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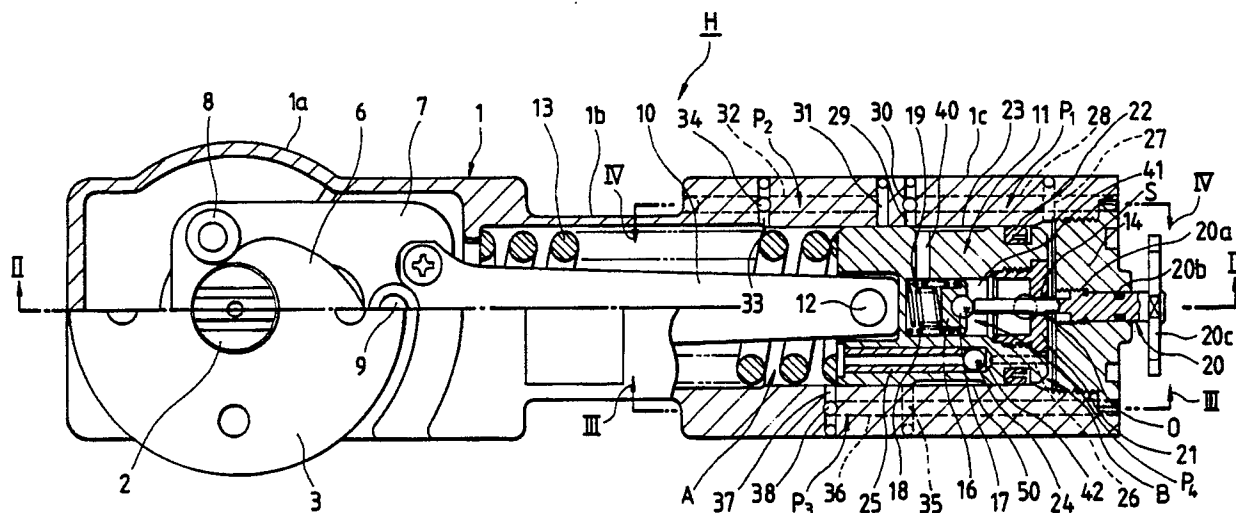
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(54) **Door closer.**

(57) A door closer has a main shaft (2) connected to a door, a piston (11) reciprocally moved in a case (1) in response to the movement of the door, a first and a second pressure chamber (A, B) operated by the piston (11), and four hydraulic oil passages (P_1 , P_2 --- P_4) for communicating and stopping communicat-

ing the two pressure chambers (A, B) with each other. A door stop releasing angle adjusting mechanism (15) for adjusting an angle at which the door is kept open is provided between the piston (11) and the end portion (14) of the case (1).

FIG. 1



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DOOR CLOSER

BACKGROUND OF THE INVENTION

The present invention relates to a door closer utilized as a hinge member for a door for smoothly opening and closing a door.

In general, a door closer is provided for a door for smoothly opening and closing the door, and the door closer has a structure for automatically closing the door after opening the door, stopping the door at a predetermined opening position and capable of maintaining the door stopping position.

The door closer, for these purposes, is provided with a main shaft which is rotatable in accordance with the rotation of the door. The rotation of the main shaft is converted into a linear movement for linearly sliding a piston accommodated in a cylinder assembly of a door closer. A return spring which is also accommodated in the cylinder assembly is urged by the sliding movement of the piston to thereby automatically closing the door when the door is released.

The door closer of the structure described above is further provided with a stop mechanism for maintaining the stopped state of the door at a predetermined position after the door has been opened. The stop mechanism includes a cam plate which is secured to the main shaft, and the cam plate is provided with a cutout at a predetermined position. An engaging member is engaged with the cutout when the door is opened to the predetermined position to stop the door at that position. However, when the cam mechanism constitutes the door stop mechanism, it becomes necessary to separately prepare a door closer provided with no stop mechanism for a door which does not require the provision of the stop mechanism, thus being inconvenient. In addition, the described cam mechanism is not provided with a function for changing the angle for stopping the door.

SUMMARY OF THE INVENTION

An object of the present invention is to substantially eliminate the defects or drawbacks encountered to the prior art described above and to provide a door closer provided with a door opening position stop function and a function for releasing a door stopping function and, optionally changing the door stopping angle positions to thereby smoothly opening or closing the door.

This and other objects can be achieved according to the present invention by providing a

door closer for carrying out door opening and closing operation having an outer case in which a piston and a return spring are accommodated wherein a rotation of a door is converted into a linear movement of the piston and the movement of the piston urges the return spring and the door is closed by return force of the return spring, characterized in that a check valve is disposed in the piston so as to allow hydraulic oil to flow from a first pressure chamber to a second pressure chamber, both chamber being disposed on opposite sides of location of the piston and to prohibit the reverse flow of the hydraulic oil, a first hydraulic oil passage is formed to communicate the second pressure chamber with a hydraulic oil passage formed on the outer periphery of the piston at a predetermined position of the piston to establish hydraulic oil communication, a second and a third hydraulic oil passages are formed to communicate the hydraulic oil passage with the first pressure chamber at a predetermined position of the piston, and a door stop releasing angle adjusting mechanism is disposed in the piston for adjusting the door stopping angle position, said second hydraulic oil passage communicating the oil passage with the first pressure chamber in a door opening angle region in which the door widely opened is closed with a predetermined door closing speed, said third hydraulic oil passage communicating the oil passage with the first pressure chamber in a door opening angle region in which the door is completely closed with a door closing speed slower than the above mentioned predetermined door closing speed, said first, second and third hydraulic oil passages being provided with adjusting valves respectively for controlling the hydraulic oil flow, said door stop releasing angle adjusting mechanism comprising a fourth hydraulic oil passage communicating the second pressure chamber with the oil passage, a stop valve disposed in the fourth hydraulic oil passage and adapted to stop the hydraulic oil flow till the door is closed to a predetermined angle position when the door widely opened is closed and an adjusting member for adjusting a position where the stop valve is opened.

According to the door closer described above, when the door is opened to an optional opening angle, the piston is displaced and the return spring is compressed by the displacement of the piston. At this moment, the hydraulic oil in the first pressure chamber is flown into the second pressure chamber through the check valve to allow the door to be freely opened. In this door opening operation, the door can be stopped with widely opened

angle, for example, more than 80° by fully closing the adjusting valve of the first hydraulic oil passage and, otherwise, the door closer can attain the delayed function by loosely closing the adjusting valve. In a case where the door widely opened is closed, the door stop function is released by the stop releasing angle adjusting mechanism in the door opening angle region of about 80° to 100° , for example, and the delayed action is ended. Thereafter, the door can be closed with the first door closing speed without stopping in the door opening angle region which is smaller than the above-mentioned releasing angle. The door stop releasing angle is predetermined by the control of the opening degree of the stop valve which is adjusted by the adjusting member such as an adjusting bolt. In a case where the door now in a stopped state is closed, the stop valve is released by forcibly pushing the door. Namely, by forcibly pushing the door, the pressure in the second pressure chamber is increased to thereby open the stop valve and the hydraulic oil in the second pressure chamber is flown into the first pressure chamber through the fourth hydraulic oil passage, the hydraulic oil communication passage and the second hydraulic oil passage, whereby the door is closed and when the door is continuously pushed to the door stop releasing angle position, the door is automatically closed. In this case, in the door opening angle region of about 80° to 100° , for example, i.e. first speed region, the second pressure chamber is communicated with the first pressure chamber through the first and second hydraulic oil passages and the door closing speed can be adjusted by the adjusting valve disposed in the second hydraulic oil passage. When the door is further closed in the door opening angle region of about 20° to 0° (second speed region), the second hydraulic oil passage is closed and the hydraulic oil in the second pressure chamber is flown into the first pressure chamber through the fourth hydraulic oil passage and the third hydraulic oil passage. The door closing speed can be adjusted by the adjusting valve disposed in the third hydraulic oil passage. According to the manner described above, the object of the present invention can be sufficiently achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, reference will now be made to, by way of a preferred embodiment, to the accompanying drawings in which:

Fig. 1 is a longitudinal sectional view, partially broken away, of a door closer according to the

present invention;

Fig. 2 is a sectional view taken along the line II-II shown in Fig. 1;

Fig. 3 is a sectional view taken along the line III-III shown in Fig. 1;

Fig. 4 is a sectional view taken along the line IV-IV shown in Fig. 1;

Fig. 5 is a view for explaining the door opening angle region;

Fig. 6 is a longitudinal sectional view, partially broken away, of a door closer when the door is in a position opened by angles of about 100° ;

Fig. 7 is a view similar to that shown in Fig. 6, but when the door is in a position opened by angles of about 80° ; and

Fig. 8 is a view similar to that shown in Fig. 6, but when the door is in a position opened by angles of about 20° .

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figs. 1 and 2, a door closer H of the present invention comprises a cylindrical case 1 which is composed of a main shaft accommodation portion 1a in which a main shaft 2, positioned to a leftside portion as viewed, is accommodated, a spring accommodation portion 1b in which a return spring 13 is accommodated at the central portion thereof and a piston accommodation portion 1c in which a piston 1c, positioned in a rightside portion as viewed, is accommodated. The free end, rightside end as viewed, of the piston accommodation portion 1c is closed by an end plug 14.

The main shaft accommodation portion 1a is closed by a cover member 3 and the main shaft 2 is secured therein to be rotatable by a bearing 4 mounted to the central portion of the cover member 3 and a bearing 5 mounted to the lower surface of the piston accommodation portion 1c. To the main shaft 2 is secured a leaf-shaped cam plate 6 accommodated in a central gap in an operating plate 7 in the main shaft accommodation portion 1a. Rollers 8 and 9 acting as cam followers are disposed at proper positions opposing to the cam plate 6 in the operating plate 7. The righthand end, as viewed, of the operating plate 7 is connected to the lefthand end of a connecting rod 10, which has the righthand end connected to the piston 11 through a connection pin 12.

In the spring accommodation portion 1b is accommodated the return spring 13 in a position between the leftside inner wall of the spring accommodation portion 1b and the piston 11 so that the return force is urged by the leftward displacement of the piston 11.

In the piston accommodation portion 1c, there is disposed a stop releasing angle adjusting mechanism 15 shown in Fig. 2 for adjusting an angle for stopping the door. The stop releasing angle adjusting mechanism 15 is provided with a valve seat 16 to be slidable in a cylindrical cavity 41 formed in the piston 11 and the valve seat 16 is urged rightwardly as viewed by a large coil spring 18 having a larger diameter and a small coil spring 19 having a smaller diameter. A ball-shaped stop valve 17 is accommodated in the valve seat 16. The cylindrical cavity 41 has an inlet opening at which is disposed a cylindrical valve seat 21 having an opening O at the central portion thereof. The front end of an adjusting bolt 20 screw-engaged with the end plug 14 extends into the cavity 41 through the opening O of the valve seat 21. There is formed a small gap 5 between the opening O of the valve seat 21 and the outer periphery of the adjusting bolt 20. When the stop valve 17 is left from the valve seat 16, hydraulic oil in a second pressure chamber B flows into the cavity 41 through the small gap S. The small gap 5, the cavity 41 and a through hole 40 formed in the radial direction of the piston 11 in the piston accommodation portion 1c form, in combination, a fourth hydraulic oil passage P₄.

The adjusting bolt 20 includes a screw portion 20a which is to be engaged with a screw portion formed to the end plug 14. A seal ring 20b is provided for the engaging portion between the adjusting bolt 20 and the end plug 14. The one end, i.e. righthand end, of the adjusting bolt 20 projects outward beyond the end plug 14 and a handle member 20c is secured to the projecting end of the adjusting bolt 20, whereby the adjusting bolt 20 can be moved in the bilateral directions as viewed by rotating the handle member 20c. A seal ring 22 is provided for the front portion, righthand portion as viewed, of the piston 11. The longitudinally central portion of the outer periphery of the piston 11 is formed as a small diameter portion 23 so as to provide a small gap between the outer peripheral surface of the piston 11 and the inner wall of the piston accommodation portion 1c, the gap being formed as a hydraulic oil communication passage 50 through which hydraulic oil flows. The through hole 40, shown in Fig. 1, is formed in the piston 11 to establish the communication between the hydraulic oil communication passage 50 and the inner central portion of the piston 11, and the through hole 40 communicates with the cylindrical cavity 41 formed in the piston 11.

As shown in Fig. 1, a ball-shaped check valve 24 is disposed in a cavity 42 to a front portion of a valve cylinder 25 near the outer periphery of the piston 11 and a first passage 26 extending in the axial direction of the piston 11 communicates with

the cavity 42. The first passage 26 communicates with a second pressure chamber B and a first pressure chamber A in which the return spring 13 is accommodated is formed on the opposite side of the second pressure chamber B. A second passage 27 is formed at the righthand end, as viewed in Fig. 1, so as to extend in the radial direction of the case 1. The second passage 27 communicates with a third passage 28 extending in the thickened wall of the case 1 and along the longitudinal direction thereof and the third passage 28 also communicates with a fourth passage 29 extending in the radial direction of the case 1. These second, third and fourth passages 27, 28 and 29 constitute, in combination, a first hydraulic oil passage P₁.

As shown in Fig. 4, a delayed action (DA) adjusting valve 30 is disposed between the third passage 28 and the fourth passage 29. The delayed action adjusting valve 30 serves to adjust the flow of the hydraulic oil between the first pressure chamber A and the second pressure chamber B by adjusting the opening degree of the fourth passage 29 in accordance with the rotation of the adjusting valve 30. A fifth passage 31 is formed on the left side, as viewed in Fig. 4, of the fourth passage 29 so as to extend in the same direction of the fourth passage 29 and the fifth passage 31 communicates with a sixth passage 32 extending in the longitudinal direction in the thickened wall of the case 1. The sixth passage 32 communicates with a seventh passage 33 extending in the radial direction of the case 1. These fifth, sixth and seventh passages 31, 32 and 33 constitute a second hydraulic oil passage P₂. As shown in Fig. 4, a first speed adjusting valve 34 is disposed at an intermediate portion between the sixth passage 32 and the seventh passage 33. The door opening speed (first speed) at a time when the door is widely opened can be adjusted by the adjustment of the first speed adjusting valve 34.

An eighth passage 35 is formed in the lower case portion constituting the lower inner wall of the piston accommodation portion 1c so as to extend in the radial direction of the case 1 and the eighth passage 35 communicates with a ninth passage 36 extending in the longitudinal direction in the thickened wall of the case 1. The ninth passage 36 communicates with a tenth passage 37 extending in the radial direction of the case 1. These eighth, ninth and tenth passages 35, 36 and 37 constitute, in combination, a third hydraulic oil passage P₃. As shown in Fig. 3, a second speed adjusting valve 38 is disposed between the ninth passage 36 and the tenth passage 37. The opening degree of the tenth passage 37 can be adjusted by the adjustment of the second speed adjusting valve 38, whereby the door opening speed (second speed) at a time when the door is almost being closed can be adjusted.

The function of the door closer of the present invention of the structure described above will be described hereunder.

Referring to Fig. 5, the door to which the door closer according to the present invention is fixed is opened by the maximum opening angles of 120° . The door opening angle region in which the door is slowly rotated from a door position opened by angles of about 20° to the door fully closed position, i.e. in the second speed region. The door opening angle region between about 20° and 80° , in which the door is closed at a speed higher than that in the second speed region, is referred to as the first speed region. The door opening angle region between about 80° to 100° is the stop release angle adjusting region in which the angle at which the door stop is released is adjusted. The door opening angle region between the door stop releasing angle and about 120° is a DA region in which the delayed action can be performed. Fig. 5 shows merely one example of the angular regions to be controlled by the door closer according to the present invention and other changes in angles may be of course adopted.

Now supposing that the door is rotated to a position to the DA region (about 100°) near the maximum opening angle as shown in Fig. 6, the rotation of the door is transmitted to the main shaft 2 which is then also rotated in the counterclockwise direction, as viewed. The rotation of the main shaft 2 is converted into the linear movement of the operating plate 7 in the leftward direction through the cam plate 6 and the rollers 8 and 9 acting as cam followers, whereby the piston 11 is moved leftwardly from the condition shown in Fig. 1 in which the door is fully closed. The leftward movement of the piston 11 compresses the return spring 13 and, at this moment, the hydraulic oil in the first pressure chamber A is guided into the second pressure chamber B through the cavity 41 in which the check valve 24 is disposed and the first passage 26. In the condition in which the door opening angle of 100° in the DA region, as shown in Fig. 6, the first hydraulic oil passage P_1 communicates the second pressure chamber B and the hydraulic oil communication passage 50 and the second hydraulic oil passage P_2 communicates the hydraulic oil communication passage 50 and the first pressure chamber A, so that the hydraulic oil in the first pressure chamber A is flown into the second pressure chamber B and, hence, the piston 11 is moved rightwardly as viewed by the return force of the return spring 13. During this operation, when the degree of opening of the fourth passage is adjusted by the DA adjusting valve 30, the door closing speed is controlled to thereby attain the delayed function.

In a case where the door is opened by angles

beyond the stop release angle, when the fourth passage 29 is completely closed by the adjustment of the DA adjusting valve 30, the first hydraulic oil passage P_1 is closed and, hence, the door is stopped at the door releasing position. In a case where it is desired to further close the door now stopped, the door will be closed by forcibly pushing the door in the door closing direction, whereby the pressure in the second pressure chamber B is increased and the stop valve 17 is moved leftwardly by this pressure. At this moment, the fourth hydraulic oil passage P_4 is opened and the first pressure chamber A and the second pressure chamber B are mutually communicated through the third and fourth hydraulic oil passages P_2 and P_4 to thereby close the door. Namely, when the door is being pushed to the door stop releasing angle position, the stop valve 17 abuts against the inner end of the adjusting bolt 20, as shown in Fig. 7, and the adjusting bolt 20 is pushed leftwardly, as shown in Fig. 7, to thereby open the fourth hydraulic oil passage P_4 and, accordingly, the door is thereafter automatically closed by the repulsive force of the return spring 13. During this operation, the door releasing angle can be changed in the door stop releasing angle adjusting region of 80° to 100° by changing the inner end position of the adjusting bolt 20 by rotating the same.

The door opening angle region from the stop releasing angle to the angle of about 20° is referred to as the first speed region, in which the door is closed with a relatively fast speed and the door closing speed can be controlled by the adjustment of the first speed adjusting valve 34.

When the door is closed at the door closing angle below about 20° , the second hydraulic oil passage P_2 is closed as shown in Fig. 8, and the third hydraulic oil passage P_3 communicates the first pressure chamber A with the hydraulic oil communication passage 50. Accordingly, the hydraulic oil in the second pressure chamber B is flown into the first pressure chamber A through the fourth hydraulic oil passage P_4 , the hydraulic oil communication passage 50 and the third hydraulic oil passage P_3 to thereby slowly close the door with the second door closing speed under the control of the second speed adjusting valve 38.

As described above, according to the door closer of the present invention, the door can be provided with the stopping function or stop releasing function by the adjustment of the DA adjusting valve 30 and, moreover, the stop releasing angle can be optionally be set within the predetermined range by the adjustment of the adjusting bolt 20 and, hence, the door closing speed can be adjusted in relation to the door opening angle region.

Claims

1. A door closer for carrying out door opening and closing operation having an outer case in which a piston and a return spring are accommodated wherein a rotation of a door is converted into a linear movement of the piston and the movement of the piston urges the return spring and the door is closed by repulsive force of the return spring, characterized in that a check valve (24) is disposed in the piston (11) so as to allow hydraulic oil to flow from a first pressure chamber (A) to a second pressure chamber (8), both chamber being disposed on opposite sides of location of the piston and to prohibit the reverse flow of the hydraulic oil, a first hydraulic oil passage (P₁) is formed to communicate the second pressure chamber with a hydraulic oil passage (50) formed on an the outer periphery of the piston at a predetermined position of the piston to establish hydraulic oil communication, a second and a third hydraulic oil passages (P₂) and (P₃) are formed to communicate the hydraulic oil passage (50) with the first pressure chamber (A) at a predetermined position of the piston, and a door stop releasing angle adjusting mechanism (15) is disposed in the piston for adjusting the door stopping angle position, said second hydraulic oil passage (P₂) communicating the oil passage (50) with the first pressure chamber (A) in a door opening angle region in which the door widely opened is closed with a predetermined door closing speed, said third hydraulic oil passage (P₃) communicating the oil passage (50) with the first pressure chamber (a) in a door opening angle region in which the door is completely closed with a door closing speed slower than the above mentioned predetermined door closing speed, said first, second and third hydraulic oil passages (P₁), (P₂) and (P₃) being provided with adjusting valves respectively for controlling the hydraulic oil flow, said door stop releasing angle adjusting mechanism (15) comprising a fourth hydraulic oil passage (P₄) communicating the second pressure chamber (B) with the oil passage (50), a stop valve (17) disposed in the fourth hydraulic oil passage (P₄) and adapted to stop the hydraulic oil flow till the door is closed to a predetermined angle position when the door widely opened is closed and an adjusting member (20) for adjusting a position where the stop valve (17) is opened.

2. A door closer according to claim 1, wherein said adjusting member of the door stop releasing angle adjusting mechanism (15) comprises an adjusting bolt (20) screw-engaged with an end plug (14) closing one open end of the outer case (1) of the door closer, said adjusting bolt (20) being provided with an inner end extending towards the stop valve (17) of the piston (11) for adjusting a position

where the stop valve (17) is opened in accordance with an adjustment of the inner end position of the adjusting position by rotating the same.

3. A door closer according to claim 2, wherein said stop valve (17) is a ball-shaped valve urged toward the adjusting bolt (20) and disposed in a cavity (41) of the piston (11), the cavity (41) being communicated with the oil passage (50) formed on the periphery of the piston (11) through a radial oil passage (40) formed in the piston (11).

4. A door closer according to claim 3, wherein when said door is forcibly pushed after it is widely opened, said door stop releasing angle adjusting mechanism (15) opens the fourth hydraulic oil passage (P₄) thereby to allow the door to close.

FIG. 1

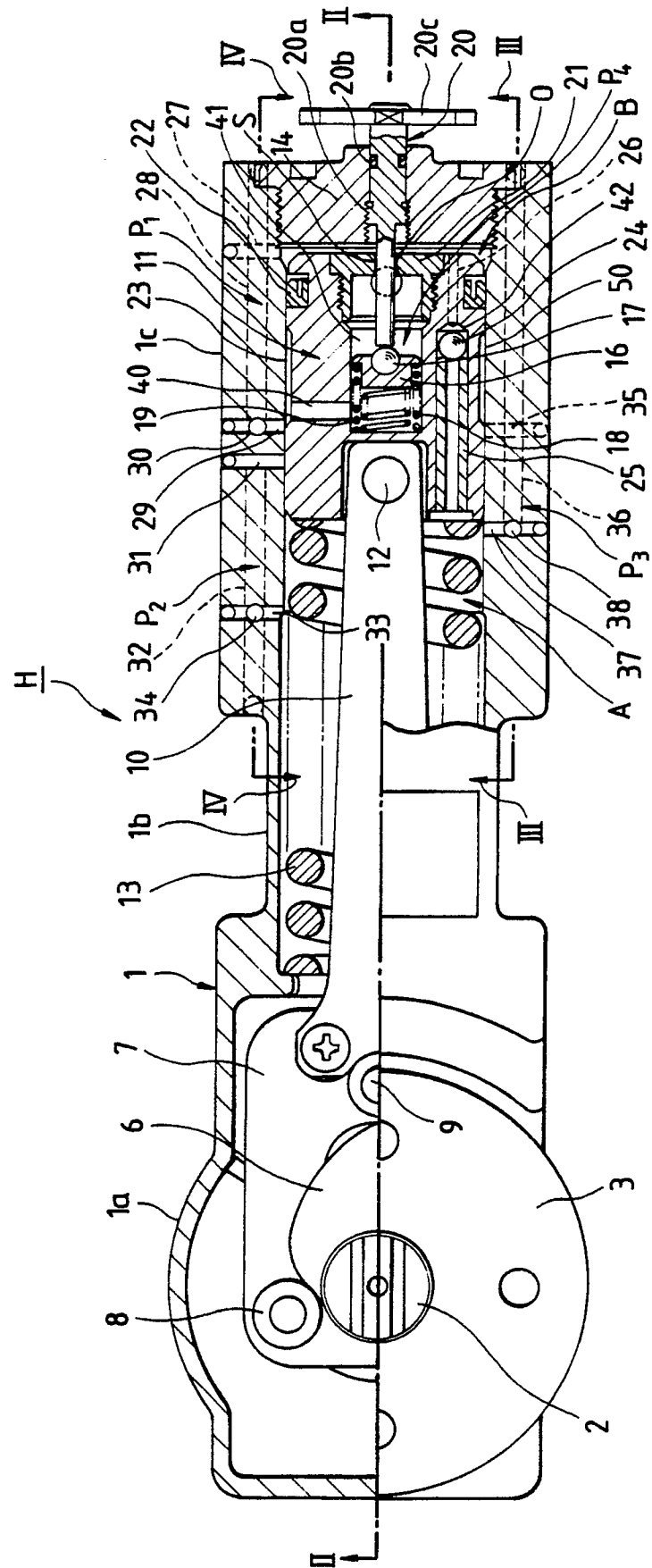


FIG. 2

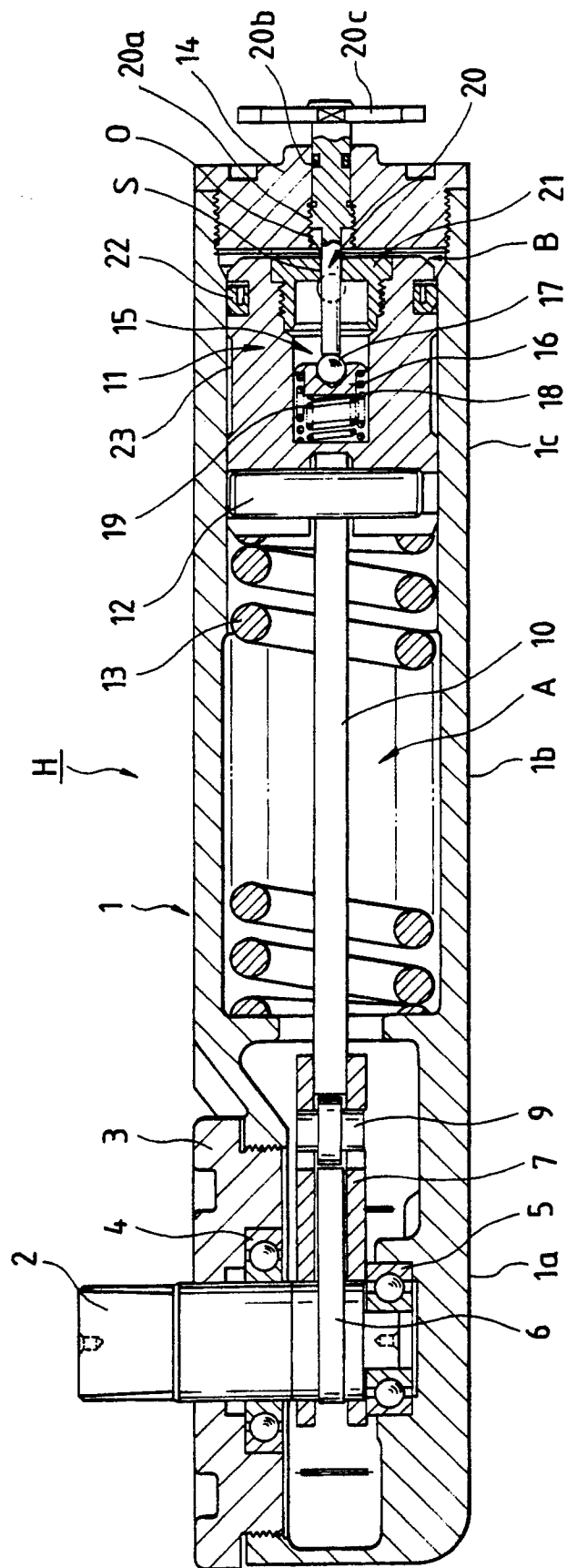


FIG. 3

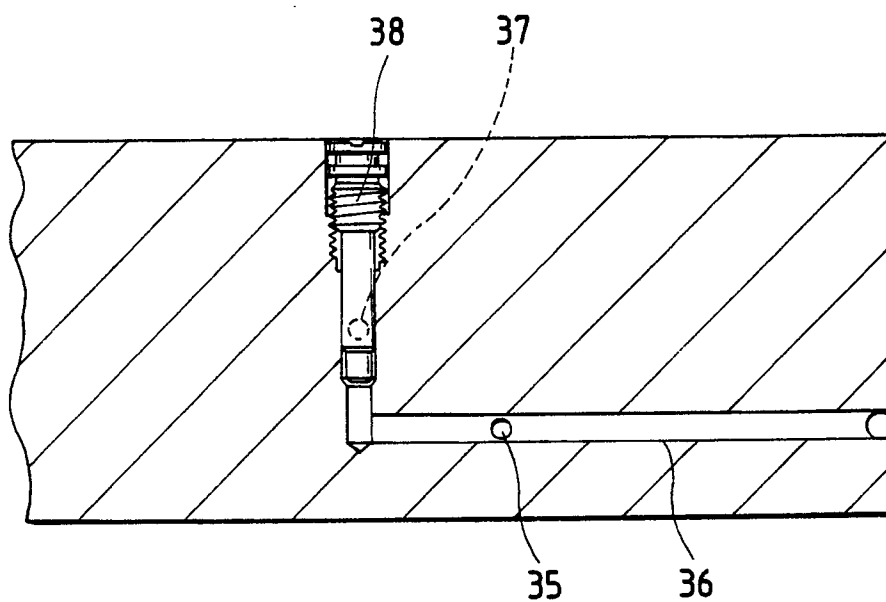


FIG. 4

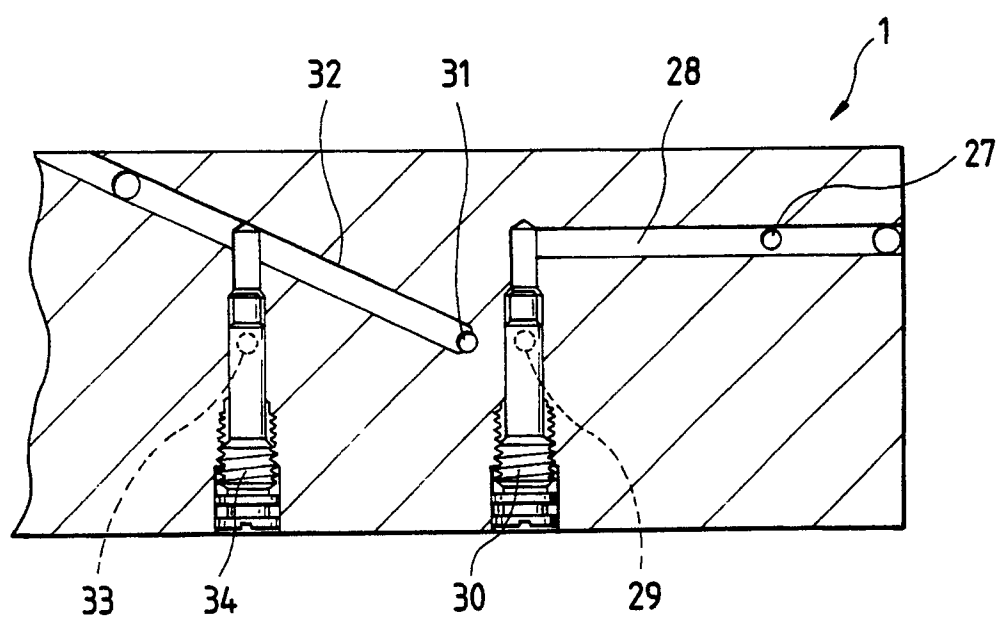


FIG. 5

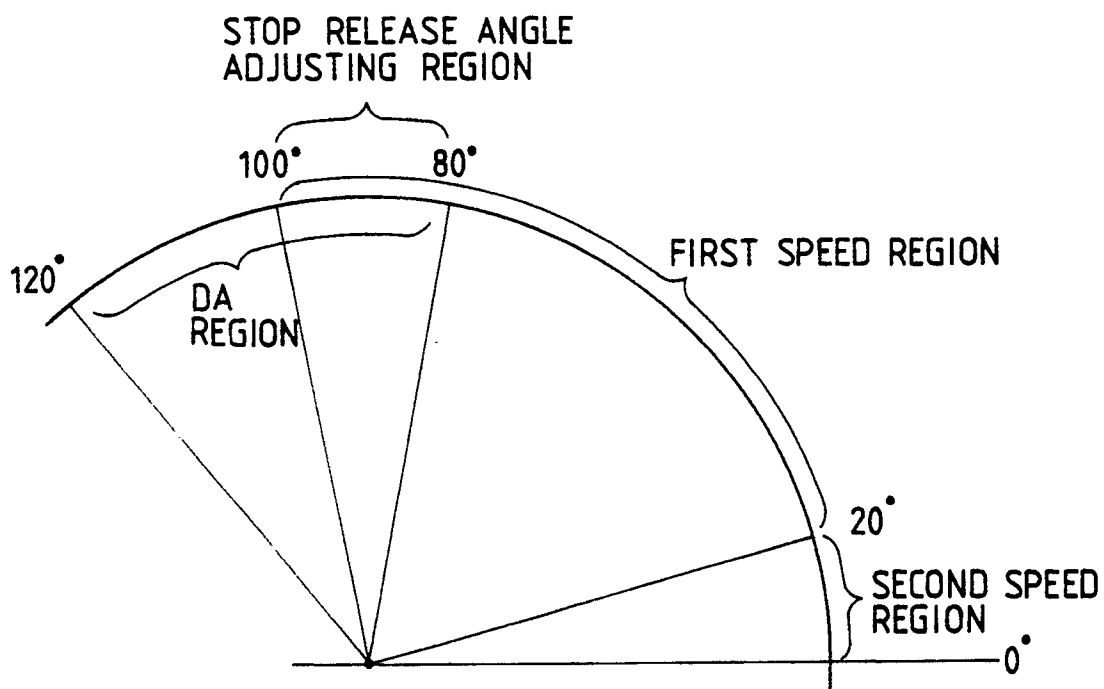


FIG. 6

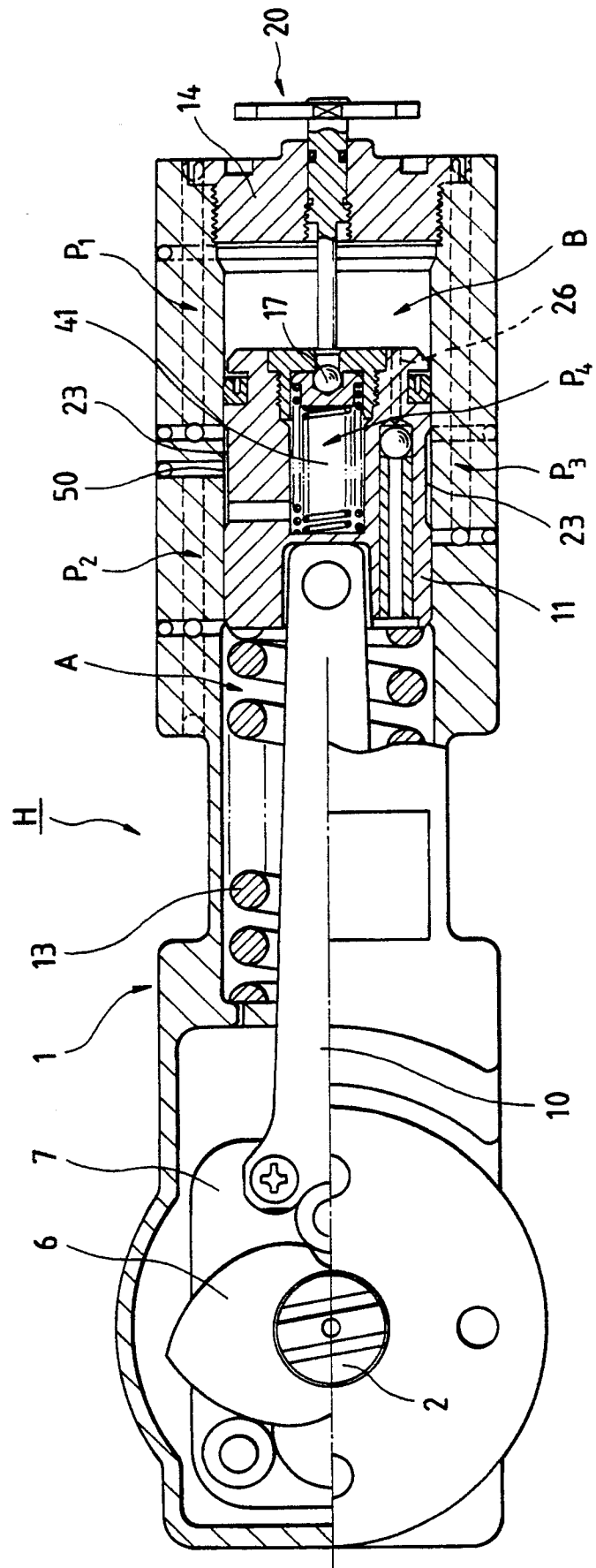


FIG. 7

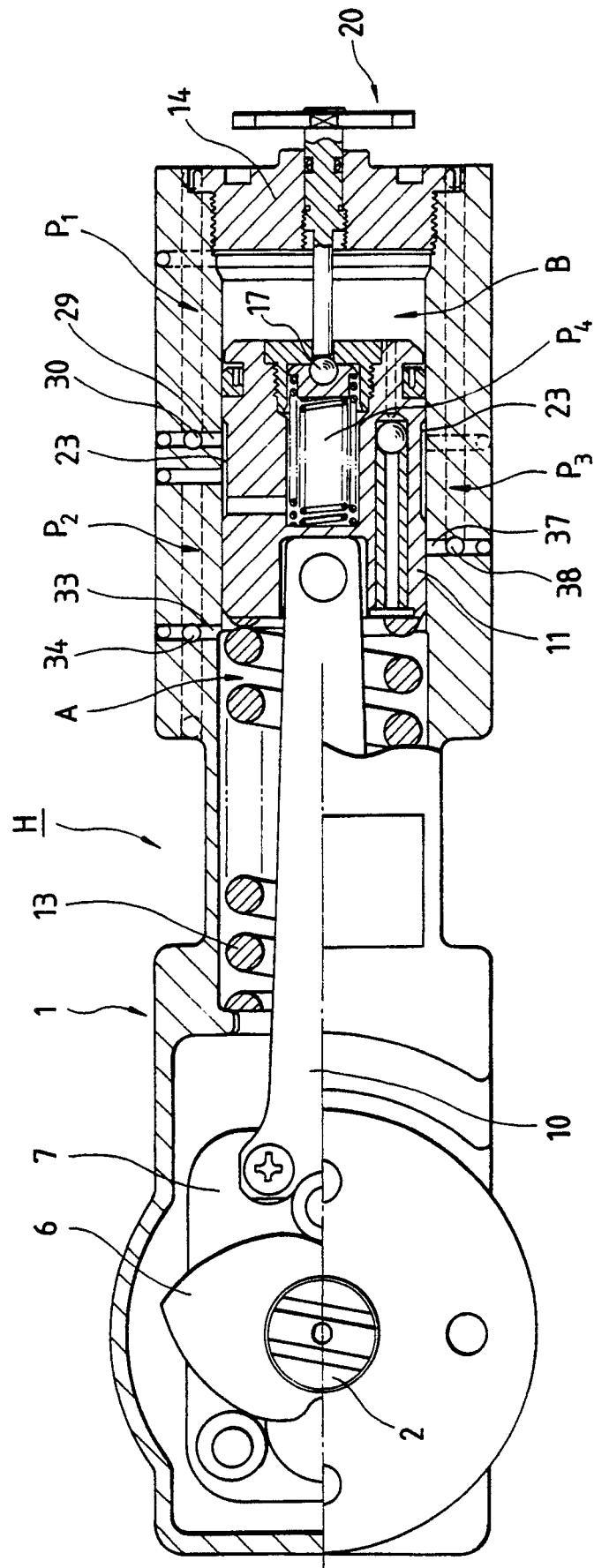
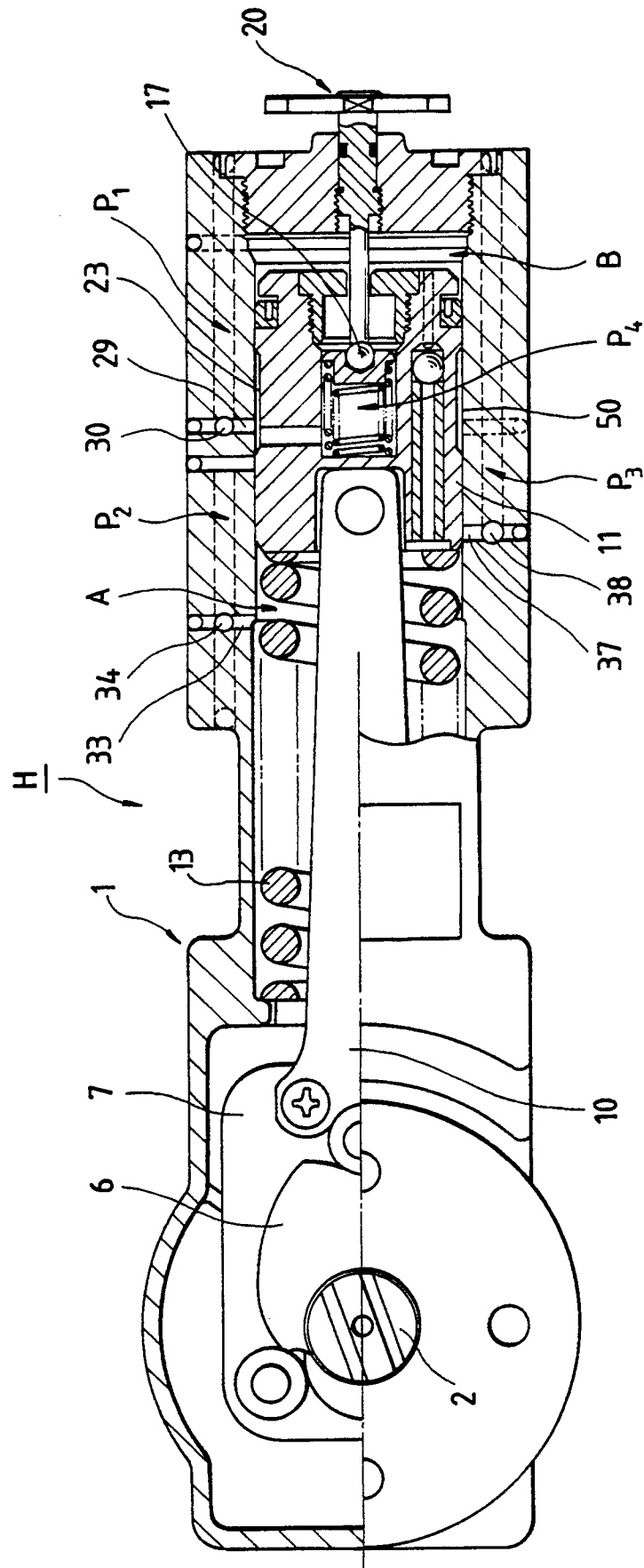


FIG. 8





European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 90 30 7271

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-U-8704569 (GRETSCH-UNITAS) * abstract * * page 6, line 1 - page 9, line 22 * * page 28, line 1 - page 35, line 1; figures 1, 2 * ---	1	E05F3/22 E05F3/10 E05F3/12
A	GB-A-672432 (BILLETER) * page 1, line 59 - page 2, line 5 * * page 2, lines 29 - 123; figures 1-5 * ---	1	
A	US-A-1965805 (RIGGINS) * page 1, lines 53 - 72 * * page 1, lines 92 - 94 * * page 2, lines 50 - 89 * * page 2, lines 106 - 110; figures 3, 8 * -----	1, 2, 3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E05F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 25 OCTOBER 1990	Examiner GUILLAUME G.E.P.
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