



(22) Date de dépôt/Filing Date: 1999/01/25

(41) Mise à la disp. pub./Open to Public Insp.: 1999/07/26

(45) Date de délivrance/Issue Date: 2004/09/14

(30) Priorité/Priority: 1998/01/26 (1998 0170/98) CH

(51) Cl.Int.⁶/Int.Cl.⁶ A47J 31/24, A47J 31/44

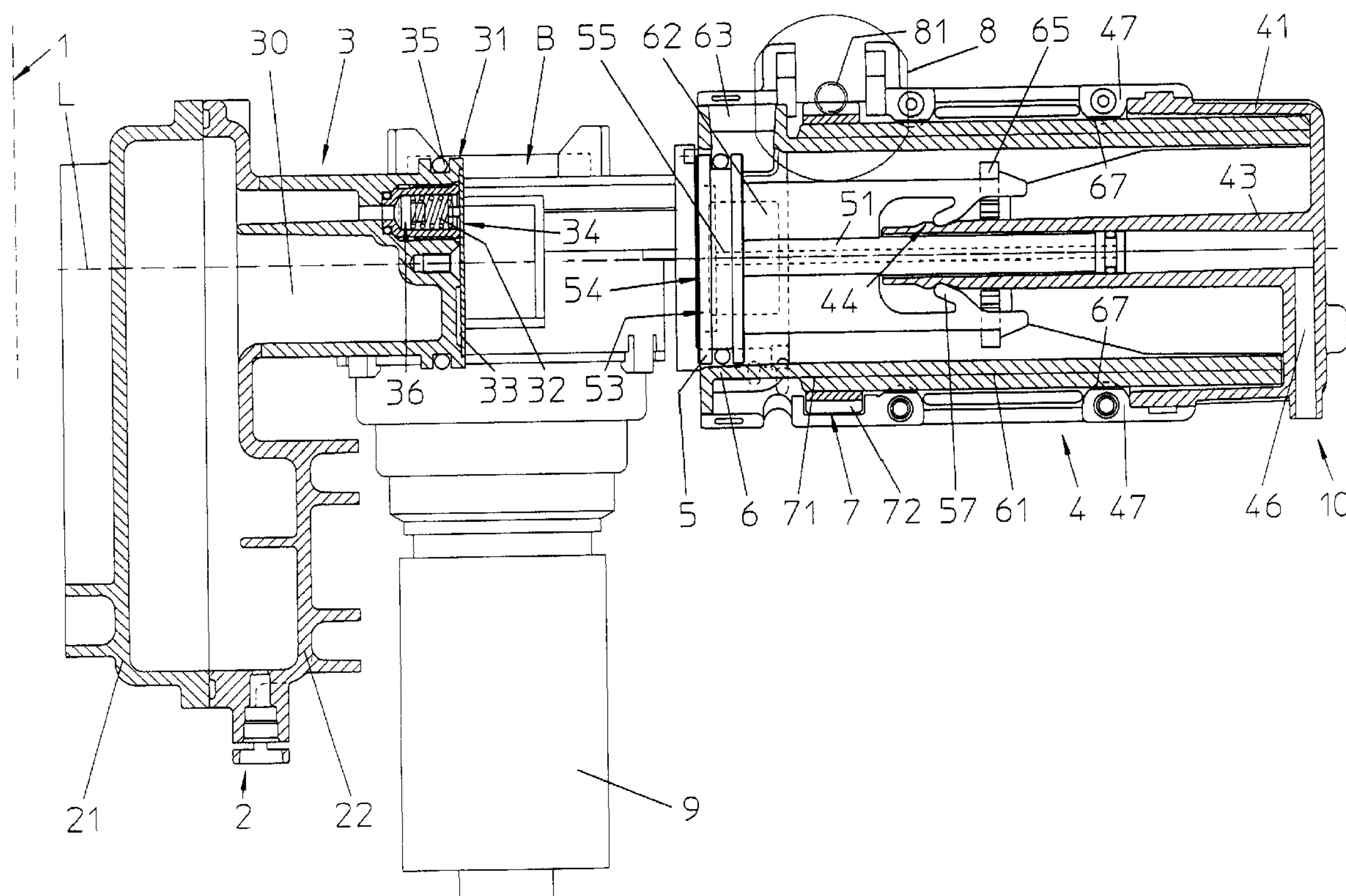
(72) Inventeur/Inventor:
SCHMED, ARTHUR, CH

(73) Propriétaire/Owner:
FIANARA INTERNATIONAL B.V., NL

(74) Agent: CASSAN MACLEAN

(54) Titre : **MACHINE A CAFE**

(54) Title: **COFFEE MACHINE**



(57) **Abrégé/Abstract:**

A coffee machine is provided with a boiler for heating brewing water, a brewing cylinder defining a brewing chamber, a closure piston for closing the one open end of the brewing cylinder as well as a brewing piston for compressing the coffee powder in the brewing cylinder and/or for ejecting the elutriated coffee powder cake, whereby the brewing piston is longitudinally movable in the brewing cylinder. The closure piston is integrally formed or rigidly connected to the housing of the boiler and firmly mounted to the housing of the coffee machine. Moreover, there is provided a brewing module that is removably inserted into the housing



(57) **Abrégé(suite)/Abstract(continued):**

of the coffee machine and that includes at least the brewing cylinder and the brewing piston. The brewing cylinder and the brewing piston are movable in longitudinal direction, but cannot be pivoted. Such a coffee machine can be designed very compactly. Moreover, the brewing module consists of only a few elements and, thus, can be manufactured at low costs and is very reliable in operation.

Abstract of the Disclosure

A coffee machine is provided with a boiler for heating brewing water, a brewing cylinder defining a brewing chamber, a closure piston for closing the one open end of the brewing cylinder as well as a brewing piston for compressing the coffee powder in the brewing cylinder and/or for ejecting the elutriated coffee powder cake, whereby the brewing piston is longitudinally movable in the brewing cylinder. The closure piston is integrally formed or rigidly connected to the housing of the boiler and firmly mounted to the housing of the coffee machine. Moreover, there is provided a brewing module that is removably inserted into the housing of the coffee machine and that includes at least the brewing cylinder and the brewing piston. The brewing cylinder and the brewing piston are movable in longitudinal direction, but cannot be pivoted. Such a coffee machine can be designed very compactly. Moreover, the brewing module consists of only a few elements and, thus, can be manufactured at low costs and is very reliable in operation.

Coffee Machine

Background of the Invention

The present invention refers to a coffee machine comprising a boiler for heating the brewing water, an essentially hollow brewing cylinder having a central longitudinal axis and an open end, and a driving unit for moving the brewing cylinder along said central longitudinal axis.

A closure piston is adapted to close the open end of the brewing cylinder to thereby form a brewing chamber, and a brewing piston is located in the interior of the brewing cylinder that is movable along said central longitudinal axis to compress coffee powder received in said brewing cylinder means as well as for removing the used coffee powder cake.

In a coffee machine of this kind, principally, a coffee beverage is prepared as follows: A brewing chamber is filled with a predetermined amount of coffee powder. This coffee powder is compressed by a movable piston and, thereafter, hot water is pressed through the compressed coffee powder under high pressure. In order to close the open side of the brewing chamber, there is provided a usually stationary closure piston, whereby the brewing cylinder usually is movable with regard to the closure piston. The brewing piston adapted to compress the coffee powder is received in the

interior of the brewing cylinder and is also used, besides its task to compress the coffee powder, to remove the used coffee powder cake from the brewing cylinder. For heating the brewing water, a boiler is used, from which the hot brewing water flows through a pipe to one of the two afore mentioned pistons. The relevant piston is provided with a sieve plate member. The hot brewing water is fed to that sieve plate member, thereby evenly distributed, enters the brewing chamber and evenly flows through the compressed coffee powder.

Prior Art

The European Patent Nr. 0,559,620 discloses a coffee machine of this kind. It comprises a slide-in module, essentially comprising a closure piston, called in that document brewing piston, a brewing cylinder, an ejector piston as well as means for feeding the brewing cylinder with brewing water. The closure piston has a certain distance to the brewing cylinder, when it is in its initial position, and is connected to guiding and mounting plates. In this coffee machine, the closure piston is moved relative to the brewing cylinder via the guiding and mounting plates in order to close the end of the brewing cylinder. In order to enable the brewing cylinder to be filled with coffee powder, a pivoting mechanism is provided, by means of which the brewing cylinder can be pivoted from the filling position to the brewing position and

vice versa. Besides the real pivoting mechanism, further driving means, control elements and driving members are required for moving the closure piston and for swiveling the brewing cylinder. Thereby, the driving members comprise a plurality of gear wheels that, on the one hand, engage toothings provided at the inner sides of driving arms for the brewing cylinder and, on the other hand, engage a rack provided on the ejector piston. A brewing assembly designed in such a way requires a lot of space both in height and in width because rigid guiding and mounting plates for supporting and moving the closure piston are required. Moreover, the slide-in module has a considerable height. Furthermore, the accessibility during cleaning of the brewing cylinder and the brewing piston is hindered due to the presence of the guiding and mounting plates as well as due to the presence of the different afore mentioned driving means. In addition, the drive and pivoting mechanism is of very complicated design, resulting in voluminous dimensions of the slide-in module and renders the brewing assembly expensive in manufacture. Finally, it has to be mentioned that a releasable clutch for the supply of brewing water has to be provided at the housing and at the slide-in module, respectively, that is released upon removing the slide-in module. Since the brewing water for brewing the compressed coffee powder received in the brewing chamber usually has a pressure of between 10 and 15

bar, the above mentioned releasable clutch must be designed correspondingly and, thereby, is expensive.

Objects of the Invention

Thus, it is an object of the present invention to provide a coffee machine of the kind referred to above that is of much more compact and of much simpler design.

Additionally, it is also an object of the present invention to provide a coffee machine of the kind referred to above in which all parts and elements that are subjected to a contamination by coffee powder or coffee beverage are simply to clean.

Summary of the Invention

To meet these and other objects, the present invention provides a coffee machine comprising a boiler for heating water having a housing, an essentially hollow brewing cylinder having a central longitudinal axis and an open end, and a drive assembly for moving the brewing cylinder along said central longitudinal axis.

Further provided is a closure piston adapted to close the open end of the brewing cylinder to thereby form a brewing chamber, whereby that closure piston is rigidly connected to the coffee machine. A brewing piston is located in the interior of the brewing cylinder. The brewing piston is movable along said central

longitudinal axis to compress coffee powder received in the brewing cylinder as well as for removing the used coffee powder cake. In addition, the coffee machine comprises a brewing module releasably inserted into the coffee machine, and including at least the brewing cylinder and the brewing piston.

Due to the fact that the closure piston is separated from the brewing module, it can be achieved that the brewing module can be designed very compact and simple. Moreover, due to the proposed design of the coffee machine according to the invention, the provision of a releasable clutch for the brewing water can be avoided.

In a preferred embodiment of the coffee machine, the closure piston is integrally formed with the housing of the boiler or rigidly connected thereto. Due to such a design, the coffee machine can be constructed even smaller and the connection pipe between boiler and closure piston can be omitted. In addition, the quality of the coffee beverage can be increased, as will be further explained herein after.

In another preferred embodiment of the coffee machine, the brewing cylinder and the brewing piston are arranged to be movable in longitudinal direction, but not pivotable with respect to each other. By abstaining to provide a pivoting mechanism, by means of which the brewing cylinder can be pivoted from a filling position

into a brewing position and vice versa, the construction of the brewing module can be kept very small and simple.

Brief Description of the Drawings

In the following, an embodiment of the coffee machine according to the invention will be further described, with reference to the accompanying drawings, in which:

Fig. 1 shows a lateral partial cross sectional view of an embodiment of a boiler and a brewing module according to the invention in the initial position;

Fig. 2 shows the boiler and a brewing module according to Fig. 1 in the filling position;

Fig. 3 shows the boiler and a brewing module according to Fig. 1 in the brewing position;

Fig. 4 shows the boiler and a brewing module according to Fig. 1 in the discharge position;

Fig. 5 shows a top view of the boiler; and

Fig. 6 shows a top view of the closure piston.

With the help of Fig. 1, the general design of the coffee machine is further explained, whereby the illustration of Fig. 1 shows only the parts and elements essential of the coffee machine according to the invention. The illustration of Fig. 1 shows parts

of the housing 1 as well of the water heater 2, a brewing module 4, a driving motor 8, a grinding mill 9 and an outlet 10.

The water heater 2 in the form of the boiler consists of two halves 21 and 22 in the form of shells, the shell 22 being directly and integrally formed with the closure piston 3. The closure piston 3 is of essentially hollow shape and communicates with the interior of the water heater 2. Thereby, the closure piston 3 is filled with the heated water and homogeneously heated. The front portion of the closure piston 3 consists of a plastic part 31. This plastic part 31 is provided with a chamber 32 of hollow cylindrical shape enclosing a chamber 32 in which is provided a valve 36. The valve 36 takes two functions: On the one hand, it acts as a pressure relief valve that opens if a certain excess pressure occurs in the boiler 3; on the other hand, it operates as a check valve ensuring that no brewing water can flow back into the boiler 3. The above mentioned plastic part 31 is located on that side of the closure piston which faces the brewing chamber. At its front side, the plastic part 31 comprises a recess 33 that is covered with a sieve plate 34. The recess 33 is in communication with the hollow chamber 32 and with the outlet of the valve 36, respectively. By the provision of the recess 33 and the sieve Plate 33 a uniform distribution of the brewing water regarding the cross section of the brewing chamber and brewing cylinder 6, re-

spectively, is ensured. Moreover, the closure piston 3 is additionally provided with a sealing ring 35.

Besides a housing 41, the brewing module 4 comprises essentially a brewing piston 5, a brewing cylinder 6 as well as an operating member 7. The brewing cylinder 6 has essentially hollow cylindrical shape and is provided at its circumference with an outer thread. The brewing piston 5 is movably received in the brewing cylinder 6. The operating member 7 is axially fixed and concentrically received in the brewing cylinder 6. The operating member 7 that is fixed in axial direction is rotatably and concentrically located as far as the brewing cylinder is concerned and provided with an inner thread 71 that engages the outer thread 61 of the brewing cylinder 6. In order to avoid a rotation of the brewing cylinder 6 around its longitudinal axis, the housing of the brewing module 4 is provided with guiding elements 47 that engage correspondingly shaped recesses 67 located at the outside of the brewing cylinder 6.

At the outside, the operating member 7 is provided with teeth 72 in the shape of a gear wheel. The driving motor 8 is located laterally of the brewing module 6 and is provided with a driving member 81 in the form of a worm that is engagement with the teeth 72 of the driving member 7. If the driving motor 8 is in the operating position shown in the drawing in order move the driving motor 8 from the operating position into the rest position, the mo-

tor 8 is pivotally mounted. This is important as the driving motor 8 has to be brought into its rest position before removing the brewing module 4. In that way, the driving member 81 of the driving motor 8 is no longer in engagement with the teeth of the operating member 7. Preferably, means are provided between the brewing unit 4 and the driving motor 8 that swivel the driving motor 8 from the rest position into the operating position upon inserting the brewing module 4 in which the driving member 81 of the driving motor 8 engage the teeth 72 of the operating member 7. Those means are not shown in the drawing for clarity's sake.

The front side of the brewing cylinder 6 is provided with two radial openings 62,63 through which ground coffee can be fed. By the provision of two openings 62 and 63, respectively, it is possible to sequentially feed two different sorts of coffee into the brewing chamber. Through the one opening 63, it is possible to directly feed coffee from the ground mill 9 to the brewing cylinder 6, if the brewing cylinder 6 is in its filling position, as will be further described. The second opening 62 is provided to feed a further brand of coffee to the brewing cylinder, if desired. Since only one ground mill 9 is provided, it is necessary to feed the second opening 62 with already ground coffee. Another possibility is that two ground mills as well as two corresponding openings in the brewing cylinder are provided with the result that different coffee beverage, prepared of freshly ground coffee, can be pre-

pared. Finally, it is possible that the brewing cylinder may be provided with three radially extending openings; two of them are fed each from a separate milling ground, while the third opening, again, communicates with one opening provided in the housing of the coffee machine.

The housing 41 is provided with a tube-like collar 43 located in the interior of the housing. The collar 43 is provided with a shoulder 44 located at its front end. The rear end of the tube-like collar 43 is provided with a curved portion 46 through which the coffee beverage can flow to the outlet 10.

The brewing piston 5 received in the brewing cylinder 6 is provided with a tube shaped piston rod 51, through which the brewed coffee beverage can leave the brewing chamber. In order to enable the brewed coffee beverage to flow from the front side of the brewing piston 5 to its back side, the brewing piston 5 is provided at its front side with a recess 53 that is covered by a sieve plate member 54. The recess 53 is connected to the tube shaped piston rod 51 by means of a channel 55. Moreover, the brewing piston 5 is provided with snap cams 57 that engage the notch 44 provided in the tube-like collar 43, as seen in the base position of the coffee machine illustrated in Fig. 1. Moreover, the brewing cylinder 6 is provided with catch members 65 located in its interior for positively entraining the brewing piston 5. The

operation of the elements mentioned above will be further explained herein below.

As can be seen from Fig. 1, both the brewing module and the closure piston are horizontally arranged in the coffee machine; in other words, their longitudinal axes run in horizontal direction.

It is understood that the brewing module as well as the closure piston also can be arranged horizontally in the coffee machine. In this case, the water heater is located above the brewing cylinder such that the water flows vertically through the brewing chamber. Moreover, also the radial openings in the brewing chamber can be avoided since the feeding of the coffee powder is accomplished by means that are located laterally oblique with regard to the brewing cylinder.

The brewing module 4 is releasably inserted into the coffee machine by means of a not illustrated connection means, for example a bayonet joint.

Fig. 5 shows the closure piston 3 in a top view. In this illustration are shown not only the valve 36 and the recess, but also channels 37 that interconnect the valve 36 and the chamber 37, respectively, with the recess 33.

Fig. 6 shows a detailed view of the closure piston 33. The valve 36 consists of a valve body 38 that is biased by a spring 39. The sealing surface of the valve body has the shape of a segment of sphere. As soon as a predetermined pressure in the boiler

is reached, the valve body 38 is moved against the biasing force of the spring 39. Moreover, the valve body avoids that brewing water flows back from the brewing chamber into the boiler 3.

The operation of this coffee machine can be explained as follows:

From the base position as illustrated in Fig. 1, the brewing cylinder is moved into the filling position, as illustrated in Fig. 2 in which the closure piston 3 closes the end of the brewing cylinder 6. The movement of the brewing cylinder 6 is accomplished by means of the driving motor 8. Thereby, the operating member 7 is rotated by means of the driving member 81 of the driving motor 8 with the result that the operating member 7 moves the brewing cylinder 6 by means of the inner thread 71 of the operating member 7 engaging the outer thread of the brewing cylinder 6. During that movement of the brewing cylinder 6, the brewing piston 5 remains in its initial position because its snap cams 57 are engaged in the shoulder of the tube-like collar 43. As soon as the front edge of the brewing cylinder 6 has passed the closure piston 3, coffee powder, freshly ground by the grinding mill, is filled into the brewing chamber 6 through the one aperture 62. Thereafter, the brewing cylinder 6 is further moved, whereby the closure piston 5 now is entrained by the brewing cylinder 6 because the catch members 65 now engage the back side of the brewing piston 5. By the brewing piston 5 now moving towards the closure piston 3, the cof-

coffee powder contained in the brewing chamber 6 is compressed. By virtue of the forward movement of the brewing cylinder 6, also the sealing ring 35 of the closure piston 3 comes in contact with the inside of the brewing cylinder 6, with the result that now a sealed brewing chamber B is formed by the brewing cylinder 6 and the two pistons 3 and 5. The forward movement of the brewing chamber 6 together with the brewing piston 5 is stopped as soon as the coffee powder has reached a predetermined degree of compression, i.e. is compressed with a certain power. The stopping of the forward movement of the brewing cylinder 6 can be accomplished, for example, by monitoring the torque of the driving motor 8. As soon as the forward movement of the brewing cylinder 6 is stopped, the brewing module 4 is in its brewing position. Instead of monitoring the torque of the driving motor, for example, also the speed of revolution thereof could be monitored.

The brewing position is illustrated in Fig. 3. In order to brew the compressed coffee powder. Now the pump, not shown in the drawings, is started. Thereby, an overpressure is created in the boiler 2, and the brewing water can flow from the boiler 2 via the valve 36 to the rear side of the sieve plate member 33 and therefrom into the brewing chamber B, where the coffee powder received therein is brewed. At the other end of the brewing chamber B, the now as coffee beverage designated brewing water flows through the sieve plate 54 located in the brewing piston 5 and further flow

through the hollow piston rod 51, the tube-like collar 43 and the curved portion 46 into the beverage outlet 10.

After the coffee beverage has been brewed, the brewing cylinder is moved in the opposite direction; this is accomplished by reversing the sense of rotation of the driving motor 8. Thereby, the brewing piston is entrained by the brewing cylinder, since the friction between the sealing ring 52 of the brewing piston 5 and the brewing chamber 6 is sufficient to entrain the brewing piston. At a certain point of the backward motion of the brewing cylinder 6, the brewing piston 5 is further entrained in a positive manner by means of catch elements that are not shown in the drawing until the snap cams 57 of the brewing piston 5 snap into the shoulder of the tube-like collar 43. The result is that the brewing piston 5 now is fixed in its base position. Additionally to the snap means 44, 57, a back stop member can be provided in order to ensure that the brewing piston safely rests in its rear base position. The brewing cylinder, however, is further moved such that a relative movement between brewing cylinder 6 and brewing piston 5 results; in this way, the used coffee powder cake is pushed out of the brewing cylinder 6, until finally the brewing piston 5 is flush with the front side of the brewing cylinder 6. The used coffee powder cake falls downwards by its own weight in a collecting container that is not shown in the drawings. In order to support the reliable removal of the used coffee powder cake, additionally, a

not shown scraper can be provided. Now, the brewing module 4 is in its initial position again in which it can be removed from the housing of the coffee machine. The brewing module 4, once removed from the housing 1, can be washed in a very simple manner, for example by flushing it with fresh water.

The cleaning of the closure piston that remains in the coffee machine can be performed from the outside, for example, by means of a brush. Another possibility is to provide a rinsing program in which the closure piston is flushed with hot water, either with removed brewing module, or with the brewing module inserted into the coffee machine, but the brewing cylinder not being filled with coffee powder. Since the closure piston normally is not in contact with the brewed coffee beverage, the latter cleaning method is usually sufficient.

Due to the fact that the closure piston 3 is integrally formed with the water heater 2, on the one hand, the hitherto required connection pipe between water heater 2 and closure piston 3 is no longer necessary. On the other hand, an advantage is that the closure piston 3 is heated by the water heater 2. Both measures contribute to the fact that the temperature of the brewing water, upon entering the brewing chamber, always has a constant predetermined temperature with the result that the coffee powder is penetrated by the brewing water always with the optimal temperature.

By using the brewing module as explained herein before and by virtue of the closure piston that is stationary mounted in the coffee machine, moreover, the coffee machine can be very compactly designed. Furthermore, the brewing module is constructed of a relatively small number of parts; this allows a manufacturing at low costs and ensures a high reliability. Due to the fact that the brewing cylinder 6 and the brewing piston 5 are longitudinally movable, but do not have to perform any rotating or swiveling motion, a swiveling drive for moving the brewing cylinder from a filling position to a brewing position can be avoided; again, this is an advantage as far as costs, number of parts and reliability are concerned.

WHAT IS CLAIMED IS:

1. A coffee machine, comprising:

a means for heating water having a housing;

an essentially hollow brewing cylinder means having a central longitudinal axis and an open end;

means for moving said brewing cylinder means along said central longitudinal axis;

a closure piston means adapted to close said open end of said brewing cylinder means to thereby form a brewing chamber, said closure piston means being rigidly connected to the coffee machine;

a brewing piston means located in the interior of said brewing cylinder means, said brewing piston means being movable along said central longitudinal axis to compress coffee powder received in said brewing cylinder means as well as for removing the used coffee powder cake; and

a brewing module means having a longitudinal axis, releasably inserted into the coffee machine, and including at least said brewing cylinder means and said brewing piston means.

2. A coffee machine according to claim 1 in which said closure piston means is integrally formed with or rigidly connected to the housing of said means for heating water.

3. A coffee machine according to claim 1 in which said longitudinal axis of said brewing module runs essentially in vertical direction, when said brewing module is inserted into the coffee machine.

4. A coffee machine according to claim 1 in which said longitudinal axis of said brewing module runs essentially in horizontal direction, when said brewing module is inserted into the coffee machine.

5. A coffee machine according to claim 1 in which said brewing cylinder means and said brewing piston means are arranged to be movable solely in a longitudinal direction.

6. A coffee machine according to claim 1 in which said brewing cylinder means is provided with at least one radial opening for filling in coffee powder.

7. A coffee machine according to claim 1 in which said brewing cylinder means is provided with at least two radial openings for filling in coffee powder, and further comprising two grinding

mills for grinding coffee beans, whereby each one grinding mill is assigned to one of said openings.

8. A coffee machine according to claim 1 in which said brewing cylinder means is provided with at least two radial openings, and further comprising a third opening for filling in coffee powder, said third opening communicating with one of the two other openings.

9. A coffee machine according to claim 1 in which said means for moving said brewing cylinder means along said central longitudinal axis is a spindle drive means.

10. A coffee machine according to claim 9 in which said brewing cylinder means is provided with an outer thread, whereby the brewing module is provided with a rotating actuation member that is located concentrically to the brewing cylinder means that is provided with a thread at its inner side which engages the outer thread of the brewing cylinder means, and whereby said actuation member is designed as a toothed wheel at its periphery and the teeth of the toothed wheel are adapted to engage with a drive means of a drive motor adapted for moving the brewing cylinder means.

11. A coffee machine according to claim 9 or 10 in which said drive motor is located beside the brewing module, and wherein said drive motor comprises one or more power transmitting elements.

12. A coffee machine according to claim 10 or 11 in which said drive motor or at least the power transmitting elements of the drive motor are pivotally supported, and further comprising means arranged between said brewing module and said drive motor or at least the power transmitting elements of the drive motor that are adapted to pivot said drive motor or at least the power transmitting elements of the drive motor, when said brewing module is inserted into the coffee machine, from a rest position into an operating position in which said drive means of said drive motor engage a gear wheel integral to said rotating actuation member.

13. A coffee machine according to claim 1 in which said brewing piston is provided with a hollow piston rod serving as an outlet of the brewing chamber for the brewed coffee beverage.

14. A coffee machine according to claim 13 in which said brewing module is provided with a tube-like collar means projecting into said brewing chamber into which said hollow piston rod partially penetrates, whereby said collar means is connected to a beverage outlet of the coffee machine.

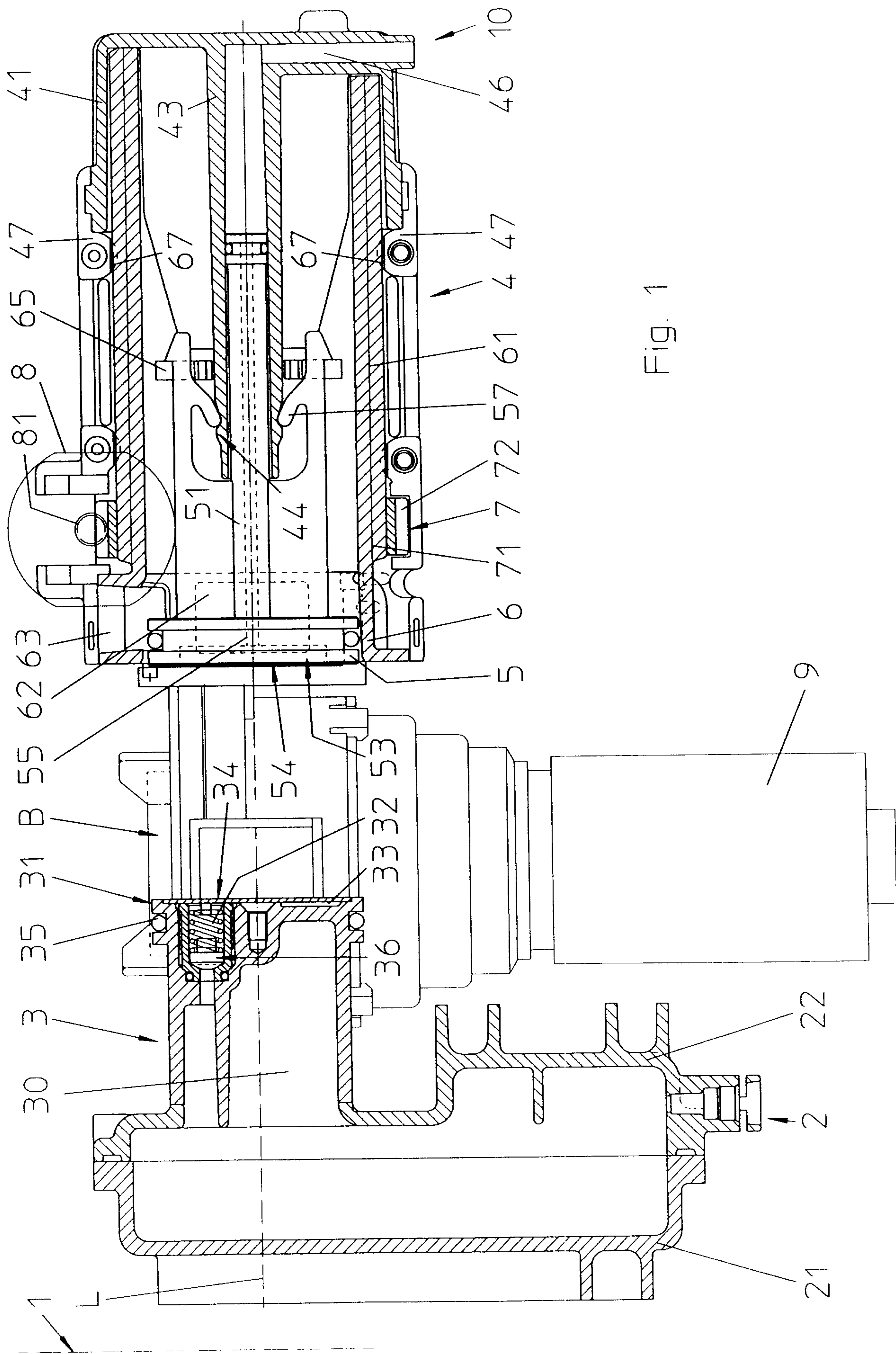
15. A coffee machine according to claim 1, further comprising snap-in means to fix said brewing piston in its initial position.

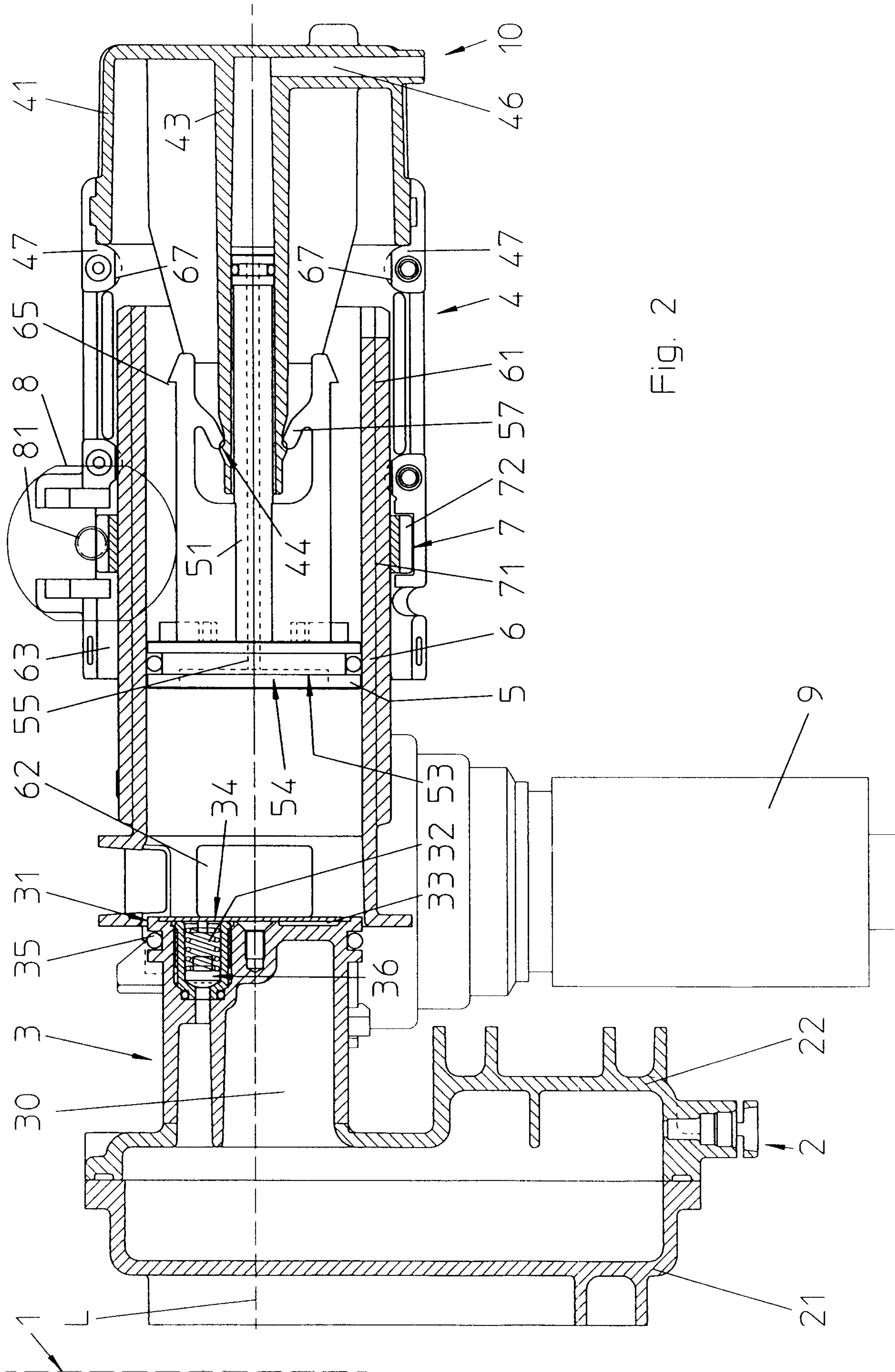
16. A coffee machine according to claim 15 in which said tube-like collar is provided with an indentation, whereby said snap-in means engage said indentation when said brewing piston is in its initial position.

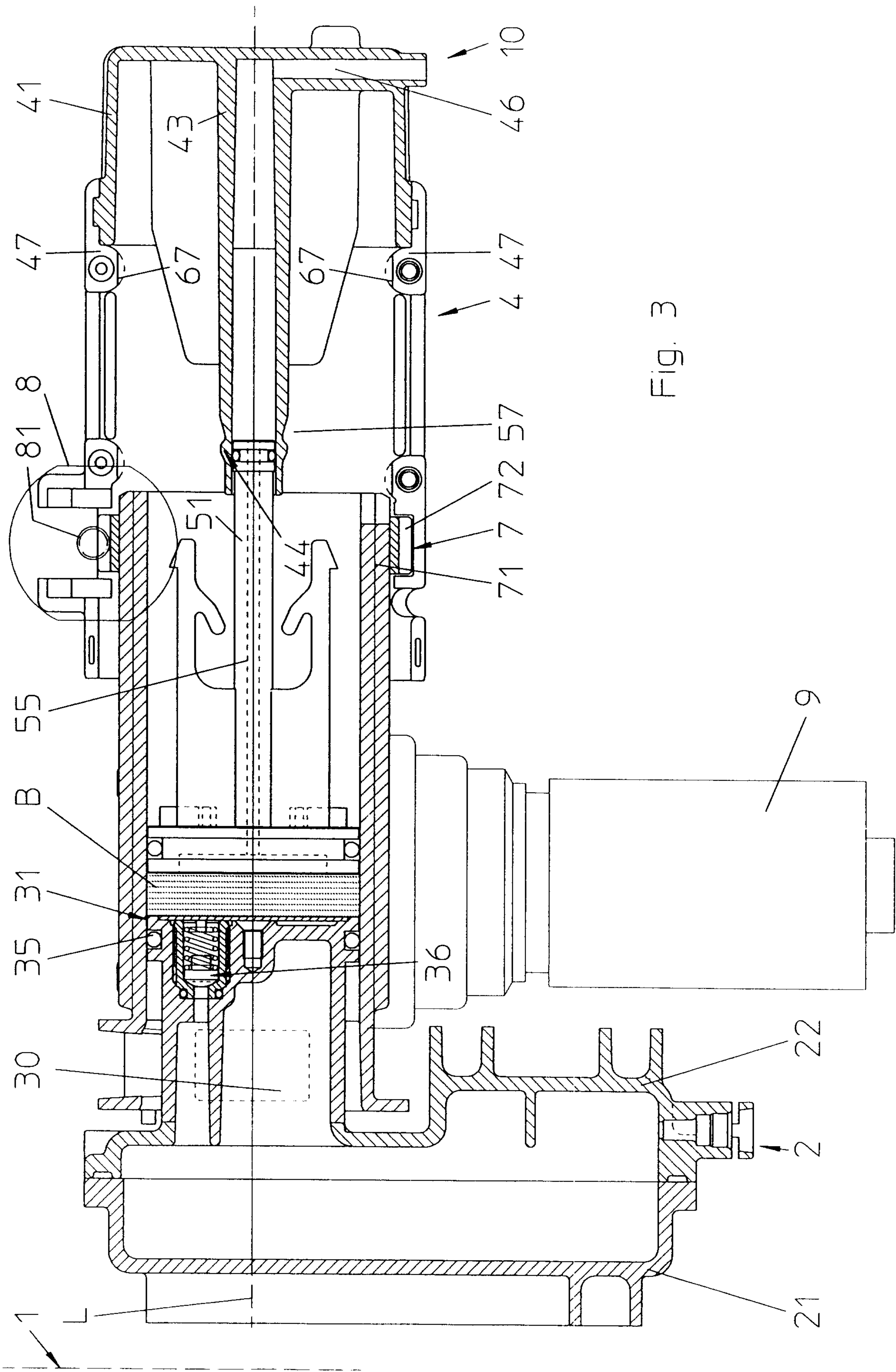
17. A coffee machine according to claim 1 in which said brewing cylinder is provided with catch means, located at its inside, for moving said brewing piston means.

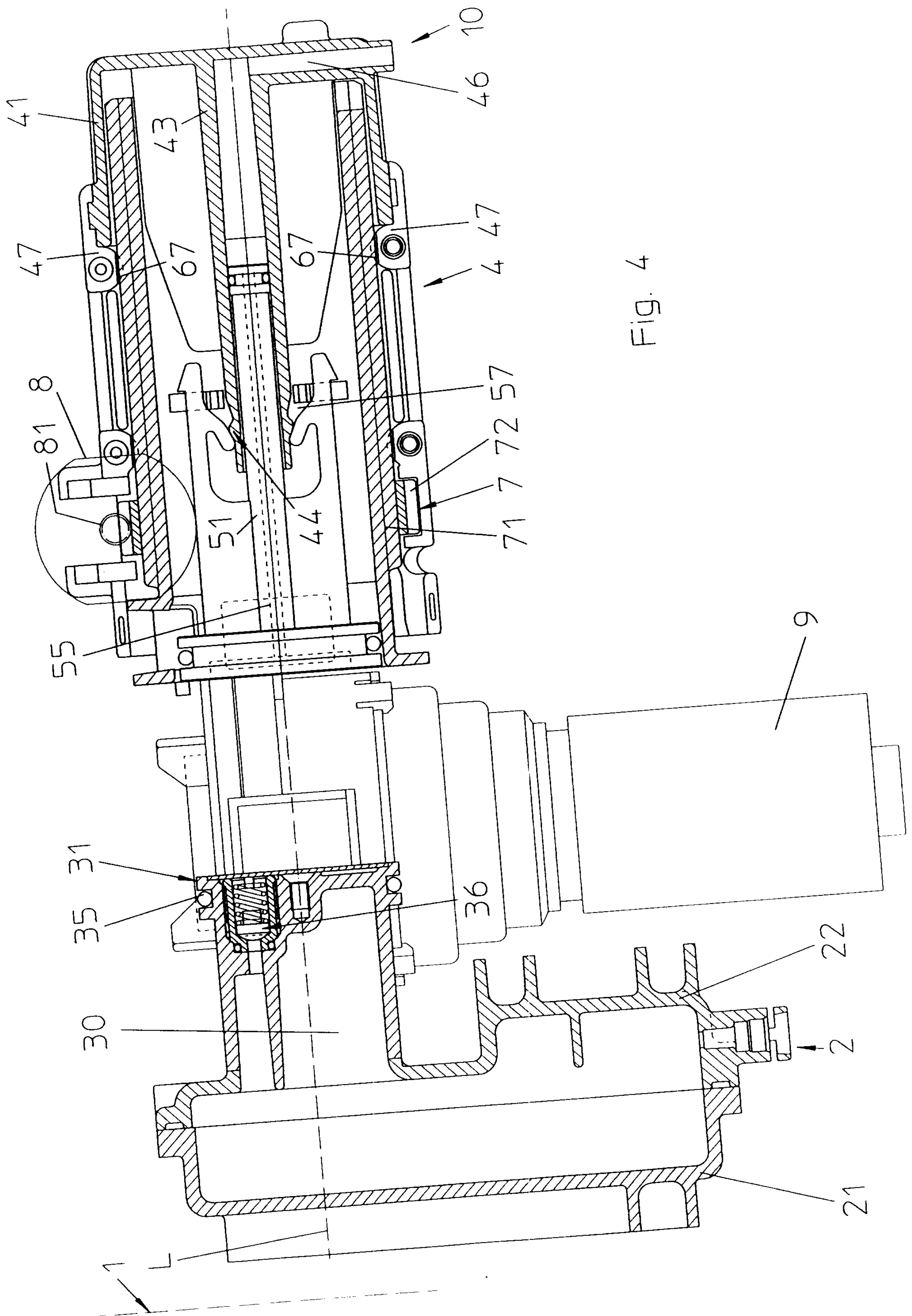
18. A coffee machine according to claim 1 in which said brewing cylinder is provided with guide means for preventing a rotation around its longitudinal axis.

19. A coffee machine according to claim 1 in which said brewing module is provided with releasable lock means adapted to lock said brewing module in the coffee machine.









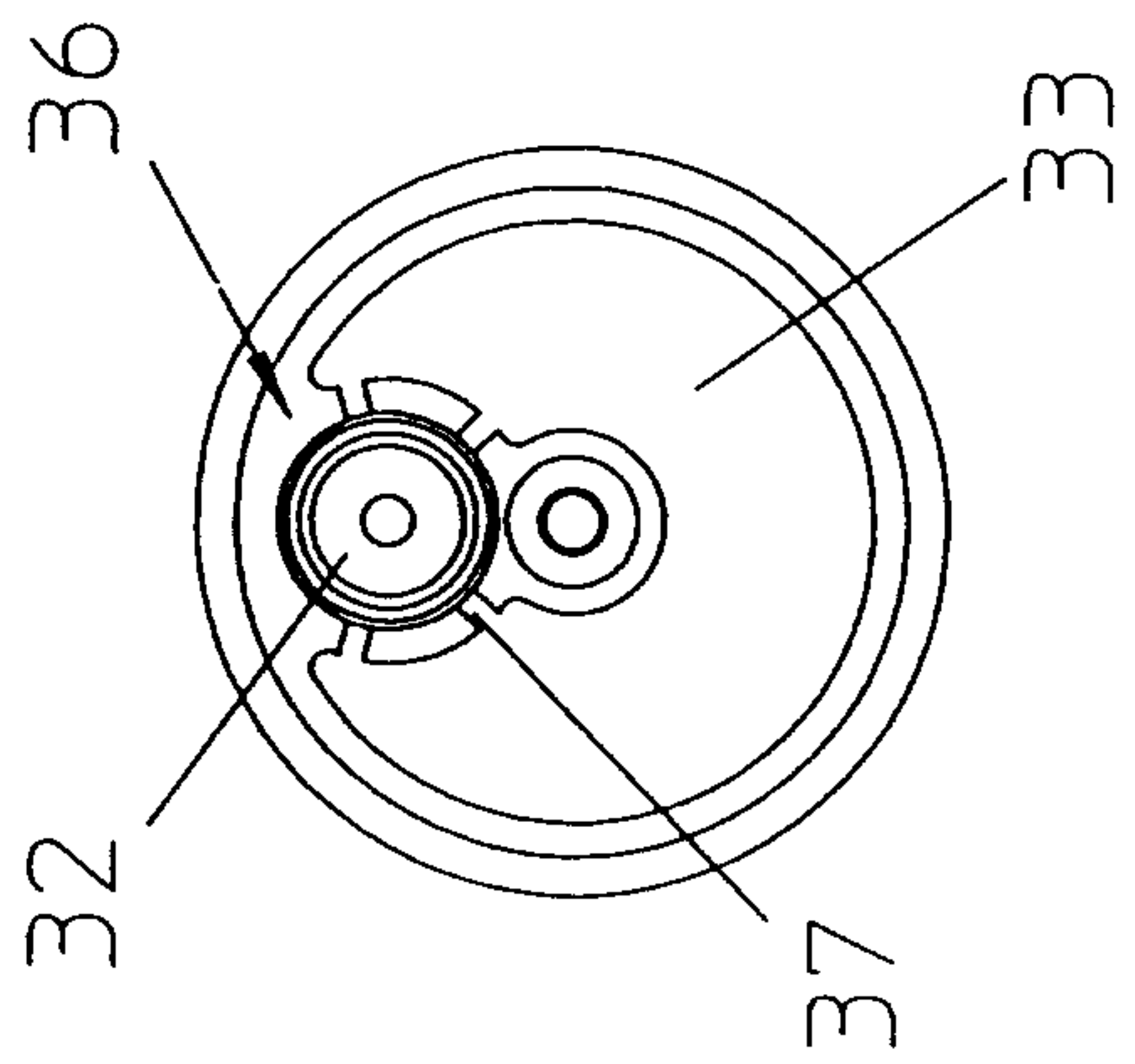


Fig. 5

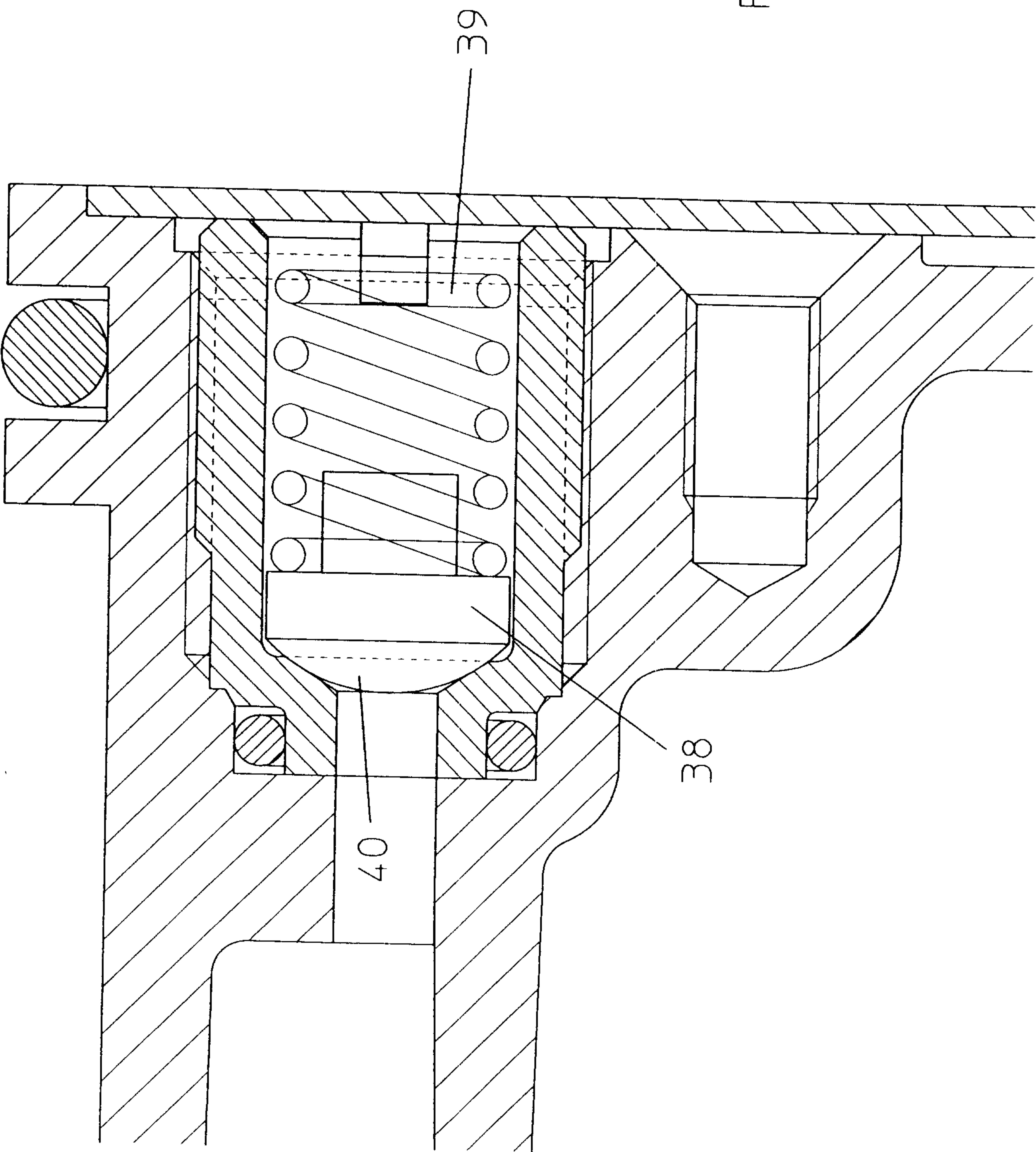


Fig. 6

