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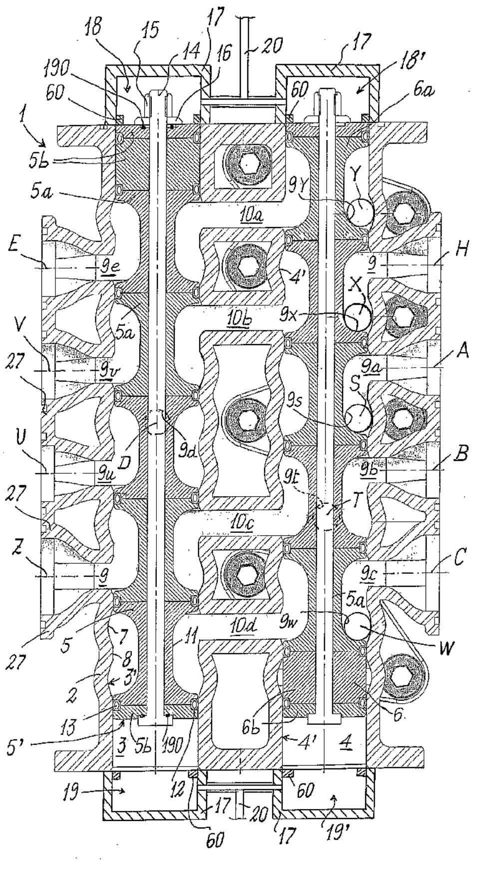
(54) **Title:** CYCLE INVERSION VALVE FOR REFRIGERATION/HEATING SYSTEMS OF ABSORPTION HEAT PUMP TYPE



(57) Abstract: A cycle inversion valve for refrigeration/heating systems of absorption heat pump type, presenting a body (2) provided with two cavities (3, 4) connected together by internal refrigerant fluid channels (10), said cavities (3, 4) being connected to the outside by passageways (9) for said fluid, comprising two spools (5, 6, 5', 6') movable within said cavities (3, 4) to enable ports to be interconnected in different ways and presenting seal means (13) for sealing against inner walls of said cavities (3, 4), said seal means (13) being radially loaded to improve their sealing capacity.

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CYCLE INVERSION VALVE FOR REFRIGERATION/HEATING SYSTEMS OF ABSORPTION HEAT PUMP TYPE

The present invention relates to a cycle inversion valve for refrigeration/heating systems of absorption heat pump type in accordance with the introduction to the main claim.

Absorption heat pump systems are well known in the state of the art. They are based mainly on the GAX thermodynamic refrigeration cycle, described for example in PCT/IT02/00793. Essentially, the refrigerant compression stage does not take place in a compressor, but instead the refrigerant vapour is absorbed into a vector fluid within an absorber.

The solution formed in this manner is brought to a higher pressure by a pump, with evident advantages in terms of efficiency. The solution is then fed into a generator, which provides it with the heat required to separate the refrigerant vapour from the vector fluid.

The refrigerant vapour is then condensed and throttled, to be evaporated within an evaporator. On its exit from the evaporator the refrigerant is again brought into contact with the vector fluid within a component of the device known as a pre-absorber, after which it proceeds to the absorber to recommence the cycle.

To improve performance in terms of efficiency, the condensed fluid is usually subcooled and the vapour superheated on exit from the evaporators. This heat transfer takes place in a refrigerant heat exchanger, commonly known as RHE (refrigerant heat exchanger) and has the effect of considerably increasing efficiency. Hence the evaporator, in such a cycle, essentially subtracts heat from the external environment, while the condenser and absorber expel it.

In a common heat pump, two-way or in some cases four-way inversion valves are present, provided to substantially invert the path of the refrigerant.

In particular, valves able to control the fluid path and to redirect the liquid or vapour between the various heat exchangers of the device are well known. These valves are essentially formed from a valve body presenting a substantially cylindrical cavity within which, controlled by usually electromechanical means, there slides a cylindrical spool presenting longitudinally a plurality of lesser diameter sections. Downstream and upstream of each lesser diameter section, the spool presents gaskets which seal against the inner surface of the cylindrical cavity of the valve body, so as to substantially isolate each lesser diameter section. The valve body also presents passageways which communicate with inlet/outlet ports present on the valve body surface and which open into apertures within the cylindrical cavity in which the spool is housed.

The movement of the spool substantially closes or frees said apertures; in this respect, when at least two of these apertures face the same lesser diameter section, communication occurs between these apertures, to enable a fluid to pass. Otherwise, the apertures remain closed and the passageways blocked.

The spool is driven by known mechanical, electrical, magnetic or fluidised pressure actuators.

In conventional systems these valves can invert the condenser and evaporator, modifying their function within the cycle.

However, in an inversion system these valves are numerous, as a large number of devices have to be inverted, a further drawback arising from the fact that considerable technical problems are encountered in constructing valves able to simultaneously handle fluids at very different temperatures.

A drawback of current valves is therefore that a single valve is unable to simultaneously handle change-over of two-component and two-phase fluids; this is because when using two-phase fluids they present considerable sealing problems, the different phases of the fluid coming into contact with each other to undermine cycle efficiency.

In this respect, in passing through the valve the fluids undergo alteration of their temperature and thermodynamic characteristics, to considerably reduce cycle efficiency.

Another drawback is that, in controlling the inversion of a heat pump device, a large number of valve devices have to be operated manually or automatically. This involves considerable plant and control complications.

An object of the present invention is therefore to provide a cycle inversion valve for refrigeration/heating systems of absorption heat pump type which is improved compared with the known art, in the sense that it enables two-phase and two-component fluids to be handled even at different temperatures, with assured high efficiency.

A further object of the invention is to provide a cycle inversion valve for refrigeration/heating systems of absorption heat pump type which enables the heat pump operation to be inverted with a single command, by operating on only one valve.

These and further objects are attained by a cycle inversion valve for refrigeration/heating systems of absorption heat pump type according to the technical teachings of the accompanying claims.

Further characteristics and advantages of the invention will be apparent from the description of a preferred but non-exclusive embodiment of the cycle inversion valve for refrigeration/heating systems of absorption heat pump type, illustrated by way of non-limiting example in the accompanying drawings, in which:

Figure 1 is a section through a cycle inversion valve for an absorption heat pump, in which the two spools are in the refrigeration position;

Figure 2 is a schematic section through the valve of Figure 1 with the spools in the heating position;

Figure 3 is a section through a detail of a spool of the valve of Figure 1;

Figure 4 is a section through a different embodiment of a detail of the spool of Figure 1;

Figure 5 is a perspective disassembled view of a coupling between pipes of the heat pump device and the valve of Figure 1;

Figure 6 is a section through the coupling of Figure 5;

Figures 7, 8a and 8b are schematic views of a device for pneumatically driving the spools of Figure 1;

Figures 9 and 10 show schematically the connections between the different passageways of the valves in their refrigeration and heating positions respectively;

Figure 11 and Figure 12 show schematically the valve of Figure 1 installed in a heat pump system.

Said figures show a cycle inversion valve for refrigeration/heating systems of absorption heat pump type indicated overall by 1.

The valve 1 is shown in detail in Figure 1, in use it being inserted into a known heat pump system indicated schematically in Figures 11 and 12, which will be described in detail hereinafter. In particular, the valve 1 presents a plurality of ports (A, B, C, D, E, H, S, T, U, V, X, Y, Z, W), specifically fourteen in this case, each connected to one or more components of the heat pump system by means which will also be described in detail hereinafter.

The valve 1 presents a valve body 2 having a first cavity 3 and a second cavity 4 which are substantially cylindrical and in which a first spool 5 and a second spool 6 are simultaneously slidable between two positions limited by stops. The cavities 3, 4 present undulated inner surfaces 3', 4' in which crests 8 and troughs 7 are present. As can be seen in Figure 1, at some of said troughs 7 there are provided peripheral fluid passageways 9 which connect said cavities to the external ports A, B, C, D, E, H, S, T, U, V, X, Y, Z, W of the valve 1. For ease of understanding these peripheral fluid passageways are indicated by the reference numeral 9 followed by the letter of the port to which it is connected. For example, the passageway 9e is that which connects the port E to the cavity 3, 9v connects the port V to the cavity 3 and so on.

The passageways 9 have a cross-section which varies in shape from circular to elliptical in proximity to where said passageways 9 open into the cavities 3 or 4, such as to ensure a substantially constant passage cross-section to limit pressure drops.

At said troughs four inner channels 10a, b, c, d are also present, connecting the two cavities 3 and 4 together.

The first spool 5 and the second spool 6 are substantially similar, at least in their functional part, which substantially faces the outlets of the passageways 9 or channels 10. The spools 5, 6 are each of undulated shape and in particular present sunken portions 11 and projections 12; however the pitch between two projections is double that of the undulations provided on the inner surface of the cavities 3 and 4. The maximum diameter of the spools, which occurs at the projections 12, is very close to the diameter of the crests 8 of the cylindrical cavities 3 and 4. Seal means, in particular elastic gaskets 13, are provided on the summit of the projections 12 so that said gaskets form a seal against the crests 8 of the inner surface 4' of the cavities 3 or 4. In this respect, the distance between two projections 12 is double the distance between two crests; in other words the distance between the projections 12 on the spools is twice that between the crests of the inner surfaces of the cavities 3 and 4, hence assuring sealing by the gaskets 13.

The spools are formed substantially from a series of axially holed cylindrical enveloping elements 5a mounted, together with spacers 5b, on a partly threaded pin 14. The cylindrical enveloping elements 5a and spacers 5b are locked together by a nut 15 screwed onto said pin 14 and pressing on a washer 16; gaskets 190 seal the connections.

The gaskets 13 are made of ammonia-resistant PTFE-coated silicone or of any other material resistant to the refrigerant used in the various stages. However such gaskets are only slightly elastic and are therefore energized or loaded radially to obtain a good seal.

In the case of the valve of Figures 1 and 2, the energization or radial loading is achieved by pressurized fluid originating from passageways 21 provided in some of the cylindrical enveloping elements, and well visible in Figure 3. These passageways 21 communicate with interspaces 23 and slits 25 provided respectively about the pin 14 and between two consecutive elements 6a, to give rise to a high pressure region to the rear of the gasket 13, which is housed in flares 26 suitably provided in the elements 6a. Besides increasing the fluid passage cross-section, the troughs 7 of the inner surface of the cavity 3, 4 have the very important function of reducing sliding contact between the gasket 13 and the inner wall of the cavity 3, 4 during the movement of the spools 5, 6. This is particularly important in reducing wear of the PTFE gaskets 13 and maintaining them always in their maximum efficiency state.

Caps 17, fixed in known manner to the valve body 2, define for each spool a first 18 and a second 19 sealed pressure chamber, which are connected by pipes 20 to a pilot device using solenoid valves.

The pilot device is known and is shown schematically in Figures 7, 8a and 8b; it presents conduits 36 and 35 connected to the first chamber 18 and second chamber 19 respectively.

In the rest position (Figure 7) the solenoids 31, 32, 33 and 34 are de-energized and the high pressure inlet 30 is closed.

In the position shown in Figure 8a the solenoids 34 and 33 are energized, hence the chamber 18 is connected to the high pressure inlet 30; the chamber 19 instead communicates with a drain 37. Under these conditions the two spools 5 and 6 are lowered to give the configuration shown in Figure 2.

In the position shown in Figure 8b the solenoids 31 and 32 are energized; the chamber 19 is under high pressure, the chamber 18 is connected to the drain 37. The spools 5, 6 are hence in the position shown in Figure 1.

At each port A, B, C, D, E, H, S, T, U, V, X, Y, Z, W, the valve body 1 comprises an inclined-wall flange 27 for connection to a suitably flared pipe 45 by means of a clamp 46. The clamp 46 presents two inclined-wall components 42, 43 tightened together by screw means 41 to cooperate with said flange 27, and when in use connect the pipe 45 and relative gaskets 44, 27a to the flange 27, to enable communication between the pipe and port without leakage. The pipe 45 is connected by tightening the clamps 42, 43 by means of the screw 41.

Essentially, the valve is installed in a heat pump system in the manner shown in Figures 11 and 12, in which conventional components are present such as a solution pump 50, a generator 51, a pre-absorber 52, a refrigerant heat exchanger 53 (RHE), and four heat exchangers 54, 55, 56, 57, the first heat exchanger 54 and second heat exchanger 55 being substantially adjacent, the third and fourth also being adjacent. The first heat exchanger 54 and second heat exchanger 55 are positioned such as to exchange against that environment the temperature of which is to be conditioned, for example a room, whereas the third and fourth heat exchanger are generally positioned outside. Figures 11 and 12 are substantially schematic, the whole system being shown very simplified as it is basically of known type.

The fourteen ports are connected to different components of the system, in accordance with the following list, schematically represented in said figures:

The port B is connected to the inlet of heat exchanger 54; the port V to the outlet of heat exchanger 54; the port Z to the inlet of heat exchanger 55; the port H to the outlet of heat exchanger 55; the port C to the inlet of heat exchanger 56; the port E to the outlet of heat exchanger 56; the port A to the inlet of heat exchanger 57; the port U to the outlet of heat exchanger 57; the port X to the inlet 1 of the RHE; the port T to the outlet 2 of the RHE; the port D to the inlet 2 of the RHE; the port W to the pre-absorber outlet; the port S to the generator outlet; the port Y to the pump inlet.

In Figure 1 the valve is in the cooling position, the chambers 19 and 19' are under pressure and the spools are raised, in this situation the connections between the ports being such that the first heat exchanger 54 and second heat exchanger 55 act as evaporators.

The connections between the ports are shown schematically in Figure 9, specifically the port E being connected to Y, V to H and to X, D to U, A to S, Z to B and T, and C to W.

These connections are also represented schematically in Figure 11. In practice the refrigerant vapour at the generator outlet penetrates into the heat exchanger 57 acting as condenser, then transfers heat within the RHE 53, is throttled and passes through the first heat exchanger 54 and second heat exchanger 55 to cool the environment or a secondary fluid. The fluid again passes through the RHE 53 and after leaving the pre-absorber 52 is directed towards the heat exchanger 56, in this case acting as absorber 56. After leaving the absorber the fluid again enters the pump 50, to repeat the cycle.

In Figure 2 the valve is in the heating position, the chambers 18 and 18' are under pressure and the spools are lowered, in this situation the connections between the ports being such that the first heat exchanger 54 and the second heat exchanger 55 act as condenser and absorber respectively.

The connections between the ports are shown schematically in Figure 10, specifically the port E being connected to X and to A, Y to H, V to D, S to B, U to T and C, and Z to W.

These connections are also represented schematically in Figure 12 together with the entire system. In practice the refrigerant vapour at the generator outlet penetrates into the first heat exchanger 54 acting as condenser, then transfers heat within the RHE 53, is throttled and passes through the third heat exchanger 56 and fourth heat exchanger 57 acting as evaporators. The fluid again passes through the RHE 53 and after leaving the pre-absorber 52 is directed towards the second heat exchanger 55, in this case acting as absorber 55. After leaving the absorber the fluid again enters the pump 50, to repeat the cycle. In this configuration the absorber and condenser exchange heat with the environment or with a secondary fluid.

In a different alternative embodiment, shown in Figure 4, the spools 5 and 6 are formed differently, the manner in which the gaskets seal against the inner wall of the cavities 4 and 5 also being different.

For simplicity of description, in Figure 4 similar parts are indicated with the same reference numerals as in the other figures, plus an apex.

In this case, in addition to the flares 26' the cylindrical enveloping elements 6a' present seats 260 for housing to the rear of the gasket 13 an energizing gasket 130 arranged to radially load the gasket 13'. In use the energizing gasket 130, consisting of a very elastic material, for example a normal rubber O-ring, presses against the gasket 13', which as stated is poorly elastic, to enable it to form an excellent seal, even at extreme and very variable temperatures.

Advantageously, the undulated inner walls of the cavities 2 and 4 provide a larger passageway for the fluid passing through the valve, to considerably reduce the pressure drop through said valve 1.

In a still different embodiment, the spools 5, 6 are operated by an operating shaft which connects them together and is driven by a gear motor controlled by a control card.

A cycle inversion valve for refrigeration/heating systems of absorption heat pump type conceived in this manner is susceptible to numerous modifications and variants, all falling within the scope of the inventive concept; moreover all details can be replaced by technically equivalent elements.

In practice the materials used and the dimensions can be chosen at will in accordance with requirements and with the state of the art.

CLAIMS

1. A cycle inversion valve for refrigeration/heating systems of absorption heat pump type, presenting a body (2) provided with two cavities (3, 4) connected together by internal refrigerant fluid channels (10), said cavities (3, 4) being connected to the outside by passageways (9) for said fluid, comprising two spools (5, 6, 5', 6') movable within said cavities (3, 4) to enable ports to be interconnected in different ways and presenting seal means (13) for sealing against inner walls of said cavities (3, 4), characterised in that said seal means (13) are radially loaded to improve their sealing capacity.

2. A valve as claimed in claim 1, characterised in that the inner walls of said cavities present undulations in the form of an alternation of crests (8) and troughs (7), to substantially reduce the wear of the gasket (13) during movement of the spools (5, 6).

3. A valve as claimed in claim 1, characterised in that said seal means (13) are loaded radially by an elastic ring disposed to the rear of said seal means, such as to urge them towards the inner walls of the cavities (3, 4).

4. A valve as claimed in claim 1, characterised in that said seal means (13) are loaded radially by pressurized conduits (21, 22, 23, 24) which open to the rear of said seal means (13), to create on their inner side a high pressure region.

5. A valve as claimed in claim 2, characterised in that said spools present sunken portions (11) and projections (12), said seal means (13) being disposed on said projections (12), said sunken portions being provided to increase the fluid passage cross-section within said valve.

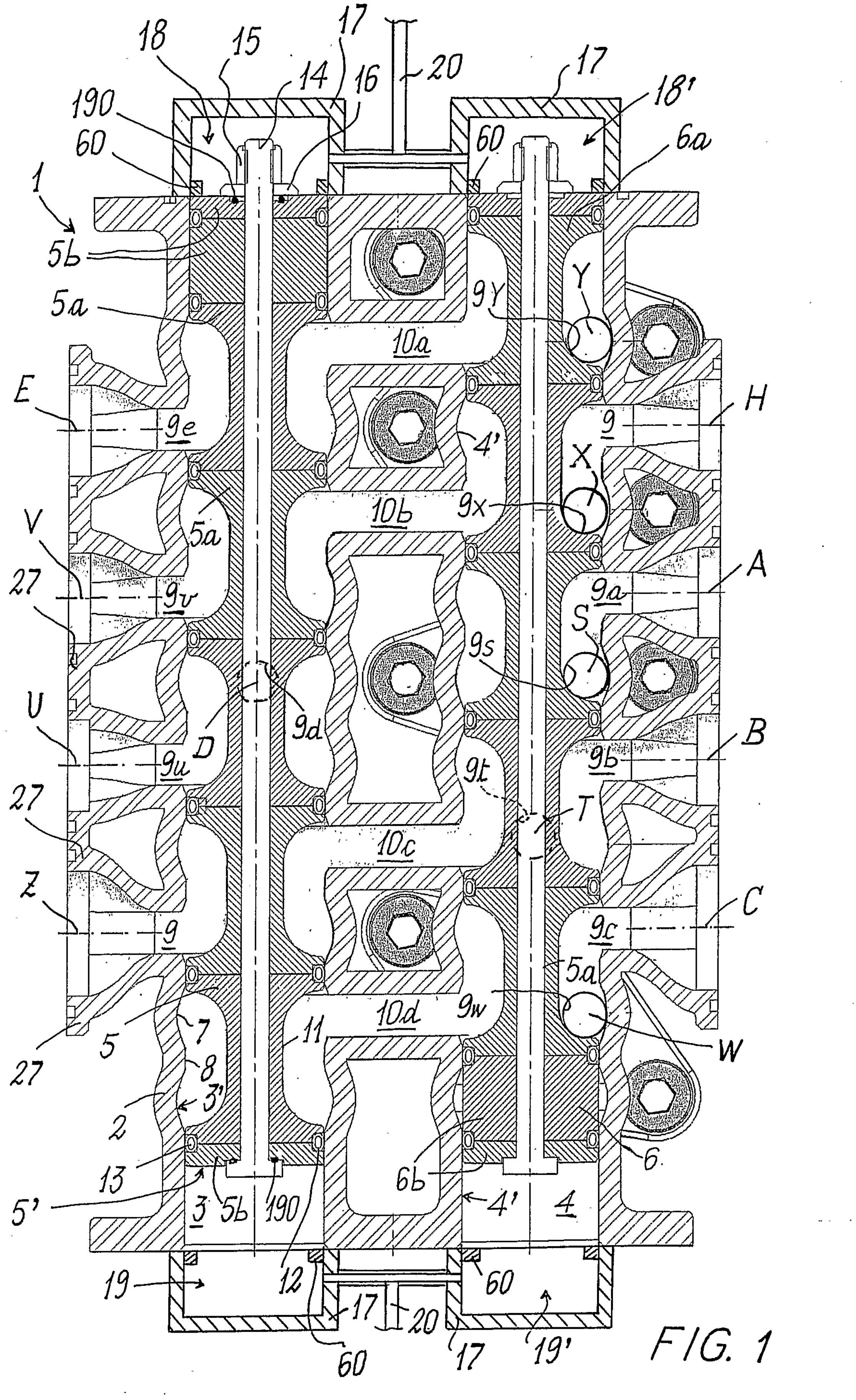
6. A valve as claimed in claim 1, characterised in that pipes (45) of a refrigeration system are connected to said ports by clamps (46) comprising two flared-wall components (42, 43) tightened together by screw means (41) and cooperating with appropriate flanges (27) provided on the valve body (2) at each of said ports.

7. A valve as claimed in claim 1, characterised in that when the spools (3, 4) are in a first position, said passageways (9) and said channels (10) connect the port E to the port Y, V to H and to X, D to U, A to S, Z to B and to T, and C to W, whereas when said spools (3, 4) are in a second position said passageways (9) and said channels (10) connect the port E to the ports X and A, Y to H, V to D, S to B, U to T and to C, and Z to W.

8. A valve as claimed in claim 5, characterised in that the pitch between said projections (12) is double that between said crests (8).

9. A valve as claimed in claim 1, characterised in that said seal means (13) are made of a material chosen from the group comprising: PTFE coated silicone, glass-filled PTFE, glass/graphite-filled PTFE.

10. A valve as claimed in claim 1, characterised in that for each spool (5, 6) there are present a first chamber (18) and a second chamber (19) which when pressurized determine the movement of said spools (5, 6).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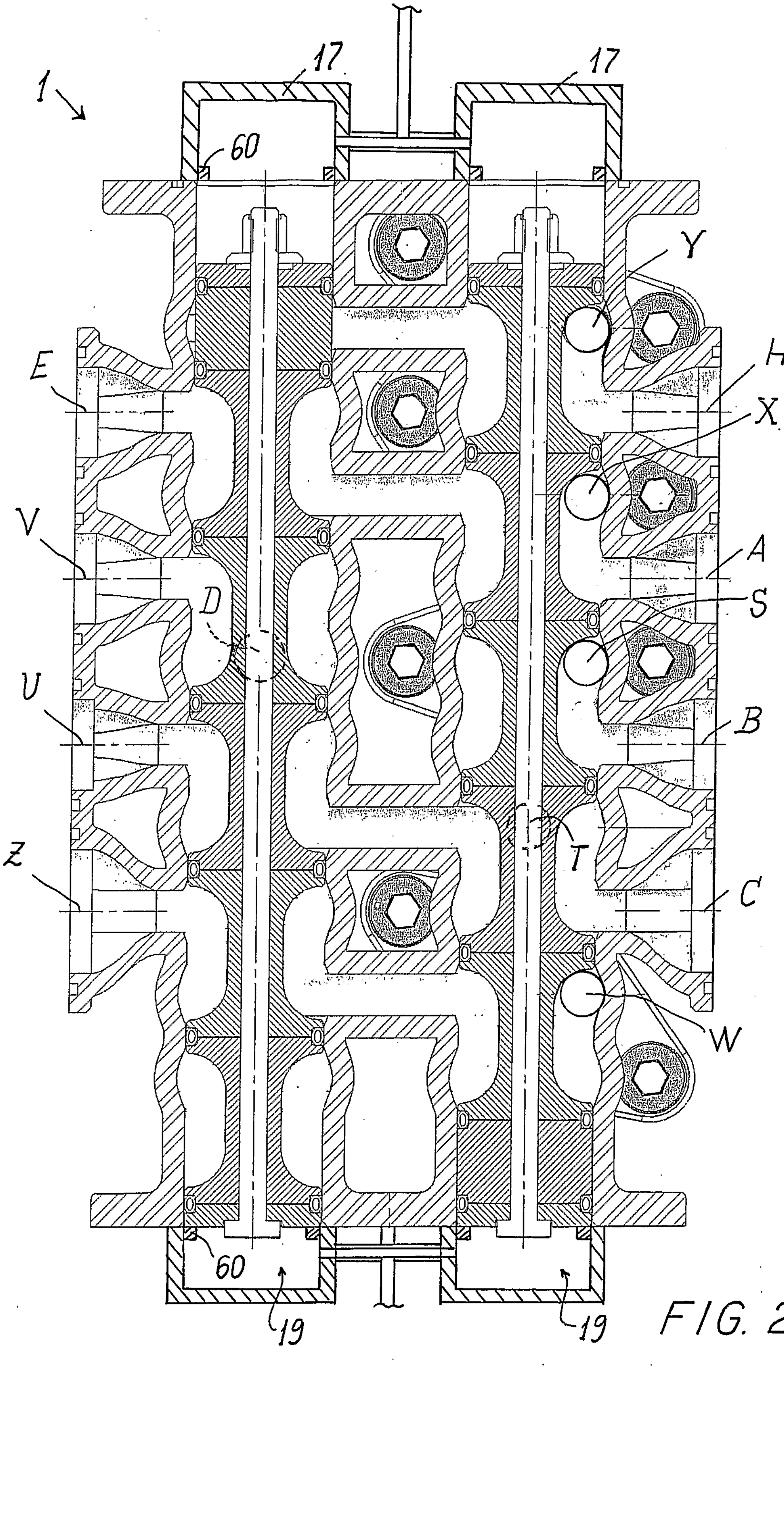

FIG. 2

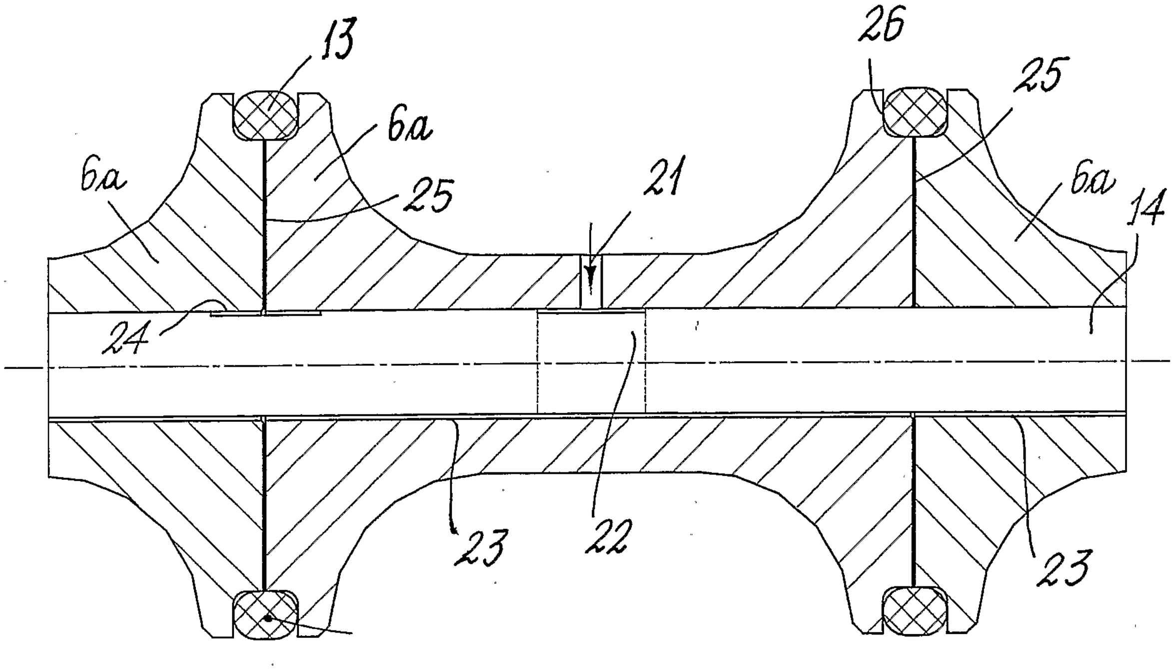

FIG. 3

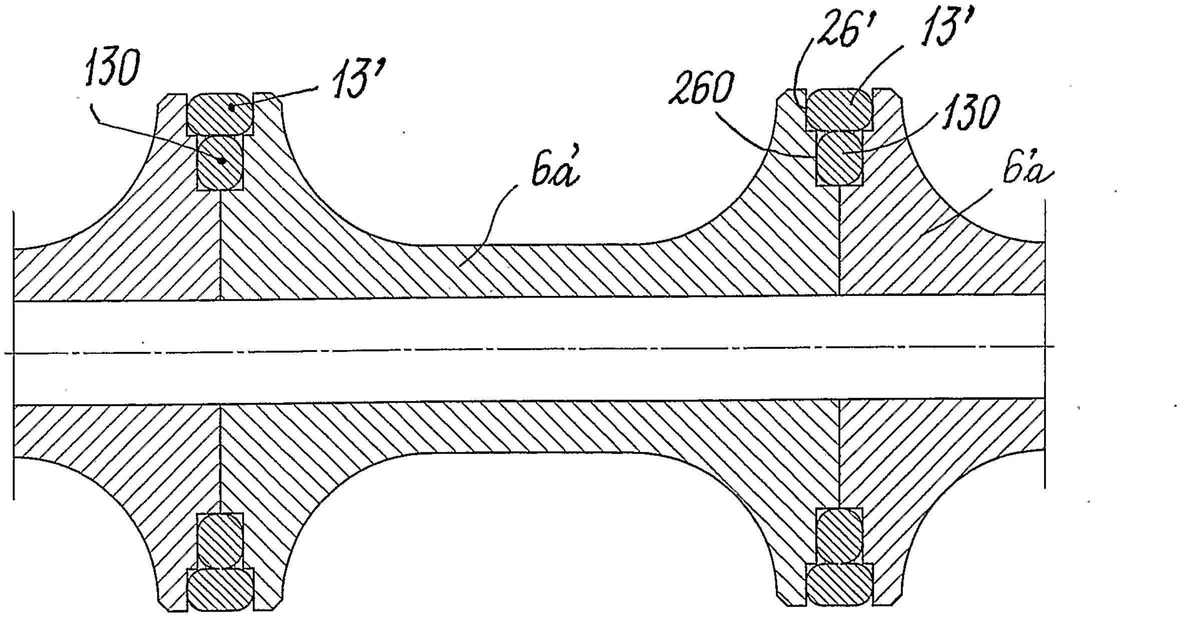

FIG. 4

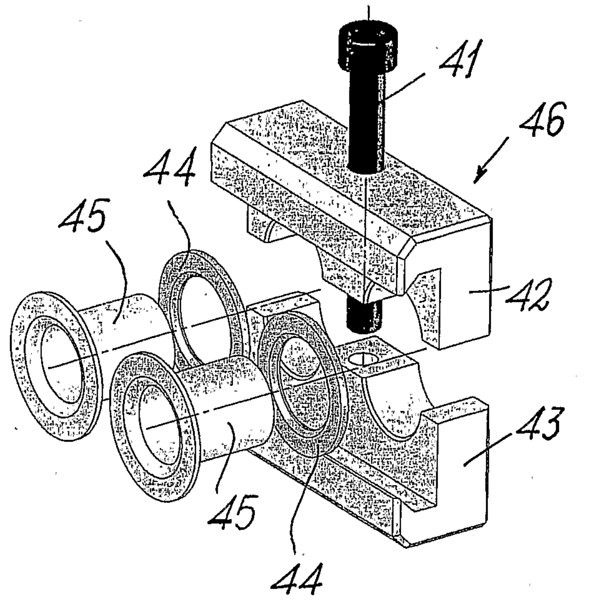

FIG. 5

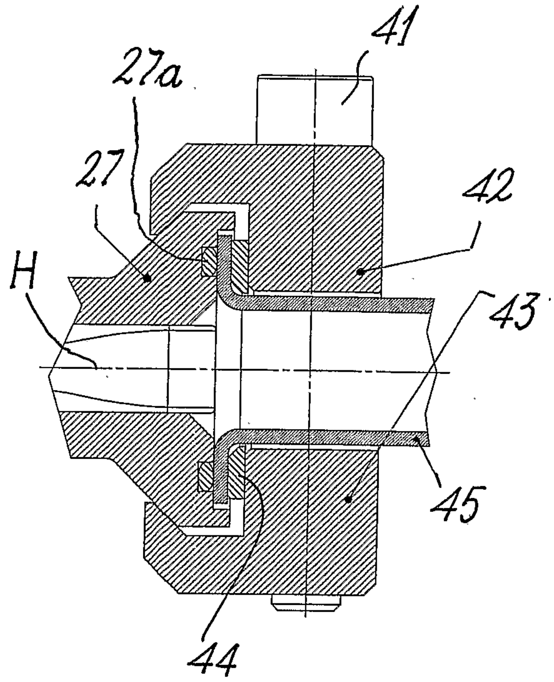

FIG. 6

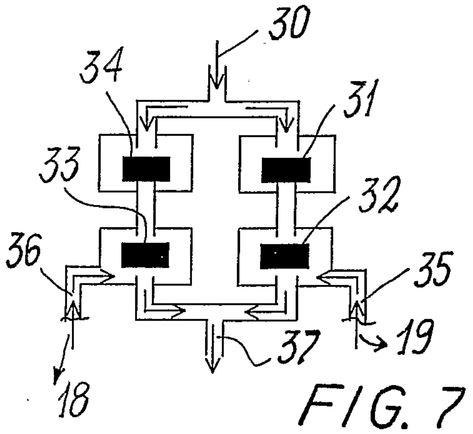

FIG. 7

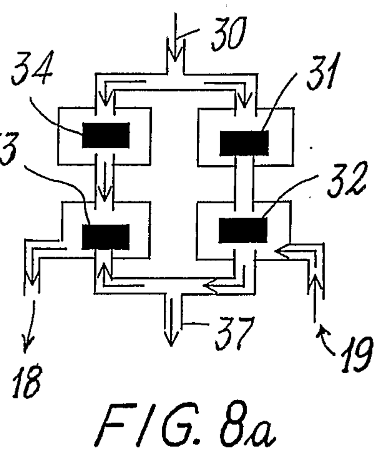

FIG. 8a

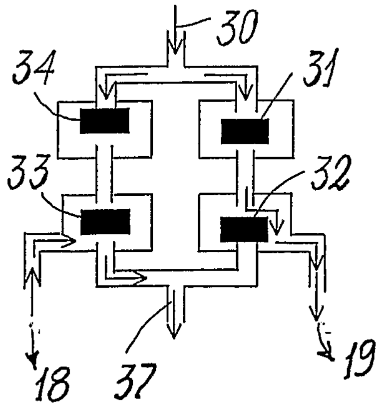

FIG. 8b

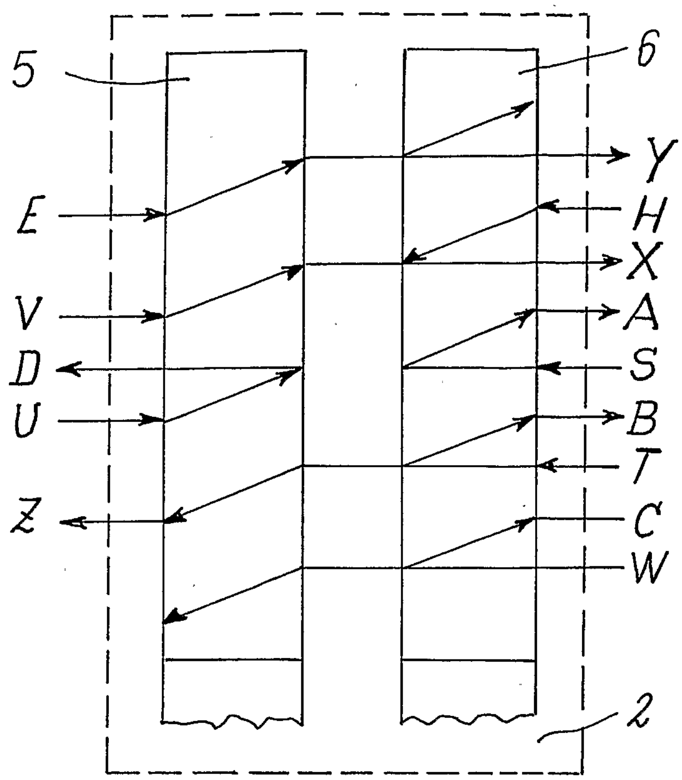

FIG. 9

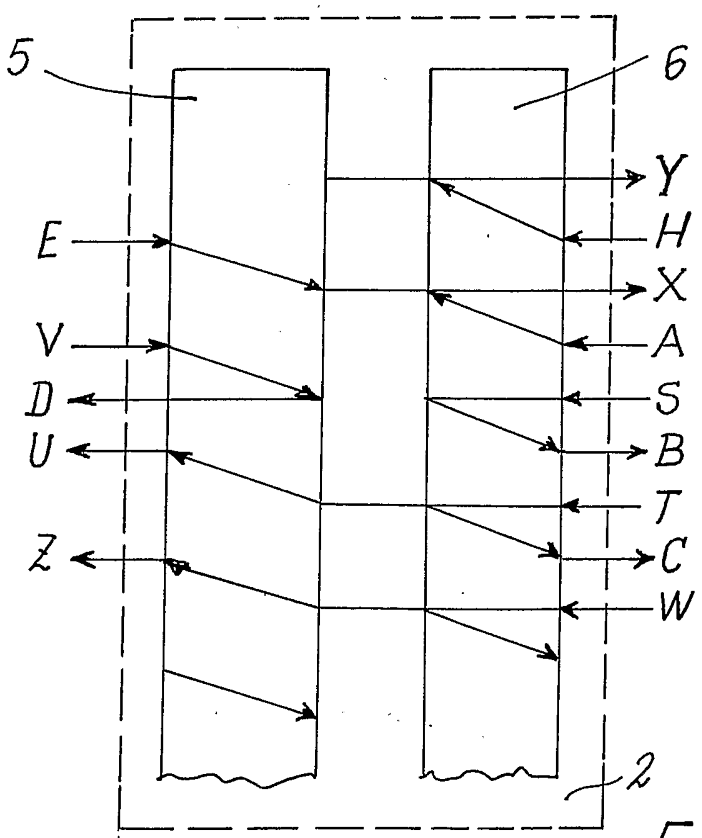

FIG. 10

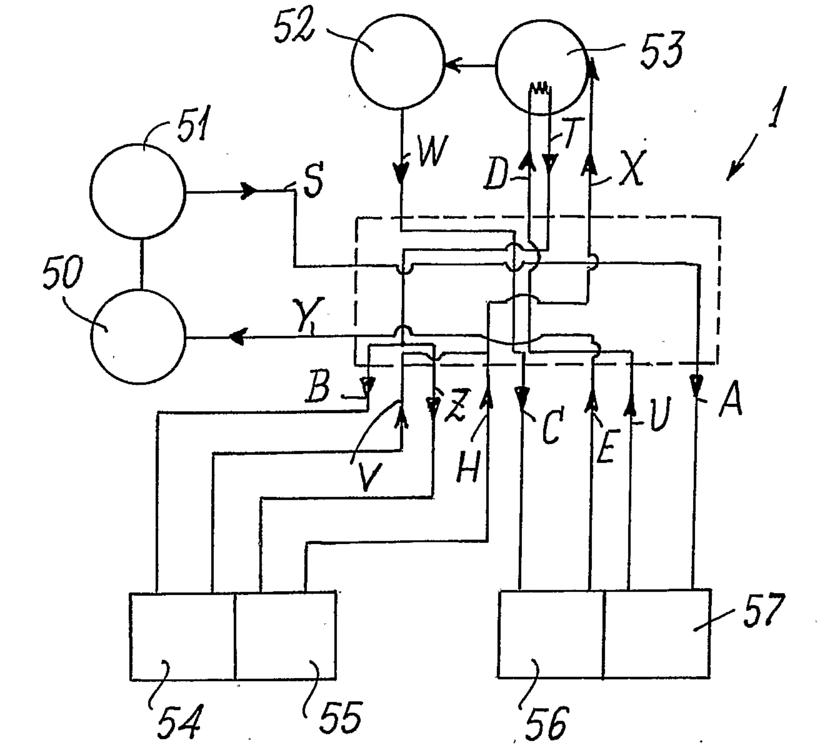
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FIG.11

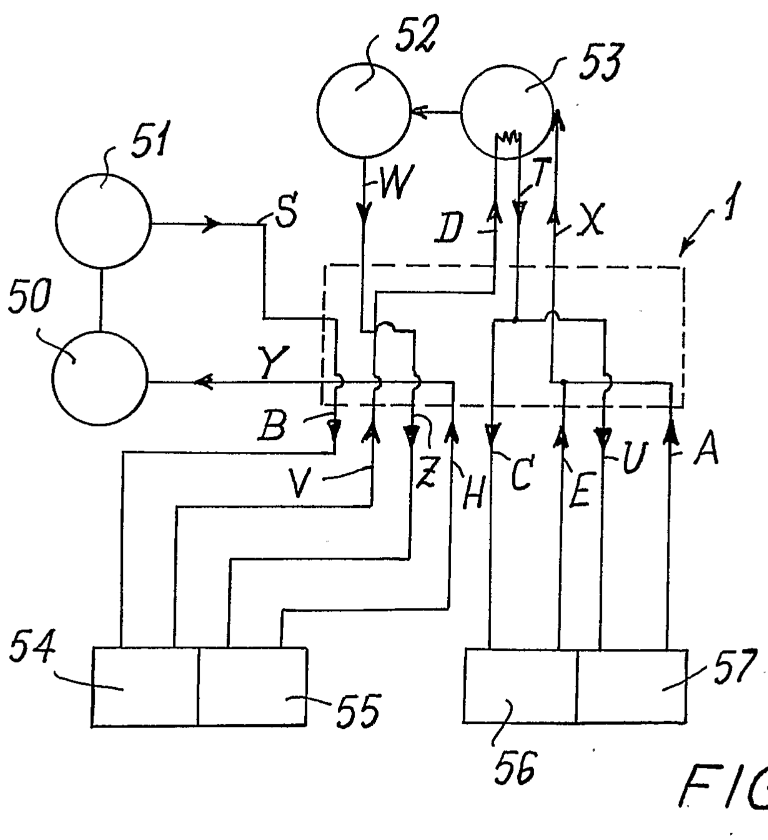
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FIG. 12

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2005/000521

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16K11/07

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/117217 A1 (LIESENHOFF THOMAS) 29 August 2002 (2002-08-29) abstract; figures 1-3	1,2,5,10
X	US 4 718 451 A (KOSUGI ET AL) 12 January 1988 (1988-01-12) abstract; figure 1	1,2,5,8, 10
X	FR 1 501 194 A (F. W. MCCONNEL LIMITED) 10 November 1967 (1967-11-10) figures 1-6	1,2,5
A	US 4 566 703 A (ZITTING ET AL) 28 January 1986 (1986-01-28) figures 1-9	1,3

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2005/000521

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 573 137 A (AUTOMOTIVE PRODUCTS COMPANY LIMITED; IVOR HORACE GORDON SAINT) 7 November 1945 (1945-11-07) figures 1-4	1,4
A	EP 0 140 052 A (CONCORDIA FLUIDTECHNIK GMBH) 8 May 1985 (1985-05-08) figure 1	1,3,4
A	FR 1 141 238 A (G. C. TEATINI) 28 August 1957 (1957-08-28) figures 1-6	1-10
A	CH 393 015 A (NOSTORAG AG) 31 May 1965 (1965-05-31) figure 1	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP2005/000521

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 2002117217	A1	29-08-2002	DE	10109206 A1	19-09-2002
			EP	1236938 A1	04-09-2002
US 4718451	A	12-01-1988	JP	4040053 Y2	18-09-1992
			JP	61106672 U	07-07-1986
			DE	3530019 A1	26-06-1986
FR 1501194	A	10-11-1967	NONE		
US 4566703	A	28-01-1986	US	4577874 A	25-03-1986
GB 573137	A	07-11-1945	NONE		
EP 0140052	A	08-05-1985	DE	3336209 A1	02-05-1985
			DE	3475557 D1	12-01-1989
			EP	0140052 A2	08-05-1985
			JP	60088275 A	18-05-1985
FR 1141238	A	28-08-1957	NONE		
CH 393015	A	31-05-1965	NONE		