an equal rotation of body 6, container 7, a portion of belt 13, body 23, coupling 44, pistons 16, blocks 17 and coupling 54. Each hole 8 corresponds, at the bottom, with a capsule 2 and, at the top, with a block 17 and piston 16. At each turn of the machine, hole 8, for a given period of time, connects the inside of container 7 to a respective capsule 2 underneath, and, for a second given period of time, is closed at the top by a fixed semiannular body 65 (Fig.1) to enable capsule 2 to exit machine 1 and prevent output of the product from container 7. While hole 8 is open, provision may be made on machine 1 for tamping the product once or several times inside capsule 2 via reciprocating motion of pistons 16 and respective blocks 17, at each downstroke of which, portion 35 of pin 18 moves down through respective hole 8 into capsule 2. The pressure exerted on the product by pin 18 depends on the pressure of the fluid inside chamber 21. Consequently, a variation in the fluid pressure results in a corresponding variation in the pressure exerted on the product and, therefore, the amount of product fed into capsule 2. During the metering and tamping stage, capsule 2 is preferably raised, by a piston 66 operated by a cam (not shown), so as to contact the edge of respective hole 8 and prevent spillage of the product from container 7. At times, a final tamping operation is also performed at a recess formed in

body 65 and so designed as to prevent the product from being fed into the recess from container 7, and to enable entry of pin 18 which moves down through hole 8 into capsule 2 for performing the final tamping operation. The conduits mentioned above preferably consist of hoses.

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

In particular, the extent to which the product is compacted inside capsules 2 depends on the pressure of a fluid which, as is known, may be regulated to a high degree of accuracy, which accuracy is also reflected in the amount of product fed into capsules 2. What is more, said fluid pressure may be regulated easily with no need for arresting operation of machine 1. Though a manual pressure regulating control is shown in Fig.1, the protective scope of the present invention obviously also extends to an electrically controlled pressure regulating system. A further point to note is that the fluid pressure, and consequently also adjustment thereof, is the same for all of blocks 17, so that the same amount of product is fed into all of capsules 2. Finally, compacting device 3 is of straightforward design; presents no components subject to wear, or springs or other components requiring periodic adjustment; and involves no fluid consumption.

To those skilled in the art it will be clear that changes may be made to device 3 as described and illustrated herein without, however, departing from the scope of the present invention.

For example, if the fluid employed is air, source 26 will consist of a straightforward compressor. Also, changes may be made to the design of chamber 22 and connection of the same to chambers 21.

Claims

1. A device for compacting pharmaceutical products in capsules on a metering machine comprising a first drum type body (6) designed to rotate a container (7) filled with said product, characterised by the fact that it comprises:
   at least a second body (17) above said container (7) and in which is formed a first airtight chamber (21); a vertical axially-mobile pin (18) supported on said second body (17) and having a top portion (33) housed in said first chamber (21), and a bottom portion (35) outside said second body (17) and designed, in at least one operating stage, to engage a first hole (8) formed in the bottom (11) of said container (7), for compacting said product in a capsule (2) underneath said first hole (8);
   a pressurized fluid circuit (55, 54, 58, 22, 24) between a source (26) of said fluid and said first chamber (21), for exerting downward pressure on said top portion (33) of said pin (18), and such that the extent to which said product is compacted is a function of the pressure of said fluid inside said first chamber (21); and
   a vertical piston (16) supporting said second body (17) and designed to move back and forth along a second vertical hole (15) formed in said first body (6).

2. A device as claimed in Claim 1, characterised by the fact that said circuit (55) presents a pressure regulator (56) operated by a manual or electrical control.

3. A device as claimed in Claim 1 and/or 2, characterised by the fact that said second body (17) presents a third vertical axial hole (28) having a top portion sealed by a cap (31), and a bottom portion smaller in diameter than said top portion and defining, with the same, an annular shoulder (32); said pin (18) comprising said top portion (33), a central portion (34) housed in said bottom portion of said hole (28), and said bottom portion (35) extending downwards outside said third hole (28); said first chamber (21) being defined inside said top portion of said hole (28), between said top portion (33) of said pin (18) and said cap (31), so that said pin (18) is free to travel axially along said third hole (28) between a bottom limit stop consisting of said shoulder (32) and a top limit stop consisting, in the absence of said fluid, of said cap (31).

4. A device as claimed in at least one of the foregoing Claims, characterised by the fact that it comprises a system (43) for centering said second body (17) in relation to said first hole (8).

5. A device as claimed in at least one of the foregoing Claims, characterised by the fact that it comprises: a number of said vertical pistons (16) housed in a respective said second hole (15), rotated by and about the longitudinal axis of said first body (6), and designed to move axially back and forth by virtue of a cam; a number of said second bodies (17) fitted integrally to the top end, outside said second hole (15), of a respective said piston (16);
   a number of said pins (18), one for each said second body (17), extending from said second body (17) inwards of said container (7) and coaxially with a respective said first hole (8) for compacting said product once or several times inside a respective said capsule (2);
   said first chamber (21) formed in each said

second body (17) and containing said pressurized fluid, preferably air, for counteracting upward travel of said respective pin (18) during the compacting stage;
a second sealed annular chamber (22) formed in a third body (23) rotated by said first body (6);
a number of first conduits (24) for constantly connecting said second chamber (22) to all of said first chambers (21); and
a member (25) for connecting said second chamber (22) to said pressurized fluid source (26).

6. A device as claimed in Claim 5, characterised by the fact that, from said first body (6), there extends coaxially and integrally upwards a cylindrical coupling (44) fitted integrally on the top end with said third body (23) having a top annular wall (45), a cylindrical lateral wall (46) and a bottom annular wall (47); said second chamber (22) being defined between said three walls (45, 46, 47) and by the outer surface of said coupling (44), which thus constitutes the inner lateral wall of said second chamber (22).

7. A device as claimed in Claim 6, characterised by the fact that it comprises a fixed column (5) mounted coaxially along said first body (6) and said coupling (44), and housing a second conduit (55) connected at one end to said source (26) and at the other to a rotary coupling (54) on the top end of said column (5); the outlet of said coupling (54) being connected to said second chamber (22) via a third conduit (58).

8. A device as claimed in Claim 6 and/or 7, characterised by the fact that said top wall (45) of said third body (23) presents a number of fourth holes (62) from each of which extends a respective said first conduit (24) connected to a fitting (64) on said cap (31) of a respective said second body (17).

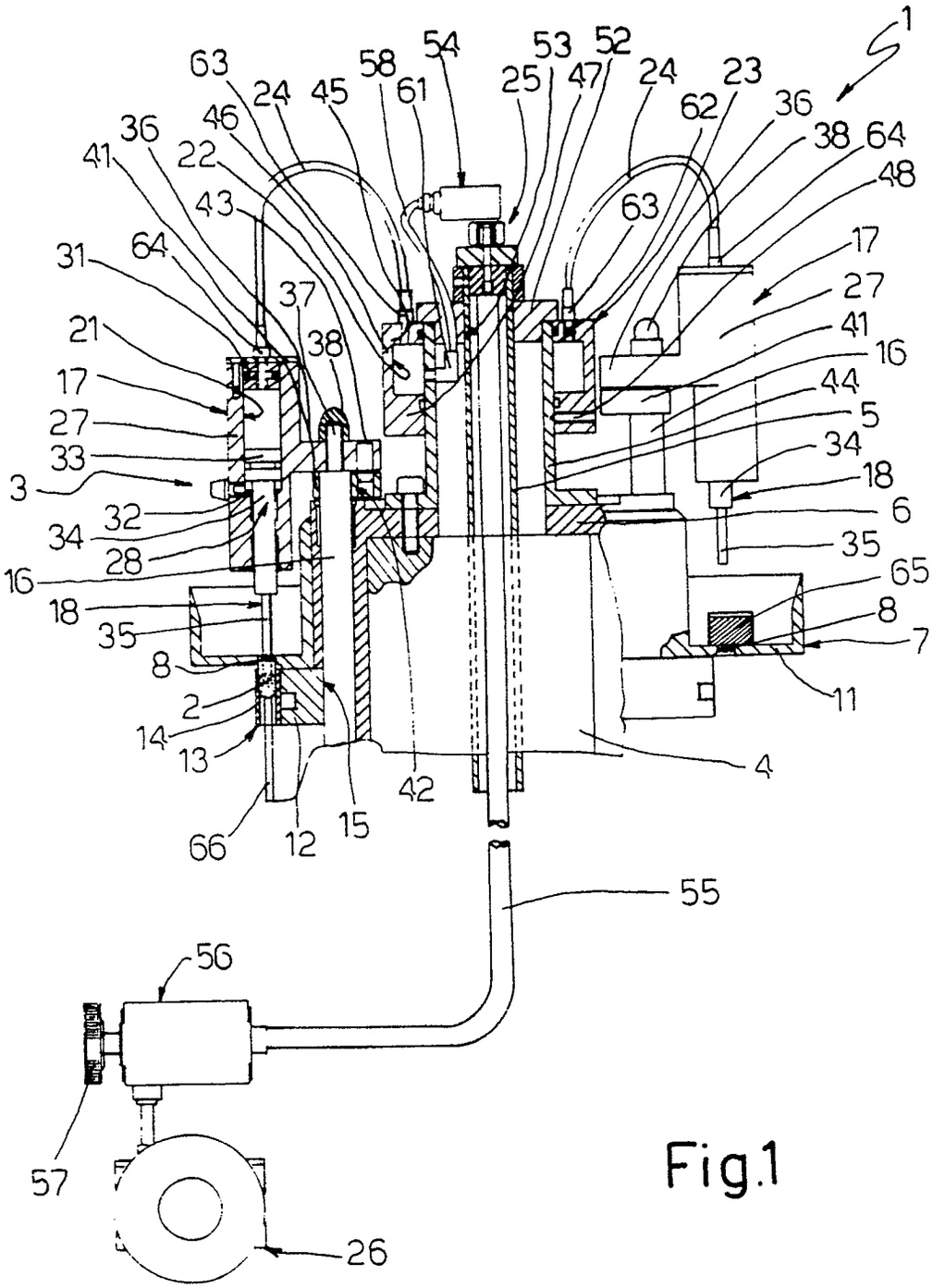
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Fig.1

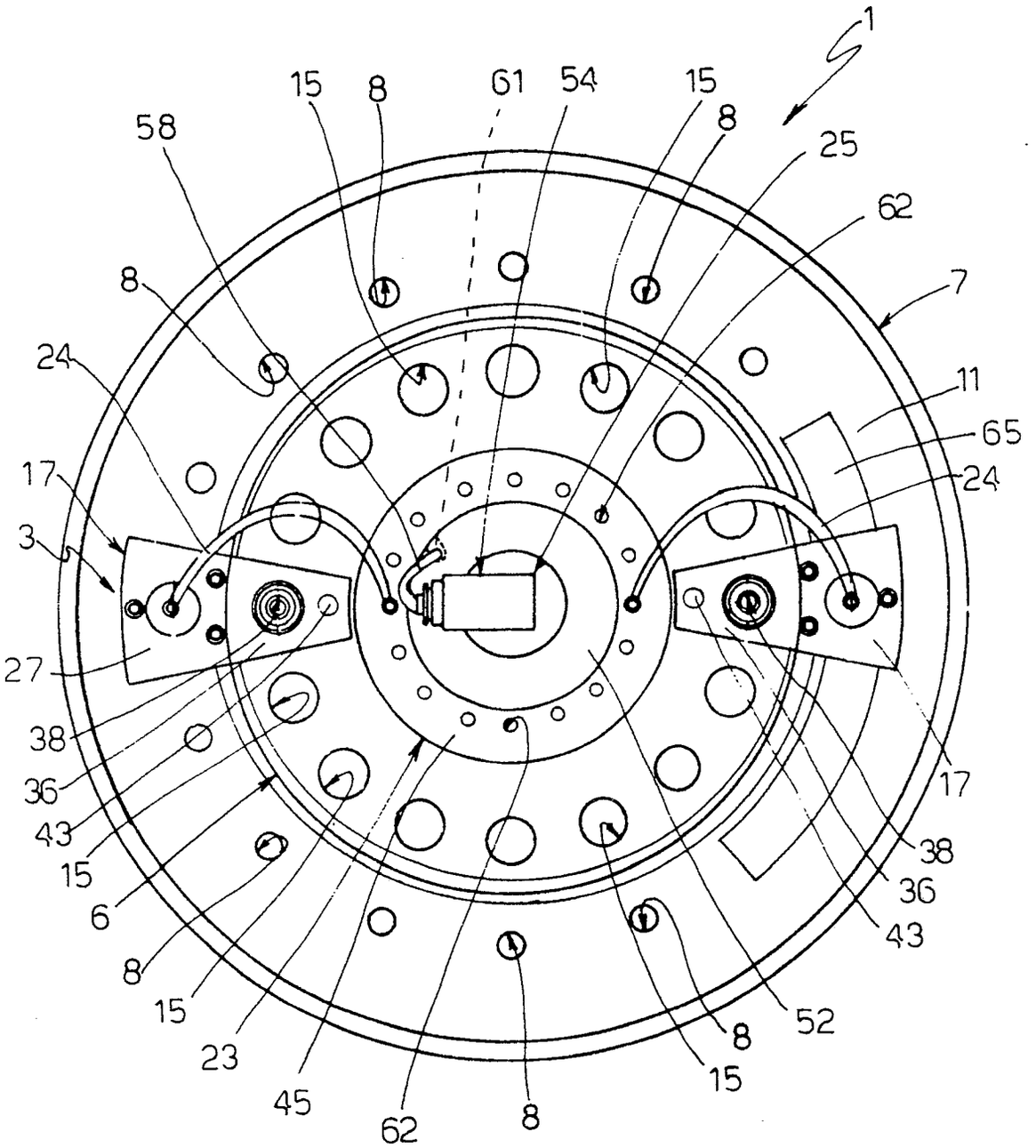
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Fig.2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 10 6238

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)
Y	DE-A-3 432 992 (MG 2 S.P.A.) * claim 1; figures 1-3 *	1,2	A 61 J 3/07
Y	DE-A-3 425 221 (AKTIEBOLAGET BOFORS) * claims 1-3; figures 1-3 *	1,2	
A	EP-A-0 344 790 (WARNER-LAMBERT COMPANY) * abstract * * figures 1-10 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A 61 J B 30 B

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	27 June 91	GODOT T.G.L.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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A: technological background
O: non-written disclosure
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