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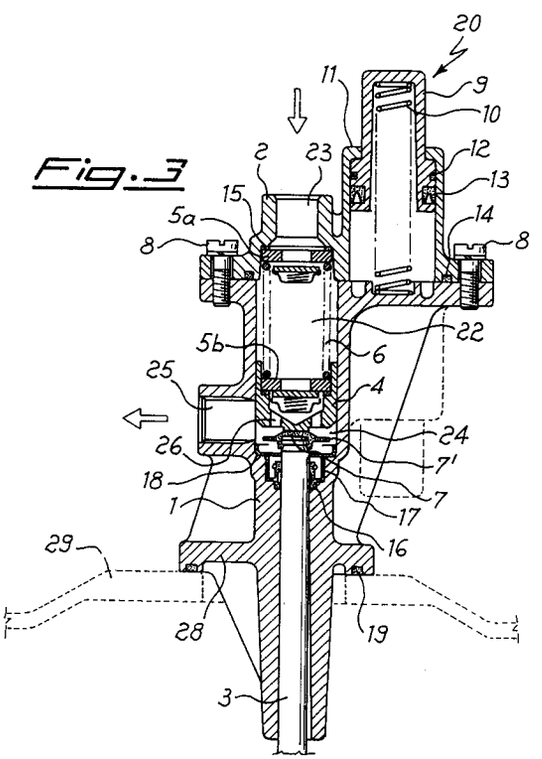
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(54) Piston pump for feeding gas oil to diesel engines.

(57) Piston pump for feeding gas oil to Diesel engines of motor-cars in general, comprising: (1) a pump casing provided with a control bar (3) provided with a damper (7) fixed at its end (3'); a cylinder subdivided into two chambers, an upper (22) and a lower (24) one; a piston (4) resting on said damper (7) and comprising at least two holes (26) for the transfer of fuel from said upper chamber (22) and said lower chamber (24); two fuel inlet (5a) and outlet (5b) valves; a pressure spring (6) acting on springs (5a) and (5b) and therefore on piston (4); a union (25) for the delivery of fuel to the engine; and means (7) for fastening said pump casing (1) to the engine (29).

Fig.3



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BACKGROUND

This invention relates to a piston pump for feeding gas oil to Diesel engines of motor-cars in general.

More particularly, this invention relates to a piston pump utilizable at a delivery pressure from 0,5 to 6 bars and capable of replacing both the present membrane pumps provided for low and middle-powered Diesel engines (up to about 13,000 cm3) and the present piston pumps installed on high-powered Diesel engines (over 13,000 cm3).

Current membrane pumps, utilizable for pressures from 0.5 to 1 bars, while having enjoyed a remarkable success in the past years both from the economic and the performance point of views, show at present several drawbacks and limits.

In fact, they are subject to a rather quick wear and have therefore a rather short life, which amounts, on the average, to about 2,000 hours of work.

A further drawback is due to the fact that the membrane of the pump is directly in touch with the engine oil, even though in some applications it has been tried to utilize a rubber protection gasket. Such direct touch with the engine oil may actually cause several breakdowns in the pump, with the ensuing stanstill of the machine. A typical case is the breaking of the membrane due to an excessive increase in the oil pressure in the sump. Another drawback is the loss of engine oil from the membrane breather, if the pump is provided with a gasket on the stem.

This drawback involves the pollution of the ground with engine oil and fuel. Lastly, the performances of the known pumps are less satisfactory at low temperatures (between -30 °C and -40 °C) and said pumps are not particularly suitable for new fuels such as Biodiesel and Arctic Diesel which would require special membranes, realized with suitable materials or material mixes.

The traditional piston pumps, utilizable for pressures up to about 6 bars, come from an old project of more than thirty years ago, and while being very reliable, they do not satisfy the present requirements, especially because of the high fabrication costs.

The object of this invention is to solve all of these drawbacks.

More particularly, the object of this invention is to provide a piston pump for feeding gas oil to Diesel engines, such as to allow to correct and overcome the limits of present pumps, independently on whether they are membrane or piston pumps.

According to this invention, these and still further objects which shall be made clear by the following description, are achieved through a piston pump for feeding gas oil to Diesel engines, comprising: a pump casing, containing the cylinder in which the piston slides, which provides for the external connections through a fuel outlet union, and in some cases also an inlet fuel union, and the seat for the priming hand pump; a pump lid which may or may not have the fuel intake union and the seat for the priming hand pump; a control bar which transforms the rotatory motion of the engine cam into a rectlinear motion, transmitting it to the piston in the pump casing cylinder; a piston which slides within the cylinder and which receives the motion from the control bar, being in thiw ways pushed upwards, and which comprises holes which allow fuel to pass in both directions; two fuel inlet and outlet valves which allow fuel to pass in one only direction; a pressure spring which pushes back the piston, once it is driven by the control bar, to the starting position; and a damper which serves to keep the control bar in its seat and to attenuate the contact between same and the piston.

The piston pump subject matter of this invention allows to achieve the following advantages:

1) compared to the present membrane pumps:
   - a longer life (on the average no less than 4,000 hours) as there are no moving parts made from rubber or similar products;
   - a greater strength, as the whole pump is one only integral moulded piece;
   - a greater tightness relatively to lubricating oils and fuels, and therefore a lower pollution;
   - capability of running at any work temperature, either high or low;
   - it is suitable for any type of motor-car gas oil, Biodiesel and Arctic Diesel included;
   - its overall dimensions are very compact, performances being the same, compared to present pumps;
   - it is realizable, according to needs, in the shape fittest for the introduction in the different engines, either existing or being developed;
   - it is adaptable without changes to the connections of the present membrane pumps.

2) relatively to the present piston pumps:
   - it has the same characteristics of functionality and duration;
   - tightness is improved: this invention has actually T a lower number of exposed connections and gaskets, as all of them are contained in a single pump casing;
   - lower fabrication costs, which allows a more general application.

The functional and construction characteristics of the piston pump subject matter of this invention shall be better explained by the following detailed description, wherein reference is made to the en-

closed drawings which are to be construed as preferred embodiments given by way of example and which do not limit this invention, wherein:

Fig. 1 shows a longitudinal section (according to a plane passing along the I-I line of Fig. 2) of an embodiment of the piston pump subject matter of this invention, without the hand primimg pump, with the valves aligned on the same axis, and shown during the gas oil intake and exhaust stages;

Fig. 2 shows a plan of Fig.1;

Fig. 3 shows a longitudinal section (along a plane passing along the X-X line of Fig. 5) of a second embodiment of the piston pump subject matter of this invention, provided with a priming hand pump inserted on the pump lid parallelly to the pump casing, with the valves aligned on the same axis, and shown during the gas oil intake and exhaust stages:

Fig. 4 shows the same view of the pump as Fig. 3, but shown during the gas oil compression and transfer stages;

Fig. 5 shows a plan of the pump of Fig. 3;

Fig. 6 shows a longitudinal section (according to a plane passing along the Y-Y line of Fig. 7) of a third embodiment of the piston pump subject matter of this invention, with the valves not aligned on the same axis and shown during the gas oil intake and exhaust stages; and

Fig. 7 shows a plan of the pump of Fig. 6, with a section of the priming hand pump inserted on the pump casing orthogonally to its axis.

With reference to Figs. 1 and 2, the pump subject matter of this invention, shown in a version without priming hand pump and in the stages of fuel end intake and exhaust, is essentially constituted by:

a) a pump casing (1) obtained in one single moulding, fixed to the engine (29) through a flange (28) by means of conventional fasteners (27) and comprising:

- a cylinder within which slides a piston (4) which subdivides said cylinder into two chambers, an upper (22) and a lower (24) one, and which is provided with at least two holes (26), which allow fuel to pass in both directions;
- a fuel outlet union (25);
- a control bar (3), sliding in said pump casing (1) and placed between the engine cam (not shown in the drawing) and said piston (4); said bar provides to the transformation of the rotatory motion of said cam into a rectilinear motion and to transmit the same either directly or indirectly (according to kwons techniques) to said piston;
- two valves, aligned on the same axis, for the gas oil inlet (5a) and outlet (5b), with spring and cotter;
- a pressure spring (6) which acts on said valves;
- a damper (7) with a protruding flange (7') from plastic material (preferably Nylon 6 or Rilsan), clipped on head (3') of said control bar (3);
- several gaskets from NBR or SBR rubber, and namely: a gasket (O-ring) (14) between pump casing (1) and lid (2); a gasket (19) between pump casing (1) and engine (29); two gaskets (15) for valves (5a, 5b); a gasket (O-ring) (16) and a lip-gasket (17) for control bar (3), protected by a lid (18).

b) a lid (2), fastened to said pump casing (1) by means of screws (8) and provided with a fuel inlet union (23);

When bar (3) is not in the thrust stage, piston (4) is driven downwards by pressure valve (6), causing an increase in the volume of chamber (2) comprised between the two valves (5a) and (5b) and leading at the same time to the opening of valve (5a) and the closing of valve (5b), with the ensuing intake of fuel from the tank through the inlet union (23).

On the contrary, when bar (3) is in the thrust stage, valve (5a) closes and at the same time valve (5b) opens, causing a reduction in the volume of said chamber (22), through holes (26) of piston (4). The fuel contained in said chamber (24) is therefore exhausted through the outlet union (25) during the already described following intake stage.

Damper (7), being made from plastic material, allows to obtain a noiseless contact between piston (4) and control bar (3).

Besides, being firmly fastened to said bar, it prevents same from coming out of its seat. Lastly, thanks to its special shape, it allows by exploiting the pressure exercised by fuel on flange (7') during the intake and exhaust stages, the prompt return of bar (3), ensuring in this way the ininterrupted and perfect adhesion between said bar and the engine cam.

With reference now to Figs. 3, 4 and 5, a first embodiment variant of the pump subject matter of this invention is shown.

Such variant provides for the presence of a priming hand pump (20), fastened to lid (2) parallelly to the control bar (3)/piston (4) system, and is shown both during the end intake and exhaust stages and during the compression or transfer stage.

Said priming pump (20) is an accessory utilized in the most various pumps, even though in some cases, as for the pump described above, it

may be omitted, as the engine is already provided with one such pump in other parts of the feeding plant.

It comprises a hand-piston (9), with a return spring (10), a lid (11) and an O-ring gasket (12) and a lip-kasket (13), also from NBR or SBR rubber which encure the tightness between said piston and said lid.

As is known, when piston (9) is hand-pushed from the outside (Figs. 4 and 5), the compressed fuel passes into the cylinder of the pump casing (1) through a hole (not shown in the drawings), causing the opening of valve (5b) and the closing of valve (5a), and obtaining in this way the delivery to the engine.

The other construction details of this pump embodiment variant are the same as indicated in the preceding description.

With reference, lastly, to Figs. 6 and 7, a further embodiment variant of the pump subject matter of this invention is shown.

Such variant is different from the preceding one in that the two inlet (5a) and outlet (5b) valves are not arranged on the same axis, but on axes that are parallel to one another, and in that the priming hand pump (20) is inserted on the pump casing, orthogonally to the control bar(3)/piston (4) system. In this type of solution, the pump can be much shorter than the pumps of the solutions described above, while keeping the same performances, and allow the interchangeability with the piston versions known to prior art, but with a greater adaptability to the sizes of the engine pieces.

Among other things, it can be mounted always vertically but upsidedown.

Obviously, other variants and construction changes may be introduced by those expert in the art in the aforementioned illustrated embodiments of the piston pump according to this invention, without exceeding the protection scope of said invention, as defined by the following claims.

Claims

1. Piston pump for feeding gas oil to Diesel engines of motor-cars in general, characterized in that it comprises:
   a) a pump casing (1) comprising a control bar (3) with a damper (7) fastened at its end (3'); a cylinder subdivided into two chambers, an upper (22) and a lower (24) one; a piston (4) which rests on said damper (7) and is provided with at least two holes (26) for the transfer of the fuel from said upper chamber (22) and said lower chamber (3); two fuel inlet (5a) and outlet (5b) valves; a pressure spring (6) acting on said springs (5a) and (5b) and therefore on piston (4); an outlet union (25) for the delivery of fuel to the engine; means (27) for fastening said pump casing (1) to the engine (29);
   b) a pump lid (2) comprising means (8) for fastening same to the pump casing (1).

2. Piston pump according to claim 1, characterized in that said valves (5a) and (5b) are arranged on the same axis.

3. Piston pump according to claim 1 or 2, characterized in that it comprises a fuel intake union inserted on said lid (2).

4. Piston pump according to any of the above claims, characterized in that it comprises a priming hand pump (20) inserted on said lid (24) parallelly to the control bar (3)/piston (4) system.

5. Piston pump according to claim 1, characterized in that said valves (5a) and (5b) are arranged on different axes, parallel to one another.

6. Piston pump according to claim 5, characterized in that it comprises a fuel inlet union (23) inserted on said pump casing (1).

7. Piston pump according to claims 5 or 6, characterized in that it comprises a priming hand pump (20) inserted on said pump casing (1) orthogonally to the control bar (3)/piston (4) system.

8. Piston pump according to any of the above claims, characterized in that damper (7) is provided with a radial flange (7').

9. Piston pump according to any of the above claims, characterized in that damper (7) is made from plastic material.

Fig.1

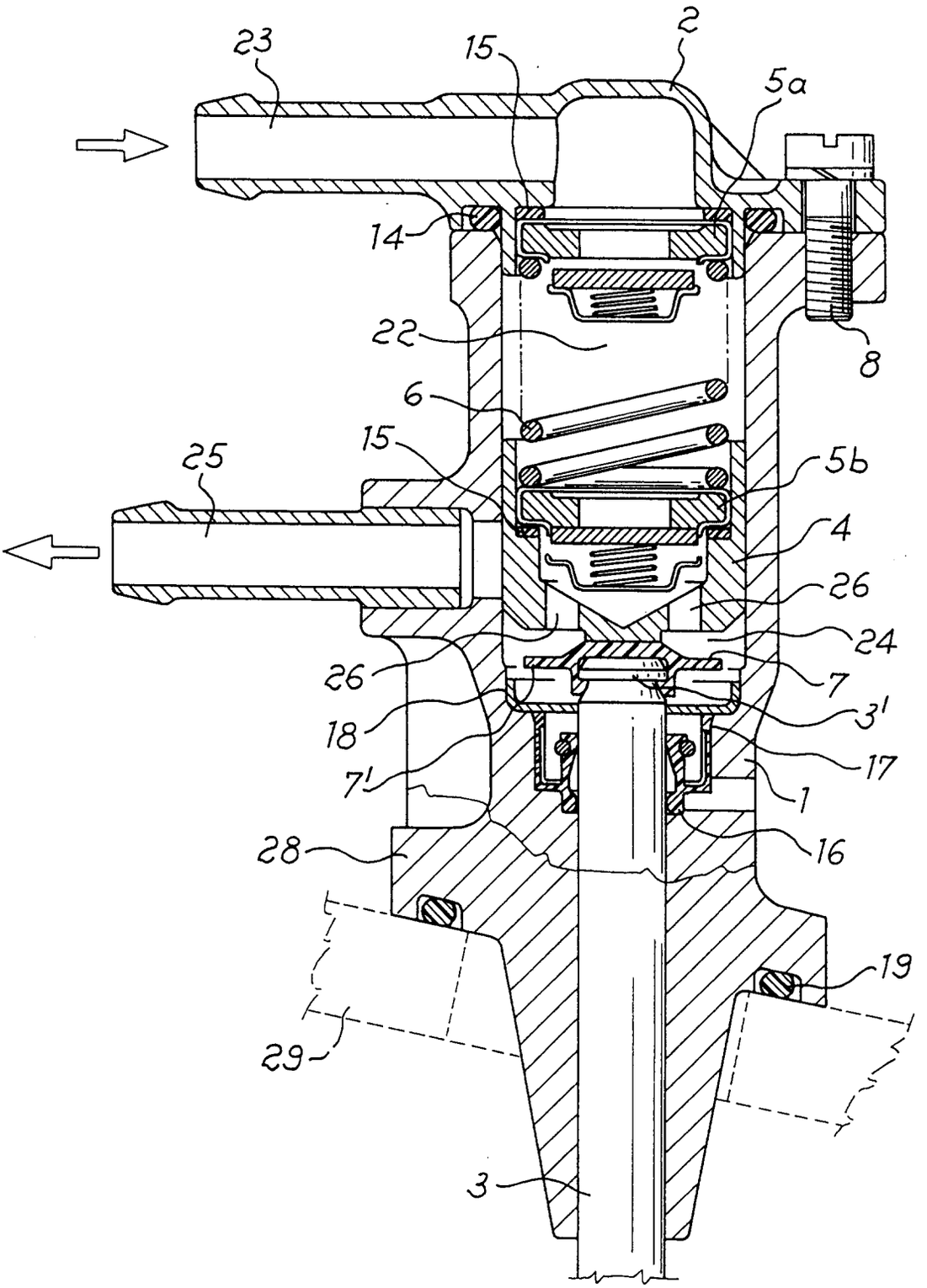


Fig.2

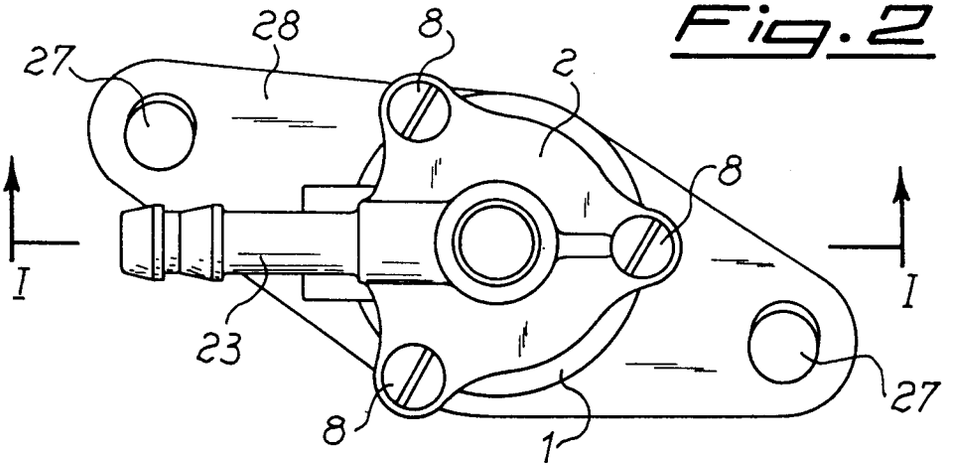

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Fig.3

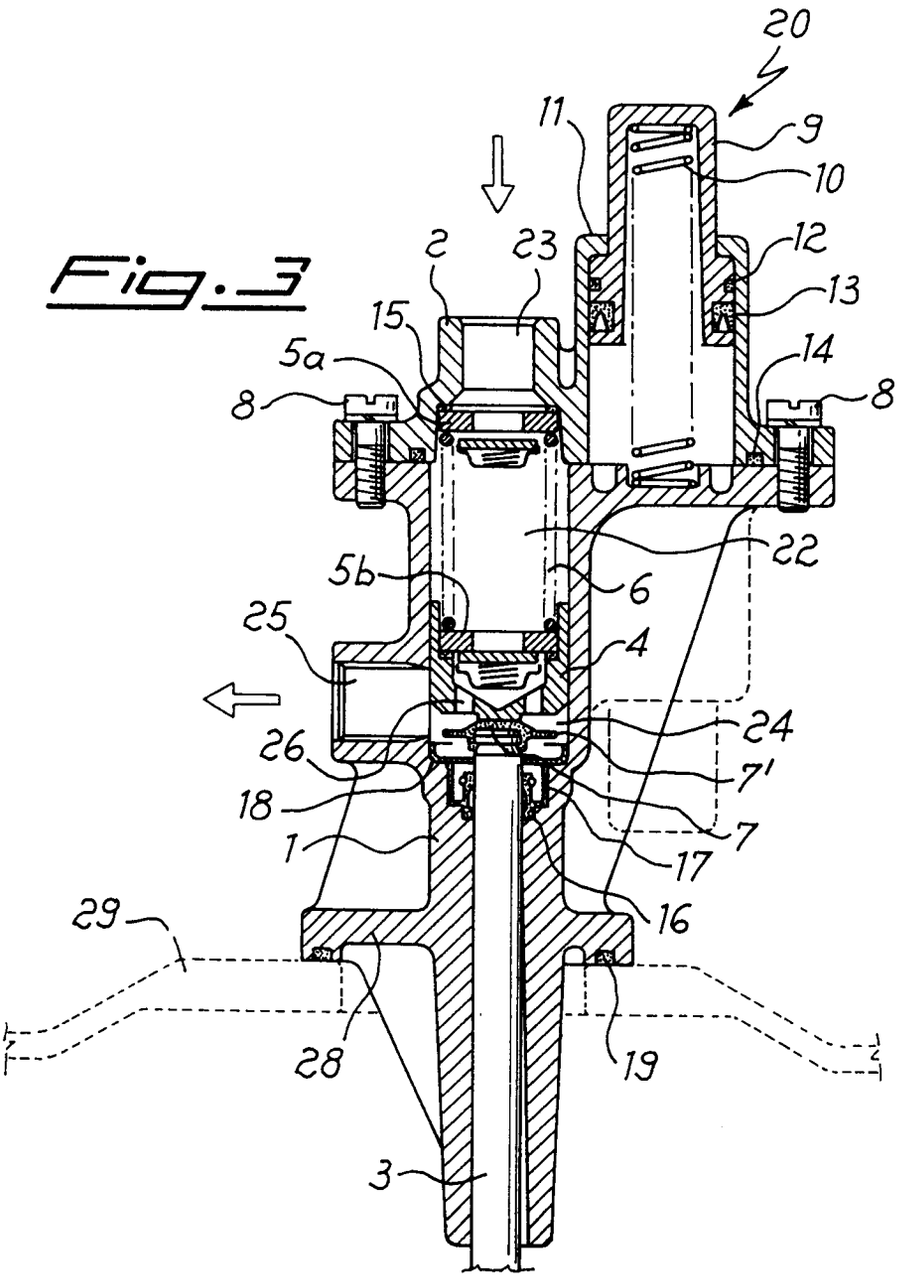
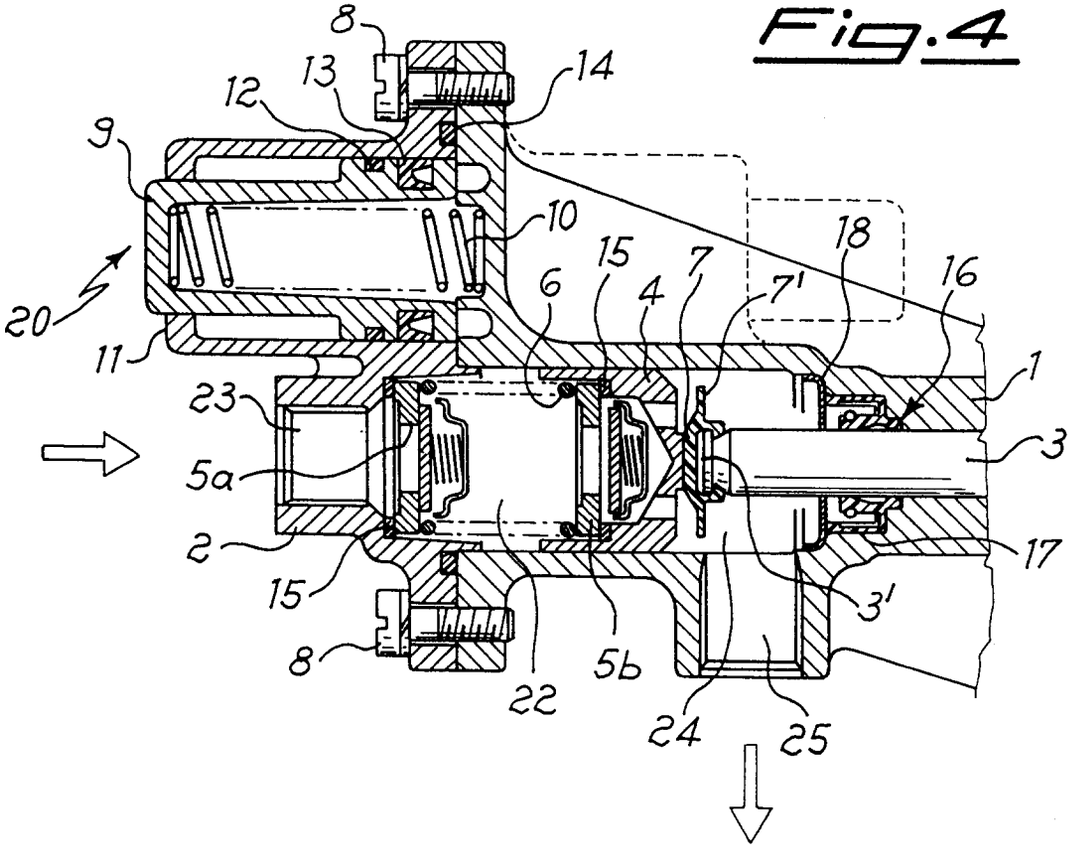

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5a
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22
5b
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24
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7'
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Fig.4


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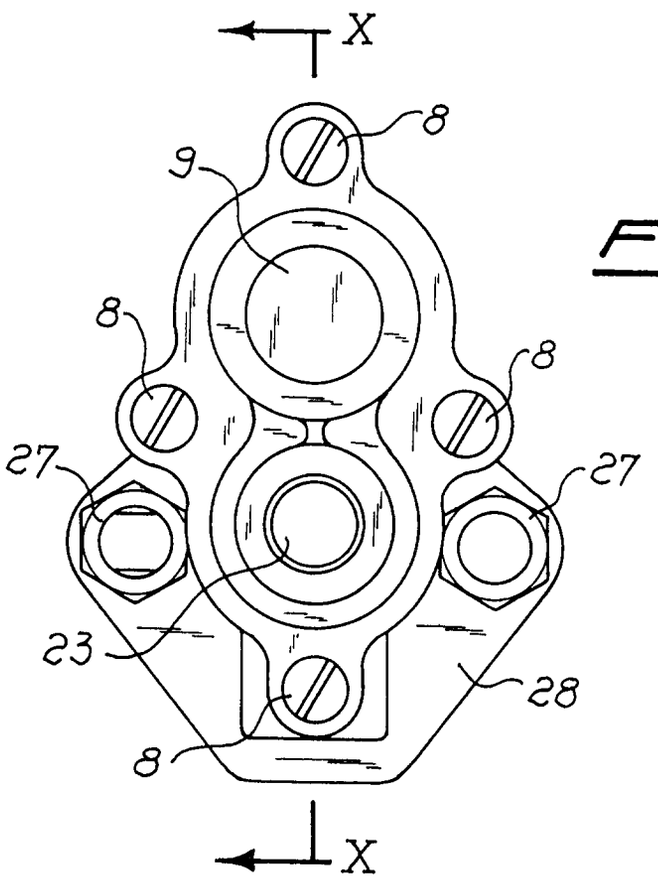

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Fig.5

Fig. 7

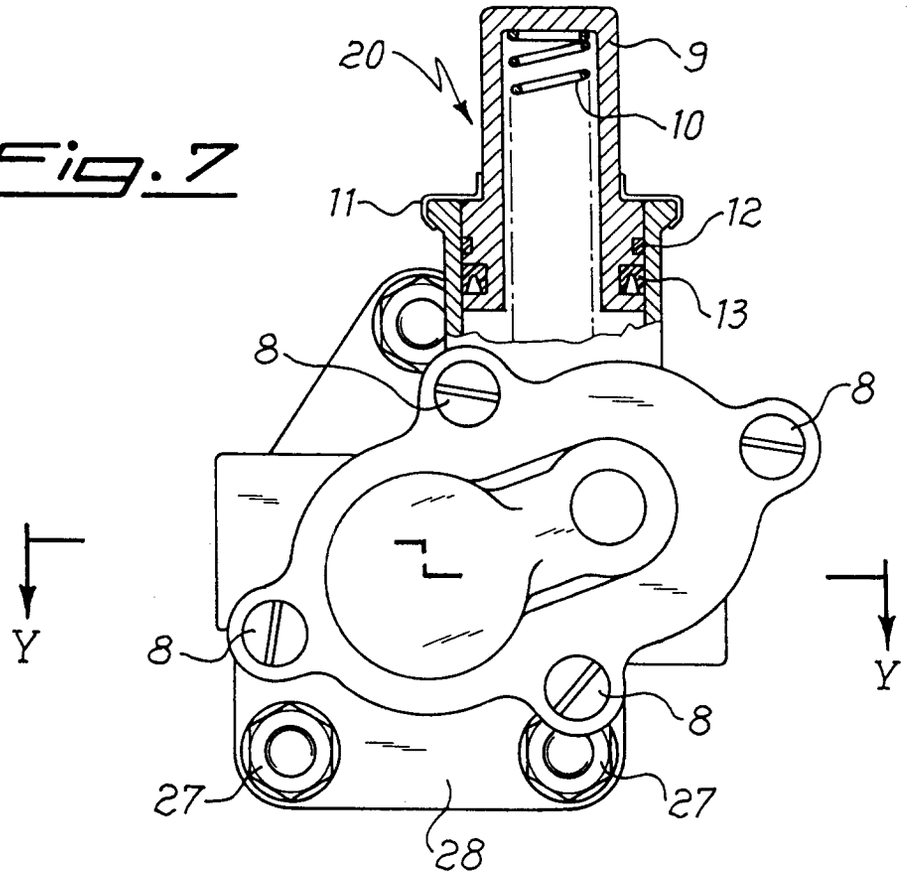
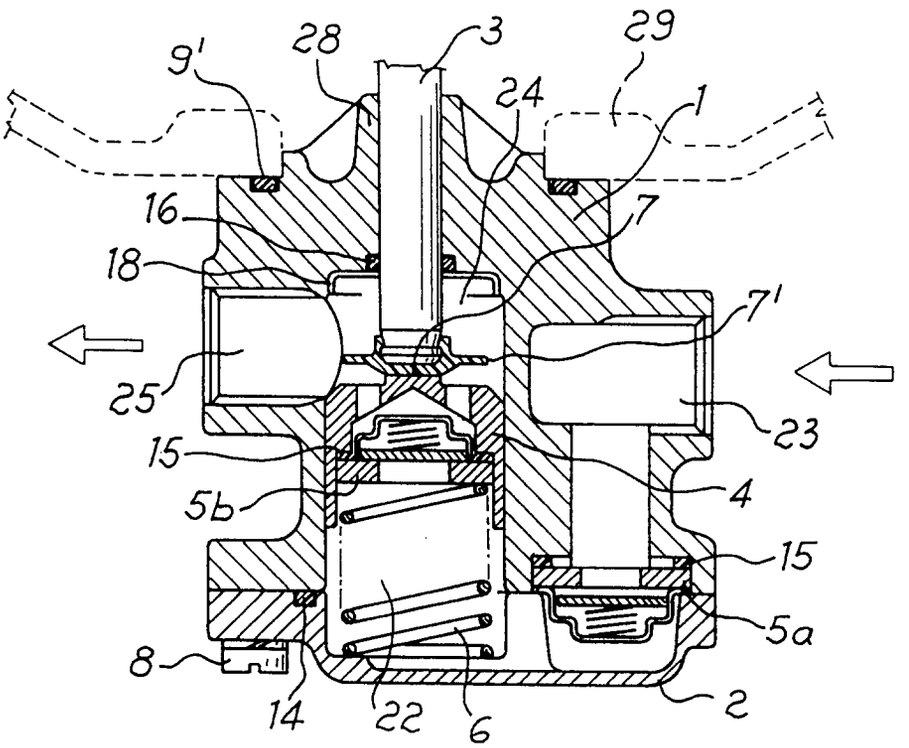

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Fig. 6


9'
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16
7
18
7'
25
23
15
4
5b
15
5a
8
14
22
6
2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 10 4394

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)
X	EP-A-0 027 717 (CATERPILLAR TRACTOR CO.) * page 6, line 18 - page 8, line 16; figure 2 *	1-3	F02M37/06
X Y	US-A-2 185 145 (H.C. EDWARDS) * page 1, right column, line 4 - page 2, right column, line 22; figures 1,4-6 *	1,5,6 7	
Y	US-A-2 290 829 (H.C.EDWARDS) * page 3, left column, line 29 - line 33; figures *	7	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			F02M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	31 May 1994	Alconchel y Ungria,J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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