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NL-2280 GE Rijswijk(NL)(54) **Device for delivering at least two fluid media in a predetermined volume ratio.**

(57) Device for delivering several fluid media in a certain volume ratio with metering cylinders, a movable piston in each of them, which pistons are interconnected. There is a two-way switch valve with a control mechanism, depending on the piston position. Each switch valve has a pressure medium inlet, a medium outlet and two overflow channels, each connected to the cylinder part volume. Due to the fact that the pistons are also connected to an energy storage device which is charged during the stroke of the pistons and has sufficient capacity to supply the energy needed to switch over the switch valves, the device is entirely independent of any external energy source for its functioning.

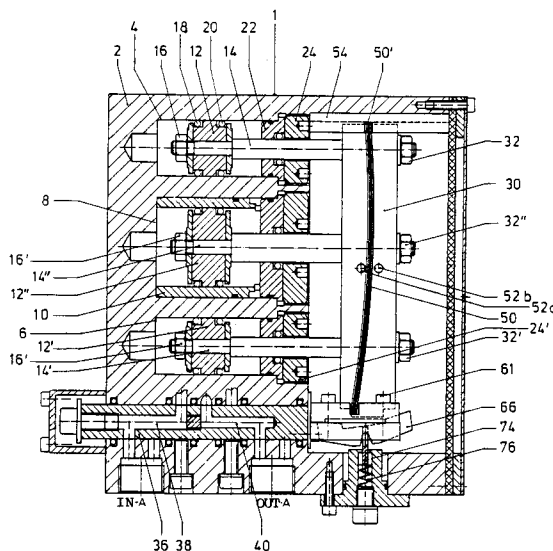


FIG. 1

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The invention relates to a device of the type described in the preamble of the main claim.

Such a device is known per se from French Patent Specification 1,595,934. In the case of this known device the predetermined volume ratio is determined by the ratios between the effective piston surfaces. The pistons are driven in a reciprocating motion by the pressure of the actual medium to be delivered, the medium present in front of each piston always being expelled, while medium flows in behind the piston. The outflowing media are mixed.

In this known device the element connecting the pistons in each of its two end positions operates a switching mechanism, which in turn controls the drive mechanism of the two-way switching valve, formed by a control cylinder in the embodiment described. If adequate energy sources are available (electrical energy, pneumatic energy or hydraulic energy), this is easy to carry out, but the situation is different when the device is to be used in situations in which laying energy lines to the device is difficult. Such circumstances occur, for example, if the device is to be used outdoors or on building sites, where the presence of energy supply lines in any form in addition to the pipes already required to supply the medium can be a great nuisance.

The object of the invention is to eliminate this disadvantage. According to the invention this object is achieved through the pistons also being connected to an energy storage device which is charged during the stroke of the pistons and has sufficient capacity to supply the energy needed to switch over the switch valves.

With such an energy storage device, the device has become totally independent of any external pressure, so that its potential applications are greatly increased, since no energy supply line at all is now needed.

Any suitable embodiment can be used as the energy storage device, for example embodiments with compressible gaseous or solid media. However, the energy storage device is preferably formed by at least one spring which is connected to the pistons and tensioned during their movement. In a preferred embodiment of the invention this spring is a leaf spring.

A preferred embodiment of the invention is described in claim 4, and in this embodiment the spring system, which can be pre-tensioned in two mutually opposed directions, can comprise two coil springs lying in line with each other. However, an embodiment of the type described in claim 5 is preferred.

A preferred embodiment of the control and switching mechanism of the switch valve is the subject of claim 6, and this embodiment is prefer-

ably designed in the way described in claims 7 and 8.

Finally, a particularly compact, and thus convenient, embodiment of the invention is designed in the way described in claim 9. This is particularly suitable for mobile applications.

Examples of energy storage devices which can be used are mentioned in claims 10 - 13..

The invention is explained with reference to the drawing, in which:

Figure 1 is a longitudinal section through an embodiment of the invention;

Figure 2 shows schematically the arrangement of the cylinder bores and switch valve bores;

Figure 3 shows schematically the arrangement of the inlet and outlet ports therein;

Figure 4 is a perspective view of the mechanism used in this embodiment for switching the switch valves;

Figure 5 is a schematic view to illustrate the way in which the switch valves work.

Figure 6 shows a modification of the embodiment according to figure 1.

The embodiment of the delivery device shown in Figure 1, indicated in its entirety by reference number 1, comprises a narrow prismatic housing 2 in which a number of cylinder bores are formed, a cylinder bore 4, a second cylinder bore 6 with the same internal diameter as the bore 4, and a third cylinder bore 8 containing an exchangeable cylinder barrel 10 determining a third bore. The embodiment shown is intended for the delivery of two fluid media, to be described below as component A and component B, in a ratio exactly equal to 1:1. For this, the cylinder bores 4 and 6 are connected in parallel, and are used for metering and delivering component A, while the cylinder bore 8 is used for delivering component B, the sum of the effective piston surfaces in the two bores 4 and 6 being equal to the effective piston surface in the bore 8. Of course, corresponding, different effective surfaces are selected for other ratios. This principle and this mode of operation are known per se from FR-A-1,595,934.

A piston with a predetermined cross-section area is thus provided in each cylinder bore. For cylinder bore 4 this is piston 12, fixed on the piston rod 14 by means of the end nut 16, and sealed relative to the cylinder bore 4 by means of the seals 18 and 20. The piston rod 14 is guided through the cylinder head 22, held by the cylinder nut 24.

The piston/piston rod system accommodated in the cylinder bore 6 is indicated by the same reference numerals as those used above, provided with an apostrophe, and thus comprises elements 12'...24'. A piston/piston rod system with the appropriate seals is accommodated in a corresponding

way in the cylinder bore 8, and thus fits inside the cylinder barrel 10; it is indicated with corresponding reference numbers provided with a quotation mark, thus 12"...24".

The three piston rods 14, 14', 14'' are fixed to a common yoke 30 and are fixed with nuts 32, 32', 32''.

The two switch valves, one for component A and the other for component B, whose mode of operation is known per se from FR-A-1,595,934, are formed by two bores 34, 34' formed in the housing below the cylinder bores. A valve plunger 36, 36' is guided in each of them, and each plunger contains two overflow channels 38, 40 and 38', 40' respectively (see also figure 4). Each overflow channel is connected to two transverse channels which interact with inlet and outlet ports formed in the housing and with channels formed in the housing and leading to the cylinder bores, the channels interacting with the inlet and outlet ports IN A, IN B and OUT A, OUT B respectively being indicated by 38a, 38a', 40a, 40a', and those with the channels formed in the housing being indicated by 38b, 38b', 40b and 40b'. The way in which the switch valves work will be explained below with reference to figure 5, although for the person skilled in the art they will be clear without further explanation.

The invention is based on the realisation that great advantages are obtained over the prior art (FR-A-1,595,934) if the control mechanism for the two switch valves 36, 36' is not driven by a mechanism dependent on an external energy source, but by an energy storage device which is connected to the pistons, is charged during each stroke thereof, and has sufficient capacity to supply the energy needed for switching over the plungers. In the specific embodiment illustrated, this energy storage device is formed by two leaf spring assemblies, placed on either side of the yoke 30, and one of which can be seen in figure 1, indicated there by reference number 50. Each leaf spring assembly is surrounded by two catch pins projecting from the yoke 30, in figure 1 indicated by 52a, 52b for the assembly 50. The top end (50') of each leaf spring assembly is accommodated in a spring holder fixed in the housing 2, for assembly 50 indicated by 54. The bottom end (50'') of each leaf spring assembly rests in a groove formed in a movable spring holder 56, 56' - see figure 4, in which the respective grooves are indicated by 58, 58'. The spring holders 56, 56' are interconnected by means of the switch plate 60, and said switch plate has locking edges 62a, 62b which interact with blocking edges 64a, 64b formed on a switch cam 66 disposed below the switch plate 60. Connecting to each of these blocking edges 64a, 64b is an upward slanting run-on face 68a, 68b, and each of such faces interacts with a control cam 70a, 70b

formed at the bottom end of the yoke 30. Finally, the switch cam 66 is provided at the underside with a transverse groove 72, containing a hinge plate 74 which supports the cam and is under the influence of the compression spring 76. The spring holders 56, 56' are connected by means of the screws 61 to the two valve plungers 36, 36'.

This switching mechanism works as follows:

When the yoke 30, starting from the position shown in figure 1, moves to the right under the influence of medium under pressure present to the left of the pistons 12, 12', 12'', the components of the control mechanism of the plungers 36, 36' are in the position shown in figure 1: the switch cam 66 is tilted anti-clockwise, the switch plate 60 lies with the edge 62b thereof against the blocking edge 64b of the switch cam 66, and the two plungers 36, 36' are in their furthest left position. They cannot move to the right now because such a movement is prevented through the fact that the locking edge 62b of the switch plate 60 is lying against the blocking edge 64b. The yoke 30, however, does move to the right; the pin 52b comes to rest against the spring assembly 50 and pre-tensions it. When the pistons 12, 12' and 12'' with the yoke 30 have almost reached their furthest right position, the cam 70b runs against the run-on face 68b of the switch cam 66 and presses this face down, with the result that the blocking edge 64b comes away from the locking edge 62b of the switch plate 60, and the switch plate 60 with the spring holders 56, 56' and the plungers 36, 36' connected thereto is pressed to the right by the bottom ends of the spring assemblies engaging in the recesses 58, 58'. This also takes the plungers 36, 36' into their furthest right end position, and the medium under pressure will now be admitted behind the right end faces of the piston 12, 12', 12''. In the meantime the locking edge 62a has come to lie against the blocking edge 64a of the switch cam 66, so that when the direction of movement of the yoke 30 reverses and the pistons start to drive the yoke from right to left the switch plate 60 with all components connected thereto cannot move to the left with them; this movement is not released until the yoke has almost reached its furthest left end position. A movement in the opposite direction is then started again. The speed at which the pistons move to and fro, and thus also the medium flow rate, depends on the pressure and viscosity of the medium at a given spring force.

The way in which the switch valves operate will be no problem at all for the person skilled in the art, but it will be explained briefly below with reference to figure 5. This relates to the way in which the switch valve plunger 36 operates, this being, of course, identical to the way in which the switch valve plunger 36' operates. The transverse channel

38a interacts with the inlet for medium A, indicated by IN A, while the transverse channel 40a interacts with the outlet for medium A, indicated by OUT A. The transverse channel 38b interacts with two adjacent bores 80a, 80b formed in the housing, while the transverse channel 40b interacts with two adjacent bores 82a, 82b formed in the housing. The bores 80a and 82b are interconnected by means of a channel 84, while the bore 80b is connected by means of a channel 86 to the bore 82a. The channels 80a and 82b are connected to the space 90 to the left of the piston 12' by means of a channel 88 formed in the housing, while the bores 80b and 82a are connected by means of a channel 92 to the space 94 to the right of the piston 12'.

In the furthest left position of the plunger 36 as shown, the inlet IN A is connected to the space 90 left of the piston 12', and the space 94 right of said piston is connected by means of the channels 92, 82a, 40b and 40a to OUT A. The piston 12' moves to the right, and the medium present to the right of the piston 94 flows out of the outlet OUT A. When the plunger 36 is moved to the right at the end of the stroke of piston 12', the medium inlet IN A is connected by means of the channels 38, 38b, 80b, 86 and 92 to the now virtually empty space 94 to the right of the piston 12', while the space 90 to the left of said piston is completely filled with medium. This space 90 is now connected by means of the channels 88, 84, 82b, 40b, 40 and 40a to OUT A, so that when there is a piston stroke to the left the medium is driven out of the space 90 to the left of the piston 12' and flows out of OUT A.

In this way an uninterrupted flow of medium to the outlet OUT A is obtained.

Of course, the plunger 36' controlling the flow of medium B operates in a way corresponding to that described above.

Figure 6 shows a modification of the above described embodiment. In figure 6 elements corresponding with the ones already described before are not provided with reference numerals; only the new elements are indicated with reference numerals.

In this embodiment the three respective piston rods 14, 14', 14'' are not interconnected by means of the yoke 30 but only piston rod 14' is connected to this yoke which, as in the already described embodiment carries the two pins 52a, 52b which couple the yoke to the leaf spring assembly 50. The piston rods 14, 14' each pass freely through the yoke 30. Each piston rod is at its free end connected to a U-shaped extension 100, 100', 100'' and the free ends of each extensions carries between them a cylindrical pivot pin 102, 102', 102''. Furthermore there are two levers, 104, 104' which pivot together, with the end of the extension 100'', around the pivot pin 102''. Each lever is provided

with a longitudinal slot 106, 106'. Each of these slots accommodates a fixed pivot pin 108, 108' respectively which protrudes from a sliding block 110, 110' respectively. Each block slides in a guide way provided in a fixed guide block 112. The slots 106, 106' also accommodate the pivot pins 102, 102' at the ends of the extensions 100, 100' respectively.

The blocks 110, 110' are provided with internal screwthread, block 110 with right hand screwthread and block 110' with left hand screw thread into which is screwed the screw spindle 114 with a right hand screw part 114a and the left hand screw part 114b. The spindle can be turned by means of the knob 116. It will be seen that the stroke of the central piston rod 14'', connected to the yoke 30, it always be the same but that the stroke of the two other piston rods, 14 and 14' respectively depends upon the adjustable - distance between the pivot pins 108 and 108' respectively, around which the levers 104, 104' pivot, and the central pivot point 102'. The longer the distance between the pivot port 108, 108' respectively on the one hand, and the central pivot port 102'' on the other hand, the greater will be the stroke of the outer piston rods 14, 14' at a given stroke of the central pivot point.

With the above mentioned measures the volume ratio not only depends upon the surface of the respective pistons but can also be adjusted at will within a certain range in dependence upon the position of the pivots 108, 108'.

Many modifications are possible within the scope of the invention. For example, instead of three piston-cylinder combinations in which the respective bores of two of them are interconnected, it is also possible to use two cylinder-piston combinations, one for each medium, while it is also possible to deliver three different media in a certain mutual volume ratio in the manner described in FR-A-1,595,934.

Although the drawing shows a simple design with a leaf spring assembly, it is also possible to replace this leaf spring assembly by two coil springs or Belleville spring assemblies, possibly lying in line with each other, which can be pre-tensioned in opposite directions.

The device according to the invention is excellent for delivering raw materials in a predetermined volume ratio which is necessary for forming polyurethane foam, and can be used on building and construction sites.

Claims

1. Device for delivering at least two fluid media in a predetermined volume ratio, comprising a number of metering cylinders (4, 6, 8), each containing a reciprocating piston (12, 12', 12''),

in which the respective cylinders are interconnected and each cylinder is combined with a two-way switch valve (36, 36') which is controlled by a control mechanism depending on the piston position, in such a way that in a first piston end position the corresponding switch valve takes up a first position, and in a second piston end position takes up a second position, and in which each switch valve is provided with a medium inlet to be connected to a source of medium under pressure, a medium outlet connected to a medium discharge, and two overflow channels (88, 92), each connected to one of the two cylinder part volumes (90, 94) determined therein by the piston (12') of the corresponding metering cylinder (10), in such a way that in the first position of the switch valve the first cylinder part volume is connected to the medium inlet, and the second to the medium discharge, and in the second position of the switch valve the first cylinder part volume is connected to the medium discharge, while the second cylinder part volume is connected to the medium inlet, **characterised in that** the pistons are also connected to an energy storage device which is charged during the stroke of the pistons and has sufficient capacity to supply the energy required for switching over the switch valves.

2. Device according to claim 1, **characterised in that** the energy storage device is formed by at least one spring which is connected to the pistons and tensioned during their movement.
3. Device according to claim 2, **characterised in that** the spring is a leaf spring (50).
4. Device according to claim 3, **characterised in that** the parallel piston rods (14, 14', 14'') of the respective pistons (12, 12', 12'') are connected to a common yoke (30) which moves to and fro with said piston rods and is also connected to a spring system which is pre-tensioned in two mutually opposite directions during the movement thereof and acts in both directions on a control element of a switch valve, which control element during the stroke of the yoke in a certain direction until it reaches an end position is locked so that it cannot be taken along by the spring system, and is released thereafter.
5. Device according to claim 4, **characterised in that** the spring (50) is a leaf spring fixed at one end (50') and lying next to the yoke (30), and is connected to the yoke by two drivers (52a, 52b) projecting from the yoke and en-

closing the spring, while the other end (50'') of the spring moving to and fro in the direction of movement of the yoke engages in a recess in the control element (56) of the switch valve, which is movable to and fro in the same direction.

6. Device according to claim 5, **characterised in that** a switch plate (60) lying at right angles to the yoke projects from the control element (56), the two end edges (62a, 62b) of which switch plate interact with two locking edges (64a, 64b), lying at a distance from each other, of a switch cam (66) disposed so that it can tilt below the switch plate, with two run-on faces (68a, 68b) which connect to the locking edges, each interacting with a control cam (70a, 70b) formed on the yoke.
7. Device according to claim 6, **characterised by** two adjacent switch valves (36, 36'), the respective control elements (56, 56') of which are interconnected by the switch plate (60), and which control elements each take one end of one of two leaf springs lying at each side of the yoke and connected thereto.
8. Device according to claim 7, **characterised in that** each of the leaf springs is combined with at least one other to a spring assembly.
9. Device according to claim 8, **characterised by** a narrow prismatic housing (2) in which three bores (4, 8, 6) lying one below the other are formed, each determining a metering cylinder and each accommodating a piston (12, 12', 12'') of which the respective piston rods (14, 14', 14''), sealingly guided in the housing, are connected to the yoke (30), while near one of the end edges of the housing two adjacent bores (34, 34') are formed, with medium channels opening out into them, which bores each accommodate a switch valve plunger (36, 36') which is provided with internal channels, and of which the end projecting from the housing is connected to the valve control element (56, 56').
10. Device according to claim 1, **characterised in that** the energy storage device is formed by a hydraulic accumulator.
11. Device according to claim 1, **characterised in that** the energy storage device is formed by an electrical accumulator.
12. Device according to claim 1, **characterised in that** the energy storage device is formed by a

combination of two permanent magnets which are movable relative to each other, while the energy is stored in the magnetic field existing between them.

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13. Device according to claim 1, **characterised in that** the energy storage device is formed by a flywheel.

14. Device according to claims 1-13, **characterised in that** each piston rod (14, 14', 14'') carries at its free end a pivot pin (102, 102', 102'') also accommodate the respective ends of two leavers (104, 104'), which are directed away from each other and are each provided with a longitudinal slot (106, 106') in which fits a pivot pin (108, 108') having an adjustable distance to the central pivot pin (102'').

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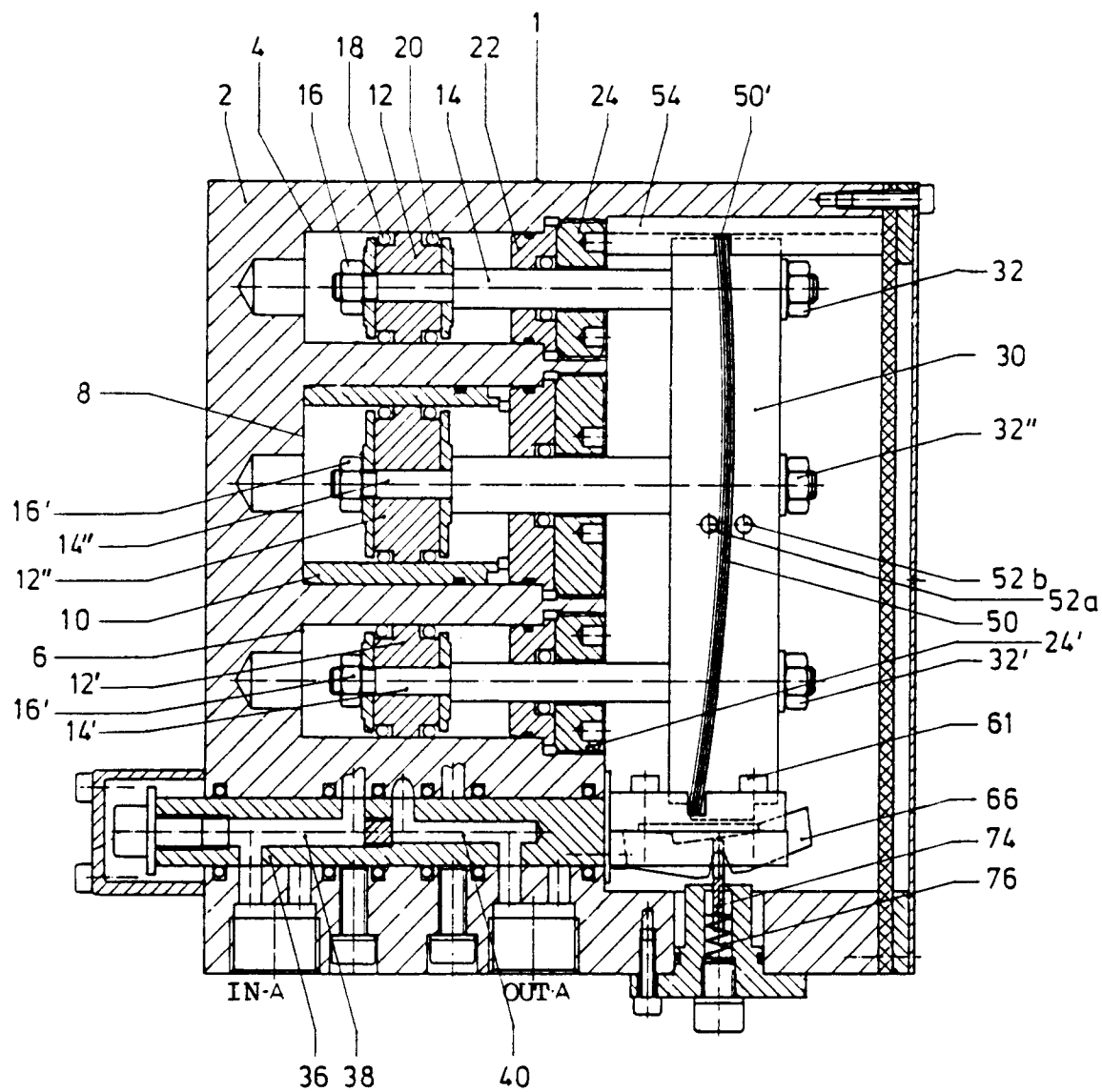


FIG. 1

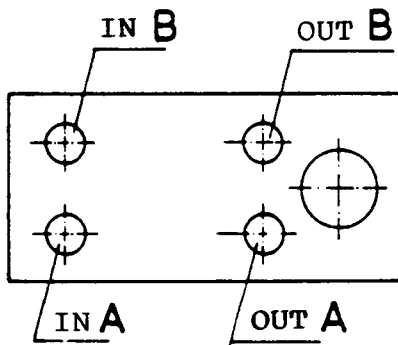


FIG. 3

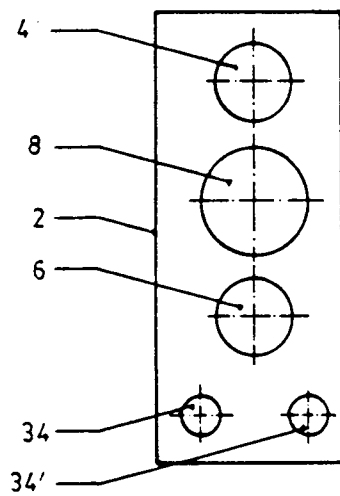


FIG. 2

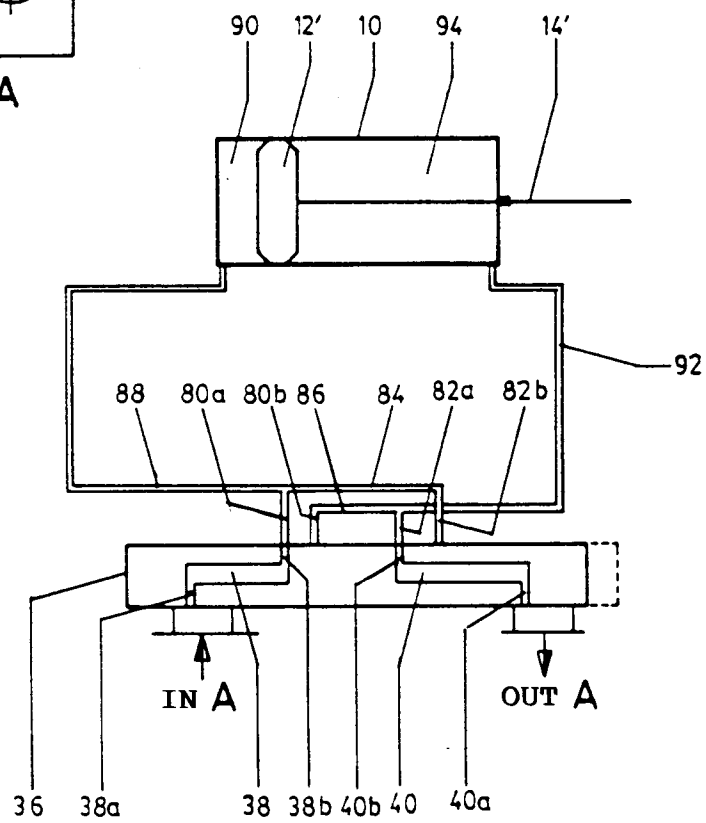


FIG. 5

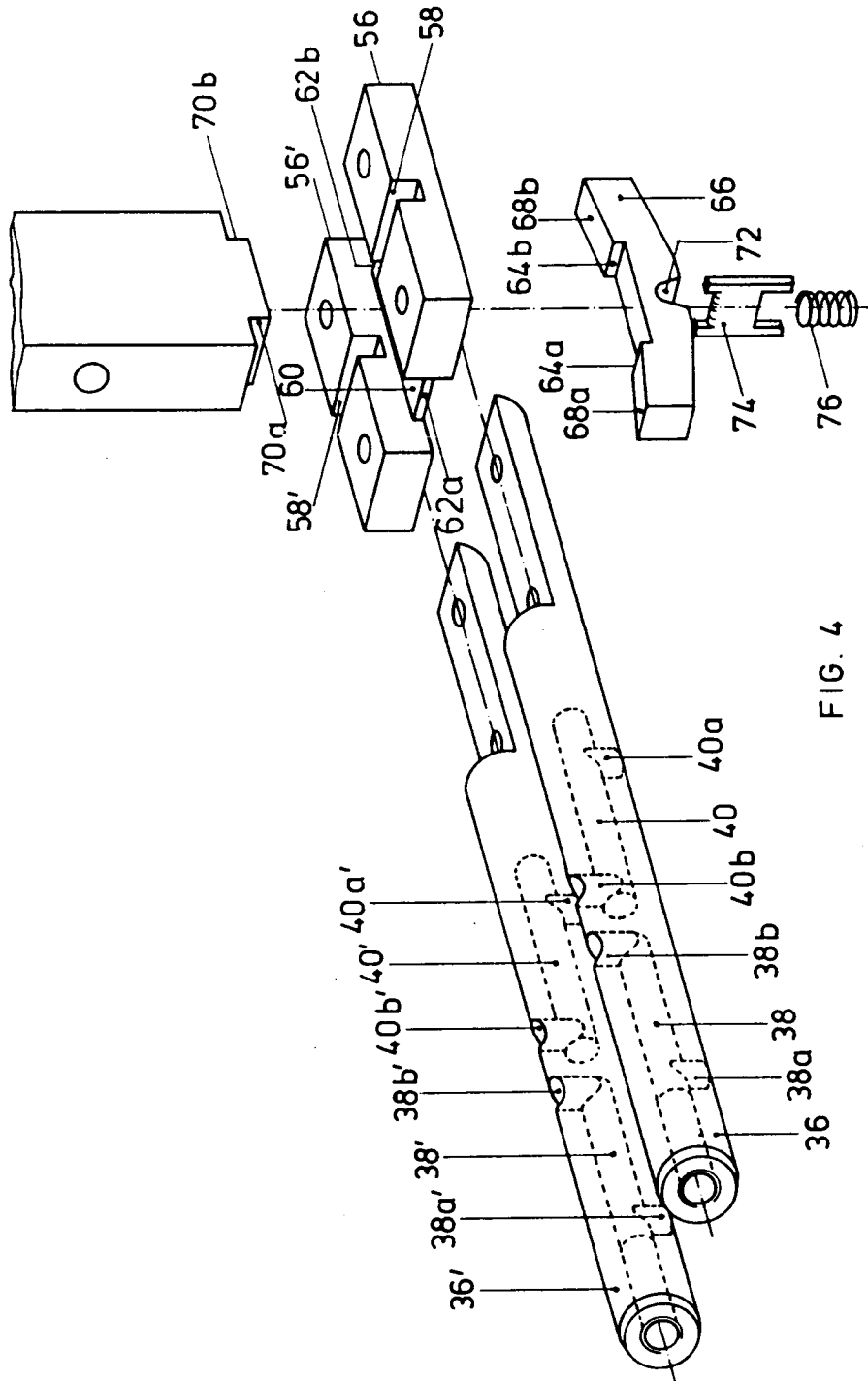
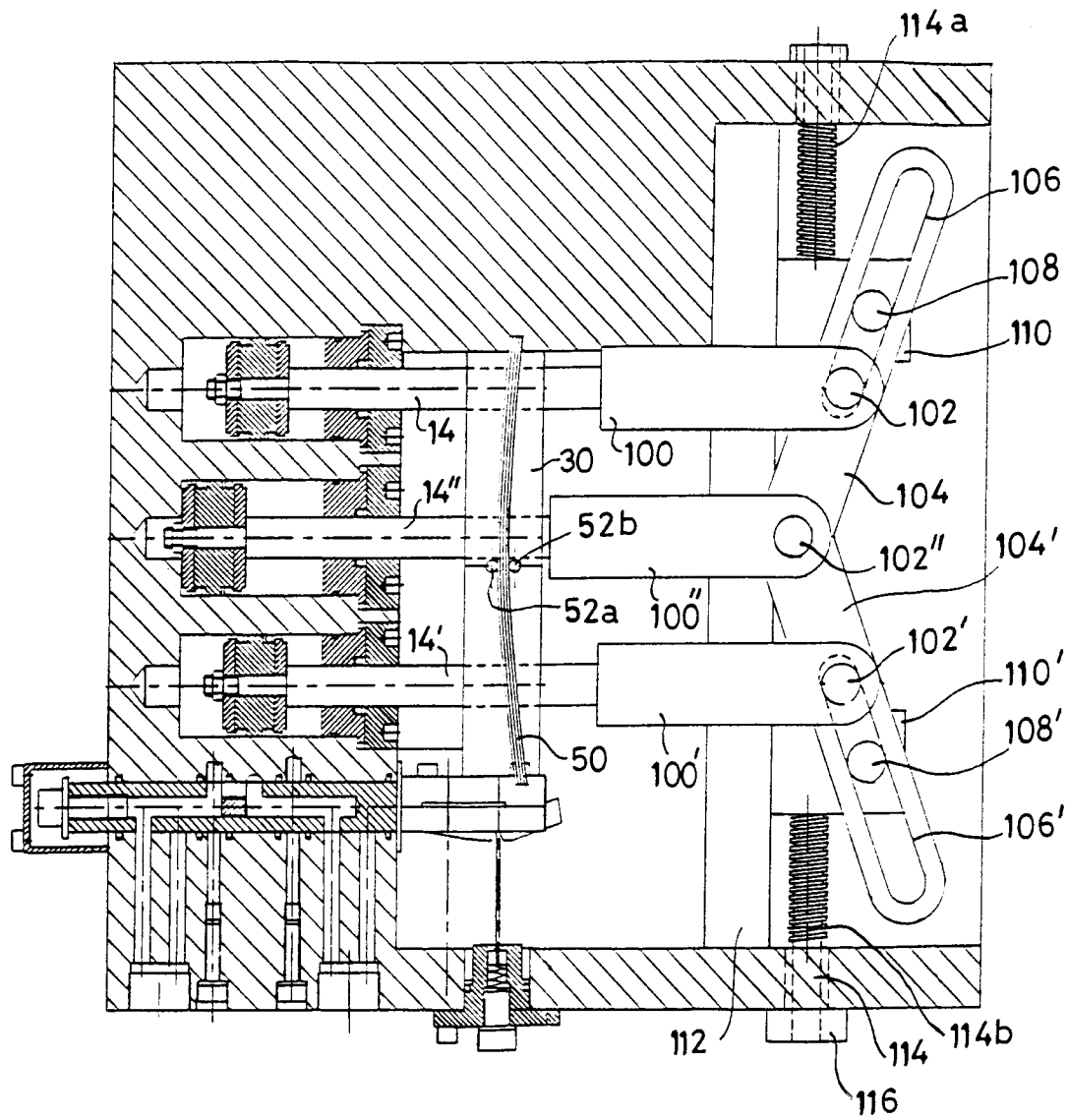


FIG. 4





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EUROPEAN SEARCH REPORT

Application Number

EP 92 20 2178

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)
D,Y	FR-A-1 595 934 (ALFA-LAVAL) * page 2, line 21 - page 5, line 30; figure *	1,2	B01F15/04 G01F3/18
Y	EP-A-0 318 596 (YAMADA YUKI SEIZO) * page 8, last paragraph - page 9, last paragraph; figures 1-3 *	1,2	
A	GB-A-2 200 695 (PA CONSULTING SERVICES) * page 6, line 10 - line 15; figures 1,2 *	1,2	
A	AU-A-484 859 (P. CLOUP) * page 3, last paragraph - page 7, paragraph 1; figures 1,2 *	1,2	
A	FR-A-2 382 680 (L. PEITHMANN) * page 7, line 23 - line 35; figures 4-8 *	12	
A	US-A-2 981 240 (R.E. NELSON) * column 6, line 9 - line 43; figure 1 *	12	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B01F G01F F16K
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 06 OCTOBER 1992	Examiner HEINSIUS R.
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