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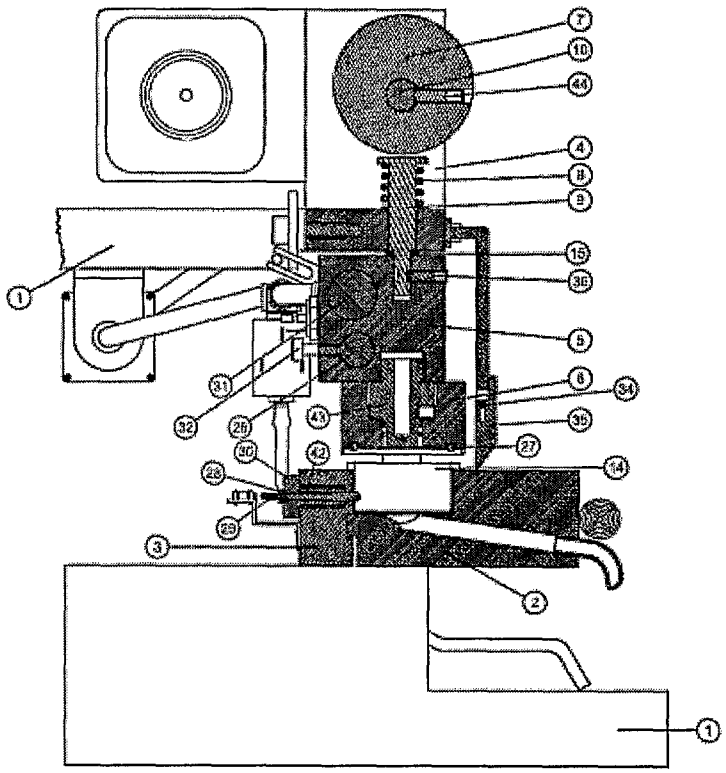
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(54) Title: COFFEE MACHINE WITH LOSING FILTER OR CAPSULE



(57) Abstract: Espresso machine with disposable filter or capsule comprising a chassis (1), a porta-capsule body comprising a rotating part (2) and a fixed part (3), which lodges a disposable filter or capsule (14), a heat exchanger (5), an electro-pump (24), an infusion piston (6), a pressure cam (7), a coffee brewing cam (19), control and regulation means, supporting means, fixing means, sealing means, characterized by the fact that: - the seal between the capsule (14) and the infusion piston (6) is ensured by the clamping given by a vertical mechanical motion, by means of the rotation of said cam (7); - the removal of the capsule is ensured by a rear sensor shaft system (29) and a front gravity extractor (35); - it uses a semi-automatic system to load and remove the capsule with the rotation of said rotating part (2) of the porta-capsule body; - It is equipped with an electro-mechanical clamping and safety system operated by said cams (7, 19) and controlled by a number of micro-switches;

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Title: "Coffee machine with losing filter or capsule"

Description

Technical filed

The present invention relates to a coffee or espresso machine with disposable filter or capsule, equipped with a semi-automatic system operating in two phases:

1) Manual placement of the disposable filter or capsule;
2) Coffee brewing and return to phase 1 by electronic control and electro-mechanical actuators.

Espresso machines of this type use a special one-cup semi-rigid plastic filter, which contains grounded, dosed and tamped coffee, and is named disposable filter or capsule or any similar. Hereafter it will be identified as capsule. In the espresso machines on the market the same pump generally serves the hydraulic clamping system and the automatic disposal of the used capsule, and the coffee brewing as well. This means that the total pressure is proportionally distributed between the clamping/disposal and the brewing. Such a pressure distribution among three systems, however, does not allow a good quality of the final product and a good clamping pressure, producing water leakage and scaling inside the machine. Moreover, the capsule filling/disposal system

is rather complex and unreliable for it uses a spring mechanism, which is likely to loose the original mechanical features due to the use and the high temperatures.

Aim of the present invention is an absolutely innovative, mechanical system to load and remove the disposable filter or capsule, which presents high strength and reliability at the high pressure; another aim of the present invention is a mechanical system of sealing and pressing on the disposable filter or capsule.

Disclosure of the invention

Espresso machine with disposable filter or capsule, equipped with a semi-automatic system to brew espresso coffee, characterized by the following features:

- A semi-automatic, totally mechanical system to load and discard the disposable filer or capsule. The counterclockwise rotation, when closing, of the capsule holder rotating on the portafilter body, creates a housing geometrically fit for the capsule; the perfect overlap of the two bodies is guided by a grooving and tonguing joint and a ball pressed on the bottom of the rotating body, that is housed in a spherical cavity on the fixed body. During the coffee brewing, a vertical and ring joint stabilizes the two mechanical parts and allows a perfect and rigid grasp between the two bodies, such as to balance the high pressures during the brewing. This implies a perfect

housing of the capsule and avoids possible deformations produced by the combined effect, by the type of plastic material, and by the high working pressure and water temperatures. The rear sensor rod and the front gravity extractor are positioned in a way to ensure, once the brewing is over, the removal of the used capsule that is discarded into a small container located on the bottom of the machine chassis. While brewing, in fact, the capsule could adhere to the housing surfaces in case it is deformed by pressure and temperature. After the removal the device is automatically ready to manually place in a new capsule for the next brewing. The system is solid, reliable, and allows to repeat the placement and removal with a rotation of 60°.

- A completely mechanical clamping system of the capsule infusion piston operated by a connection between pressure cam, tappet, heat exchanger and infusion piston, with double function: to clamp the piston and to feed the electric circuit of the electro-pump with a synchronized system comprising a brewing cam connected to the motor shaft, which activates a micro-switch. In fact, only when the capsule is on its place, the electro-motor starts rotating, clockwise, of 180°; it drags the pressure cam and at the same time, the brewing cam which makes sure (by its synchronized position) that the capsule is pressed and, contemporary, sets in motion the

electro-pump and the brewing. This system allows to spare the total working power of the electro-pump for the brewing, ensuring an excellent coffee, no water leakage and no scaling or wear of the mechanisms.

- A double possibility to adjust the distance between the capsule and the piston: a macro-regulation by mean of the piston rotation (clockwise or counterclockwise), increasing or decreasing the distance from the capsule for large distances; a micro-regulation by mean of the tappet sliding in the housing shaped on the heat exchanger, controlled by two Belleville washers and a limit stop given by a threaded dowel. This regulation allows a further adjustment with any possible flaw of the capsule.
- An electro-mechanical control system to verify that the capsule is lodged and the lodging pressure of the brewing piston. This guarantees that the machine works under these conditions only; moreover, in this way, the number of manual operations is reduced.

Aims, advantages and features of the present invention will be more understandable with the detailed description of a preferred but not limited to, embodiment, reported as an example. Reference will be made to the attached drawing in which:

- Figure 1 shows the espresso machine, internal left side;
- Figure 2 shows the espresso machine, internal front side;

- Figure 3 shows a longitudinal section of the center line and shows the assembling system of the mechanical elements;
- Figure 4 shows the fixed part and the rotating part of the porta-capsule body with the hinge mechanism and the capsule removal system according to a first embodiment of the invention;
- Figure 5 shows the system connecting the two bodies and the tamping motion on the capsule;
- Figure 6 shows the functioning of the sliding system of the capsule adjustment;
- Figure 7 shows the flare on the piston that contains possible spurts of coffee or hot water within the machine body;
- Figure 8 shows the hinge mechanism between the porta-capsule bodies, the grooving and tonguing joint;
- Figures 9a and 9b show the fixed part and rotating part of the porta-capsule body with the hinge mechanism and the removal system according to a second embodiment of the invention;
- Figure 10 shows a longitudinal section of the center line and the assembling system of the mechanical elements according to said second embodiment of the invention.

Ways of carrying out the invention

Referring to the drawings, and particularly to Figs. 1, 2 and 3, the espresso machine consists of a chassis 1, a porta-capsule body comprising a rotating part 2 and a fixed part 3, equipped with a knob 37, a brewing spout 38, a sensor shaft 29, a micro-switch 33 and front extractor 35 which can lodge a disposable filter or capsule 14, a heat exchanger 5, with electro-pump 24, electro-valve for water delivery 25, a heater 26 and thermostat 39, a piston 31 and related ciclers 43, tappet 9 and an accelerator 31, a pressure cam 7, and a coffee brewing cam 19 with micro-switch 20, both controlled by an electro-motor 21, supporting means, fixing means, regulation and sealing means.

With the machine in stand-by, the pressure cam 7 is at the top dead center (Phase A in Fig. 5). This cam connected to the motor shaft 10 by means of a threaded dowel 44 rotates inside the motor flask 4; on the same shaft the coffee brewing cam 19 is connected by means of a screw 18.

By means of the knob 37 the rotating part of the porta-capsule body is manually rotated clockwise; the sensor shaft 29, tensioned by the helical spring 42 (Fig. 3), pushes forward the used capsule 14 from the fixed body. The front extractor 35, fastened on the motor shaft 4 by means of the front extractor-supporting shaft 16 and the elastic pin 34, during the rotation of the rotating body, serves to hold and make the capsule fall by gravity. The system comprising the rear sensor shaft and the front

extractor ensures the discharge and fall of the used capsules into a small container, in case the capsule is jammed in the lodging of parts 2 and 3 of the porta-capsule body due to some strains or adhesions produced by the pressure and the temprature.

The rotating motion of the rotating part 2 of the porta-capsule body makes the mechanism ready for the placing of a new capsule for the next brewing, as shown in Fig. 4 (Phases A and B). After the capsule is positioned on the rotating part 2, the manual rotation, counterclockwise, closes and connects said rotating part 2 and fixed part 3 of the porta-capsule body.

The correct positioning of the two parts takes place tanks to the hinge created between said parts and the fulcrum of the grooving 11 (detail G of Fig. 8) and to the tonguing joint (detail F of Fig. 8) and guide ball 46 (detail P in Fig. 5) kept pressed by an helical spring 45, sited in the spherical slot 48 on the fixed part of the porta-capsule body.

When closing, the sensor shaft 29, fastened on the fixed part of the porta-capsule body by a clamping screw 30, is forced to counterbalance the spring 42, and is pushed toward the micro-switch lever 33, which feeds the electrical circuit of the electro-motor 21.

Such motor rotates the pressure cam 7 of 180°, up to the bottom dead center (Phase B of Fig. 5), determining a pressure on the tappet 9 that brings the heat exchanger 5 near the piston 6,

connected by an infusion cicler 43, towards the cap to reach a perfect adhesion piston/capsule and a satisfactory infusion pressure.

The infusion piston stroke towards the capsule shapes the lodging of the locking bushing 12 (detail O of Fig. 5) into the slot on the rotating part of the porta-capsule body creating a ring coupling that connect the two parts 2 and 3, during the coffee brewing (Phase B of Fig. 5)

The perfect seal between the capsule and the infusion piston 6, during the brewing of coffee, is ensured by other factors. First, the right regulation of the distance between the capsule and the piston by rotating clock- or counterclockwise the piston 6, threaded to the infusion cicler 43. The second factor is the flexible slide (detail E of Fig. 6), controlled by two Belleville washers 15, of the tappet 9 in the lodging on the heat exchanger 5 that allows any further adjustment due to any possible flaw of the capsule, with a stroke of 0,7 mm (detail D of Fig. 6), controlled by the socket head screw 36. The third factor relates to an O-ring 27, positioned on the lodging on the piston, that ensures a perfect adhesion to the capsule and, consequently, a perfect seal.

The synchronism of the brewing cam 19 and the pressure cam 7 allows, when the pressure cam reaches the BDC (Phase B of Fig. 5), that the electrical circuit controlled by the micro-switch 20 breaks off the feed of the electro-motor 21 and acts the electro-

pump 24, producing the brewing of the coffee. The geometric truncated-conical shape on the infusion piston, close to the contact with the capsule (detail A of Fig. 7), suitable to avoid possible coffee or hot water spurts, is another safety element.

Once the brewing is accomplished the electro-mechanism stops the electro-pump circuit and acts the electro-motor so that the pressure cam reaches the TDC, allowing the capsule to separate from the assembly piston-accelerator-tappet by means of the helical spring 8 and making the system ready for a new brewing.

In this preferential embodiment of the invention there are other components: a second grooving 13, a clamping screw 17 of the brewing cam, a clamping screw 22 of the coffee group, a rotation lever 23 of the accelerator, a regulating nut 28 of the sensor shaft, a clamping screw 32 of the heater, a screw 40 to rotate the accelerator, a clamping screw 41 of the accelerator, and a ball 47. All the mechanical components, single or coupled, are made with high standards of quality.

Another useful way to realize the porta-capsule body is shown in figs. 9a, 9b and 10. Here, the rotating part 2 of the porta-capsule body is made of plastic, while the gravity extractor 35 is supplied with a rubber terminal. This implies an alteration of the infusion piston 6 and the increase of its stroke. When closed, in fact, this piston presses on the capsule, stops the rotating part of the porta-capsule body preventing it from opening. In this way the fixing

by the tonguing joint and the pressed ball can be avoided.

The realization details, the materials and the shape of the espresso machine with disposable filter or capsule or similar can vary but remaining within the field of the invention and the patent.

CLAIMS

1) Espresso machine with disposable filter or capsule comprising a chassis (1), a porta-capsule body comprising a rotating part (2) and a fixed part (3), which lodges a disposable filter or capsule (14), a heat exchanger (5), an electro-pump (24), an infusion piston (6), a pressure cam (7), a coffee brewing cam (19), control and regulation means, supporting means, fixing means, sealing means, characterized by the fact that the seal between the capsule (14) and the infusion piston (6) is ensured by the clamping given by a vertical mechanical motion, by means of the rotation of said pressure cam (7).

2) Espresso machine according to claim 1 characterized by the fact that said seal between the capsule (14) and the infusion piston (6) is ensured by the adjustment of the macro-distance between the piston and the capsule, by the piston (6) rotation, by the controlled slide of two Belleville washers (15) of said tappet (9) and by an O-ring (27).

3) Espresso machine according to claims 1 and 2 characterized by a rear sensor shaft system (29) and a front extractor (35), located in a way to make sure the removal and fall of the capsule in a suitable container.

4) Espresso machine according to one of the previous claims characterized by the use of a semi-automatic system to load and remove the capsule with the rotation of said rotating part (2) of the porta-capsule body, hinged by a grooving (11) to the fixed part (3) of the porta-capsule body, which ensures the removal of the used capsule, making the system ready for the next capsule and next coffee brewing.

5) Espresso machine according to claim 4 characterized by the fact that the positioning of the two parts (2 and 3) is made by the grooving and tonguing joint and the ball (46).

6) Espresso machine according to claim 4 characterized by the fact that the rotating part (2) of the porta-capsule body is made of plastic, the gravity extractor (35) is equipped with a rubber terminal (49) and the infusion piston (6) presses the capsule (14), and lock said rotating part of the porta-capsule body to avoid its opening.

7) Espresso machine according to one of the previous claims characterized by an electro-mechanical clamping and safety system operated by said cams (7, 19) controlled by the electro-motor (21); said cams located the piston (6) on the capsule (14) and with the same action, they allow the electro-pump (24) feeding for the coffee brewing.

8) Espresso machine according to claim 7 characterized by a number of micro-switches connected to an electrical or

electronic circuit, which make easier and safer the use of the machine with only one manual operation, that is the load and removal of the capsule.

9) Espresso machine according to one of the previous claims characterized by the fact that the truncated-conical shape on the infusion piston (6), close to the contact with the capsule (14), avoids possible spurts of coffee or hot water.

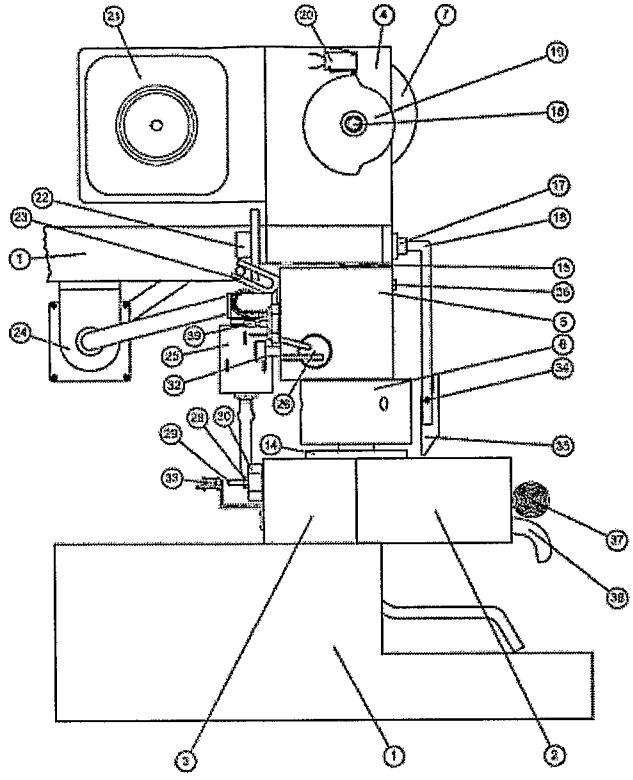


Fig.1

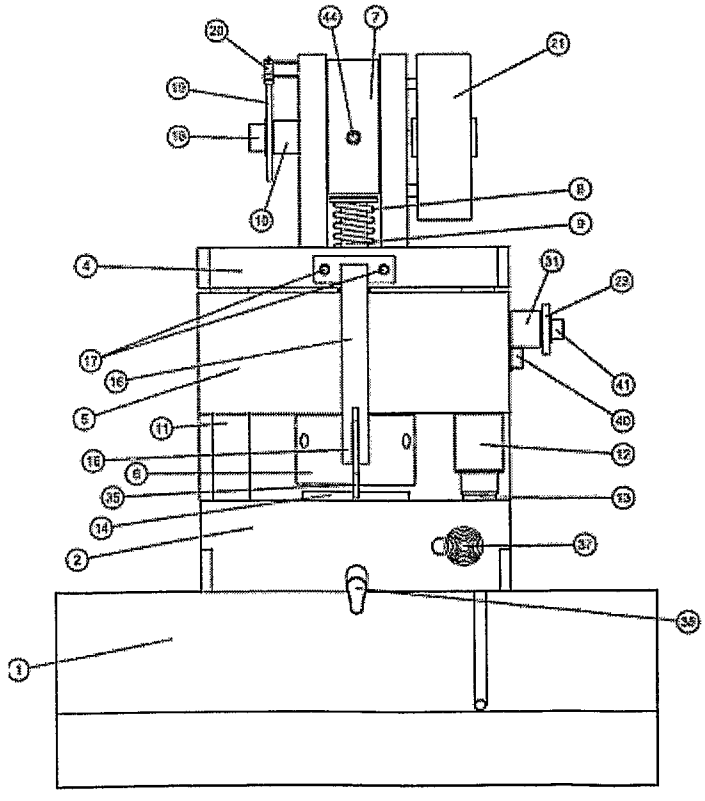


Fig.2

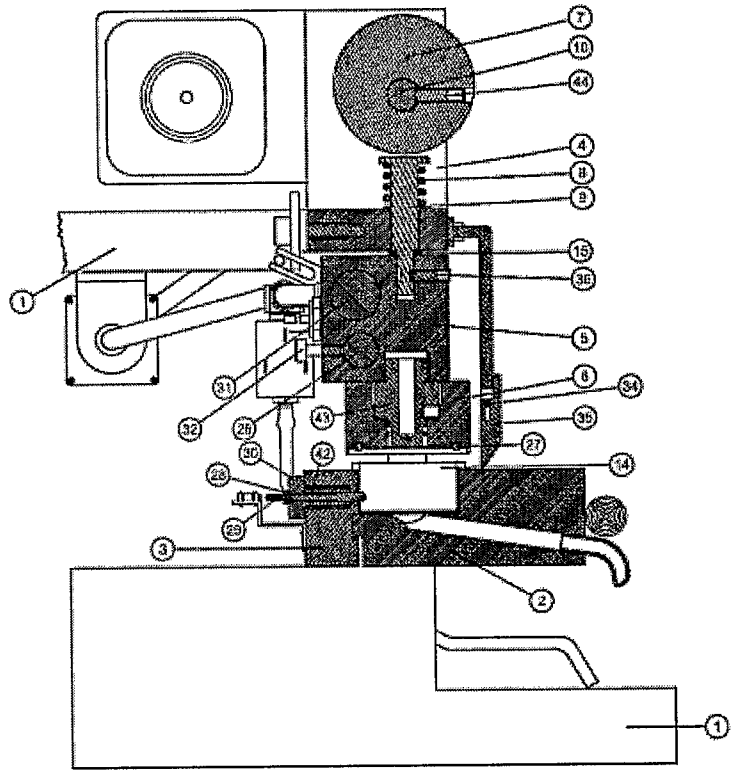

7
10
44
4
8
9
15
36
5
6
34
35
27
14
31
32
26
43
30
42
28
29
3
2
1

Fig.3

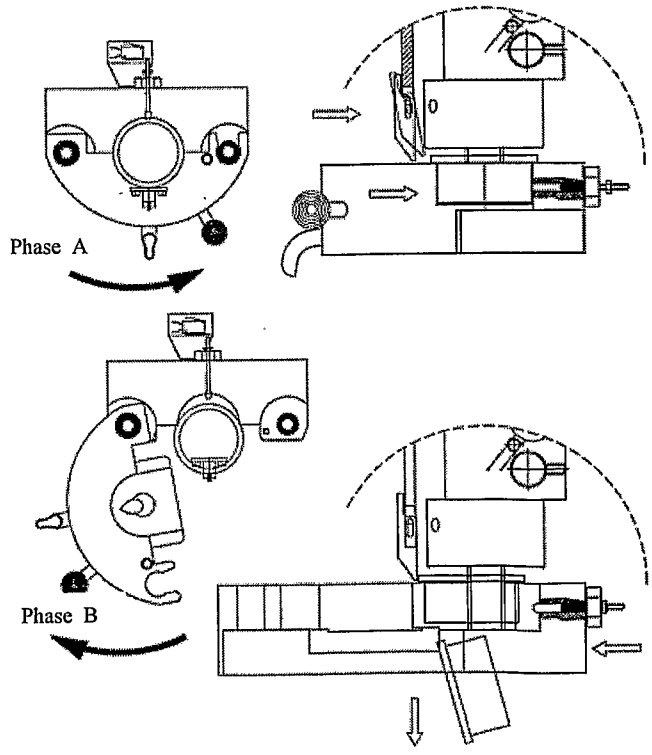

Phase A
Phase B

Fig. 4

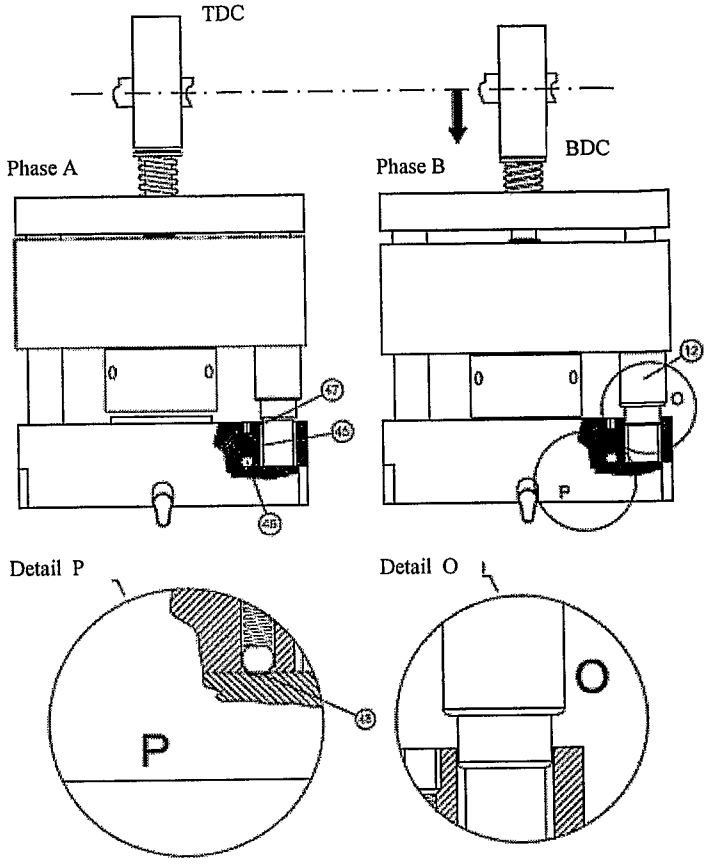

TDC
BDC
Phase A
Phase B
47
45
46
12
O
P
Detail P
Detail O
P
O
43

Fig. 5

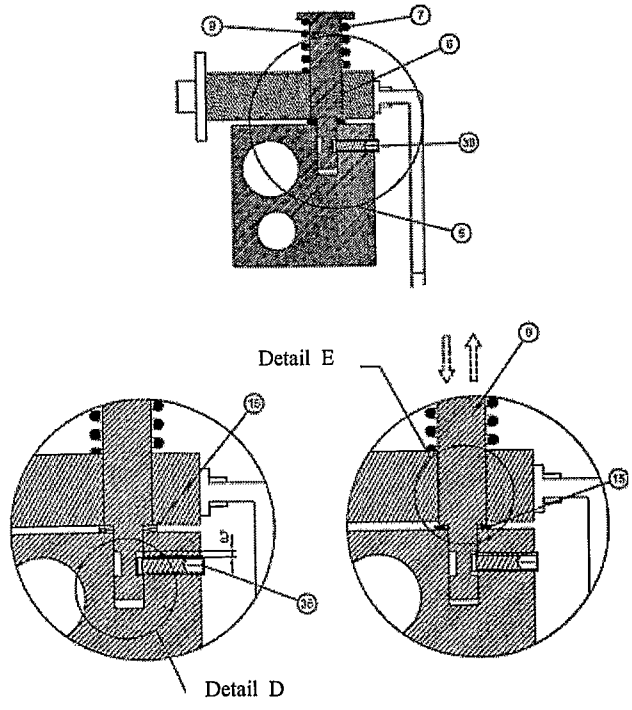

9
7
6
38
5
Detail E
15
9
15
a1
36
Detail D

Fig. 6

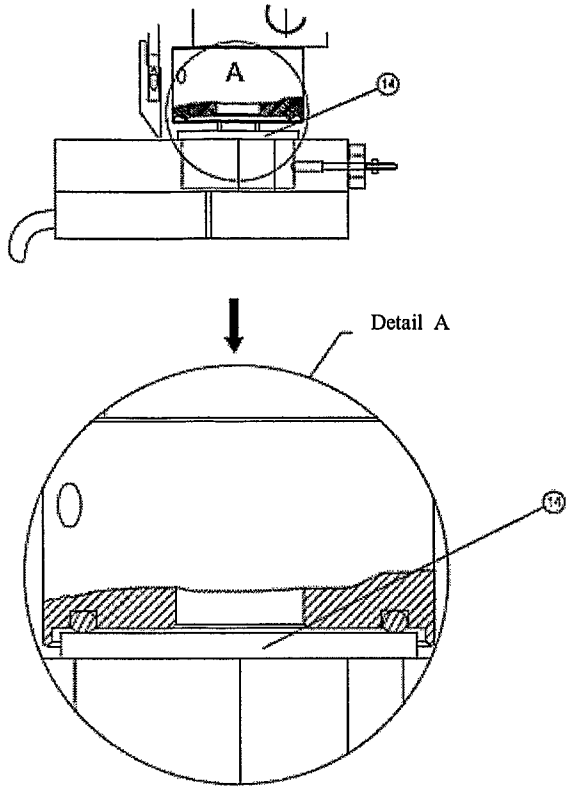


Fig. 7

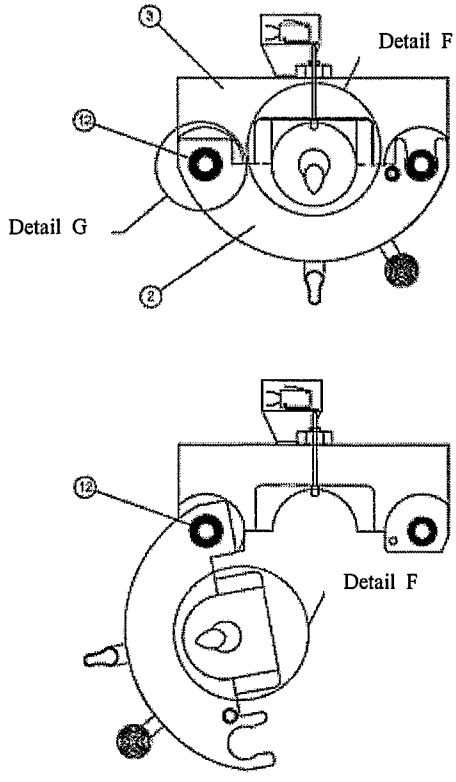
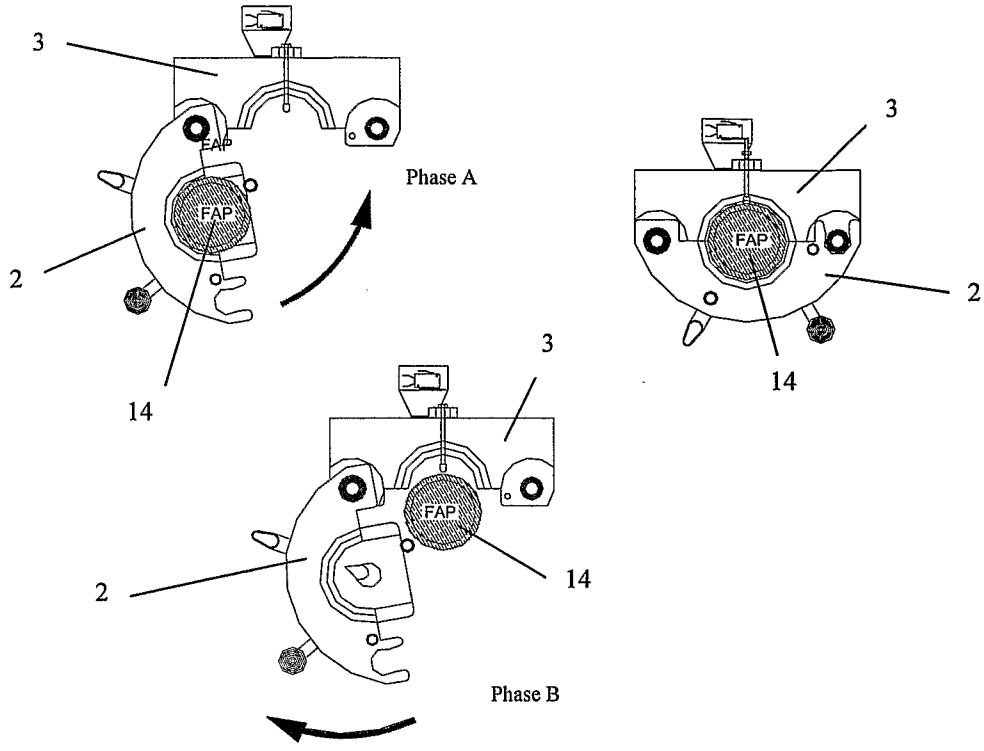
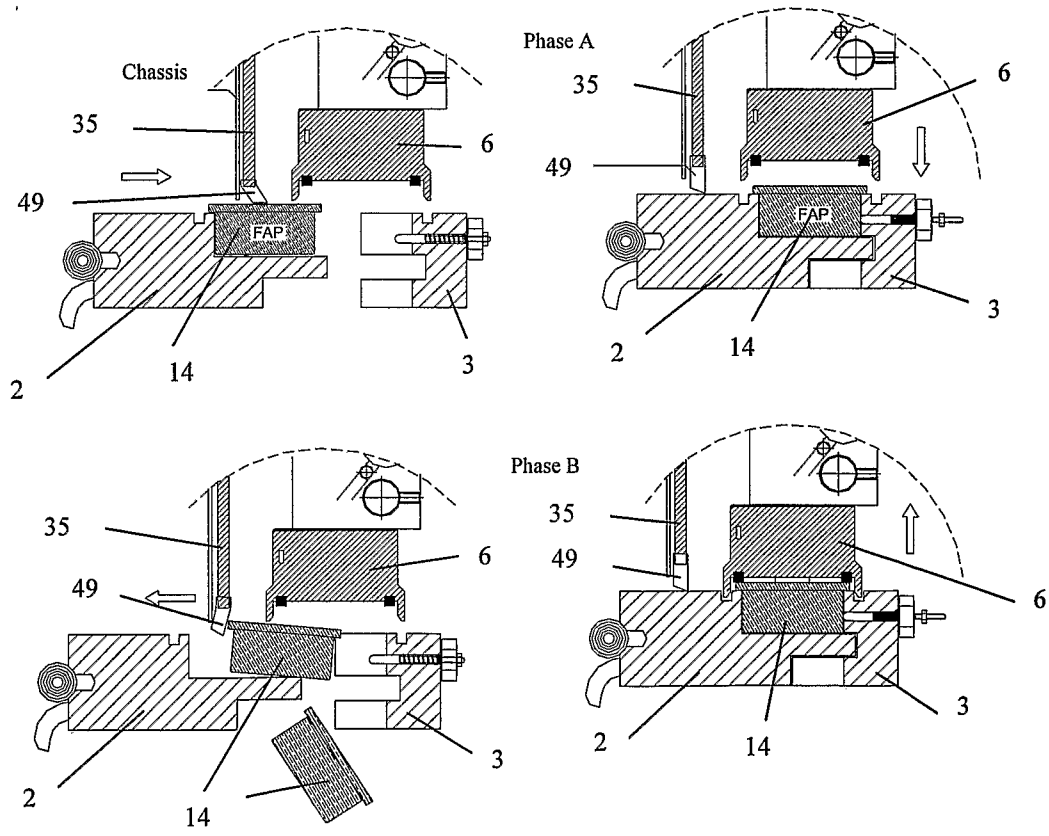


Fig. 8


3
FAP
Phase A
2
14
3
FAP
2
14
3
FAP
14
2
Phase B

a)


Chassis
35
6
49
FAP
2
14
3
Phase A
35
6
49
FAP
3
2
14
35
6
49
3
2
14
Phase B
35
49
6
3
2
14

b)

Fig . 9

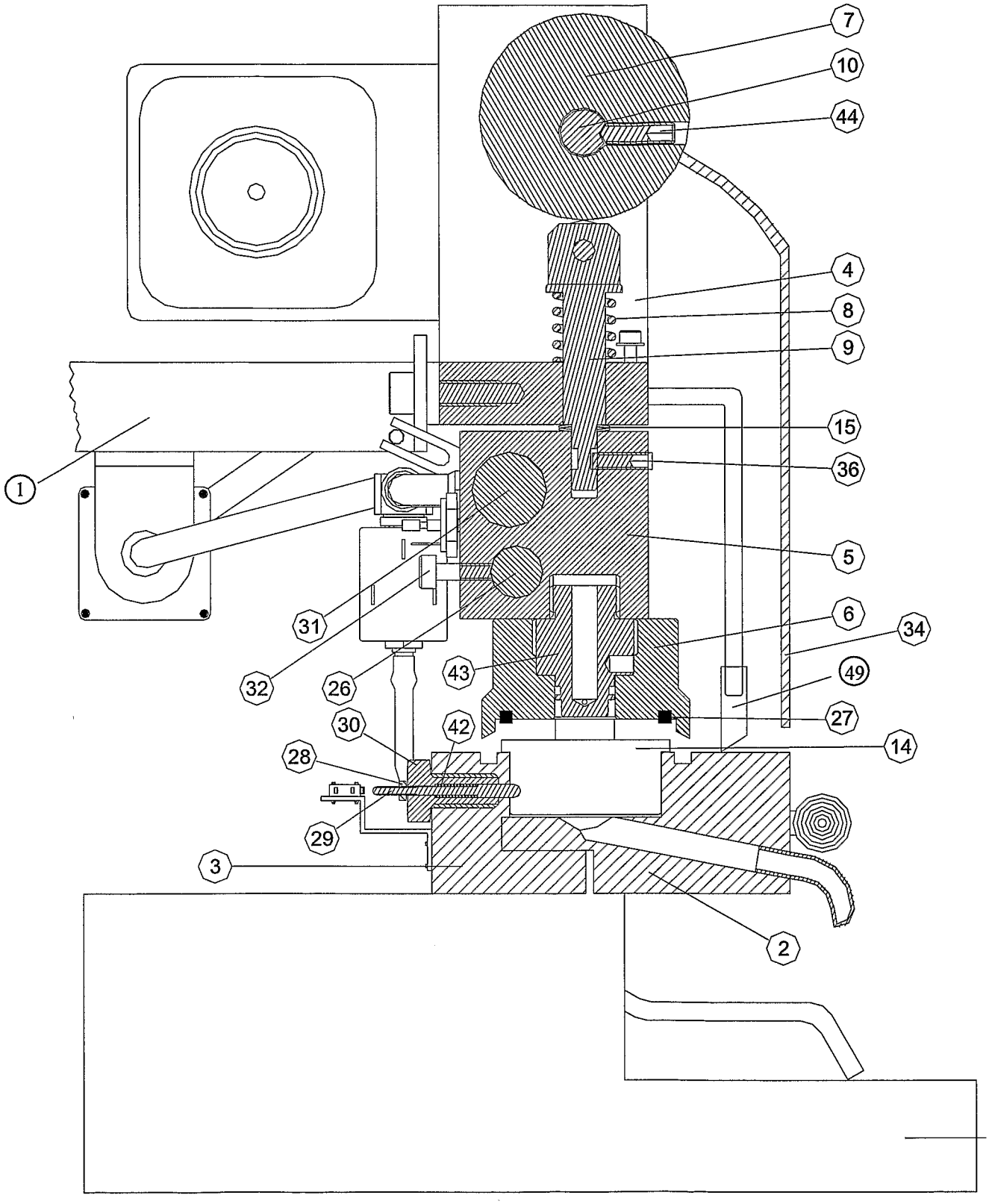


Fig. 10