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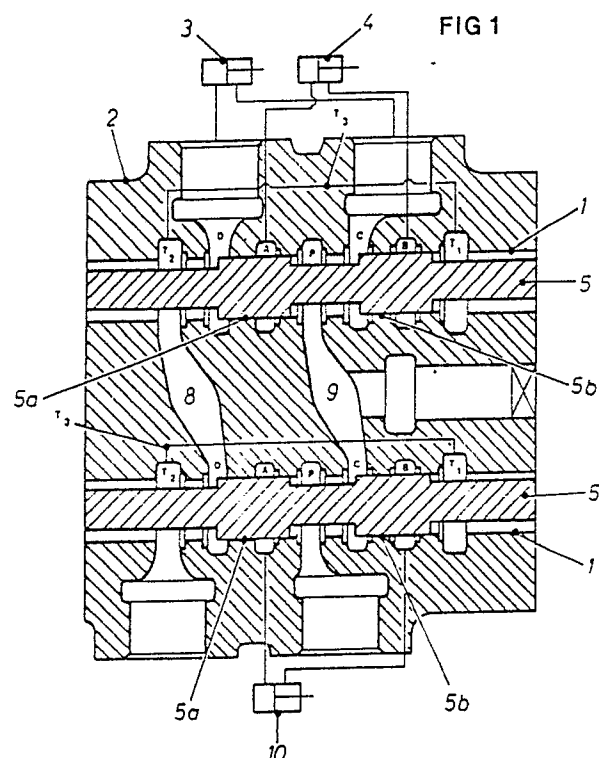
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54 Multi-stage selector valve.

57 A single housing (2) is formed with selector valve ports (A, B, C, D, P, T₁, T₂) in a plurality of parallel rows each forming a selector valve, wherein the cylinder ports (D, C) in one set in one of the two adjacent rows communicate with the tank port (T₂) and pump port (P) in the other row through communication passages (8, 9); thus, the selector valves are connected inside the housing (2) by the communication passages (8, 9), whereby pipe lines (6, 7) can be simplified.



MULTI-STAGE SELECTOR VALVE

BACKGROUND OF THE INVENTION

Generally, a multi-stage selector valve, as shown in Fig. 2, comprises a housing 2 having a pump port P formed in the middle of a spool receiving hole 1, two sets of cylinder ports D, A and C, B on opposite sides of said pump port P, and tank ports T₁ and T₂ at opposite ends of said hole communicating with each other through a by-pass circuit T₃, all ports being disposed at equal intervals, and a spool 5 switchably slidably inserted in said spool receiving hole 1 in said housing 2 so that it is movable between right and left positions, said spool having control sections 5a and 5b, whereby in one position (left-hand side position) the cylinder ports D and C on the one hand are blocked while the cylinder ports A and B on the other hand are allowed to communicate with the pump port P and tank port T₁ to thereby drive one hydraulic cylinder 3 and in the other position (right-hand side position) the cylinder ports A and B on the other hand are blocked while the cylinder ports D and C on the one hand are allowed to communicate with the pump port P and tank port T₂ to thereby drive the other hydraulic cylinder 4.

The arrangement of the selector valve described above is as shown in Fig. 3 using hydraulic circuit symbols. The switching action of this selector valve makes it possible to alternately activate the two hydraulic cylinders 3 and 4, the switching of the operating direction for the respective hydraulic valves being effected by a directional control valve S.

The selector valve described above employs a directional control valve to activate two hydraulic cylinders 3 and 4; however, when the number of hydraulic valves 3 and 4 is increased to more than two, one selector valve must be added for each increase in the number. Thus, as shown in Fig. 4, pipe lines 6 and 7 for connecting the selector valves are needed. If, therefore, the number of hydraulic cylinders 3 and 4 is increased, the pipe lines for connecting the selector valves become complicated, resulting in problems including increased cost, wider space for installation, higher probability of the pipe lines 6 and 7 being damaged or broken, and increased tendency for oil to leak.

SUMMARY OF THE INVENTION

The present invention has been proposed in

view of the problems in the prior art described above, and its object is to provide a multi-stage selector valve which makes it possible to simplify pipe lines even if the number of hydraulic cylinders is increased.

To achieve the above object, the present invention provides a multi-stage selector valve comprising a housing 2 in which ports are formed in a plurality of parallel rows each consisting of a pump port P formed in the middle of a spool receiving hole 1, two sets of cylinder ports D, A and C, B disposed on opposite sides of said pump port P, and tank ports T₁ and T₂ at opposite ends of said hole communicating with each other through a by-pass circuit T₃, wherein the cylinder ports D and C in one set in one of the two adjacent rows communicate with the tank port T₂ and pump port P in the other row through communication passages 8 and 9, and a plurality of spools 5 independently switchably slidably inserted in said spool receiving holes 1 in said housing 2 and having control sections whereby in one switch position the cylinder ports A and B in one set communicates with the pump port P and tank port T₁ while the cylinder ports D and C in the other set are blocked, and in the other switch position the cylinder ports A and B in said one set are blocked while the cylinder ports D and C in the other set are allowed to communicate with the pump port P and tank port T₂.

The single housing 2 is formed with selector valve ports in a plurality of parallel rows, wherein the cylinder ports D and C in one set in one of the two adjacent rows communicate with the tank port T₂ and pump port P in the other row through the communication passages 8 and 9; thus, the selector valves are connected inside the housing 2 by said communication passages 8 and 9, whereby the pipe lines can be simplified.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a middle longitudinal sectional view of a two-stage selector valve showing an embodiment of the present invention;

Fig. 2 is a middle longitudinal sectional view of a conventional selector valve;

Fig. 3 is a hydraulic symbol circuit diagram of the selector valve of Fig. 2; and

Fig. 4 is a hydraulic symbol circuit diagram for activating three hydraulic cylinders using a conventional selector valve.

DESCRIPTION OF THE PREFERRED EMBODI-

MENTS

Fig. 1 is a middle longitudinal sectional view of a two-stage selector valve showing an embodiment of the present invention. The numeral 1 denotes spool receiving holes; 2 denotes a housing; 3, 4 and 10 denote hydraulic cylinders; and 5 denotes spools.

The spool receiving holes 1 are disposed in parallel, extending transversely through the housing 2. Each spool receiving port 1 is formed with a pump port P in the middle, two sets of cylinder ports D, A and C, B on opposite sides of the pump port, and tank ports T₁ and T₂ at opposite ends of the hole, all these ports being disposed at equal intervals, said tank ports T₁ and T₂ at opposite ends communicating with each other through a bypass circuit T₃ formed in the housing 2.

The cylinder ports in one set in one of the two adjacent rows communicate with the tank port T₂ and pump port P in the other row through the communication passages 8 and 9 formed in the housing 2.

The spools 5 are inserted in said spool receiving holes 1 in said housing 2 so that they are independently switchably slidable between two positions, each spool having control sections 5a and 5b whereby in one switch position the cylinder ports A and B in one set communicate with the pump port P and tank port T₁ while the cylinder ports D and C in the other set are blocked, and in the other switch position the cylinder ports A and B in said one set are blocked while the cylinder ports D and C in the other set are allowed to communicate with the pump port P and tank port T₂.

In the two-stage selector valve described above, on one side (upper side), the cylinder ports D, C and A, B connected to the hydraulic cylinders 3 and 4 can be formed in the same plane, opposed planes or planes orthogonal to each other in the housing 2. This also applies to the port arrangement on the other side (lower side).

In the case of a three-stage selector valve, of the two sets of cylinder ports D, C and A, B in the intermediate row, the ports D and C will be arranged to communicate with the pump port P and tank port T₂ of the selector valve in the next row through the communication passages 8 and 9 in the housing 2, while the ports A and B will be formed in the plane of the front or back of the paper of Fig. 1.

Multi-stage selector valves having more than three stages may be constructed by utilizing the arrangement described above.

According to the present invention, even if the number of hydraulic cylinders is increased, connections by pipe lines between selector valves can

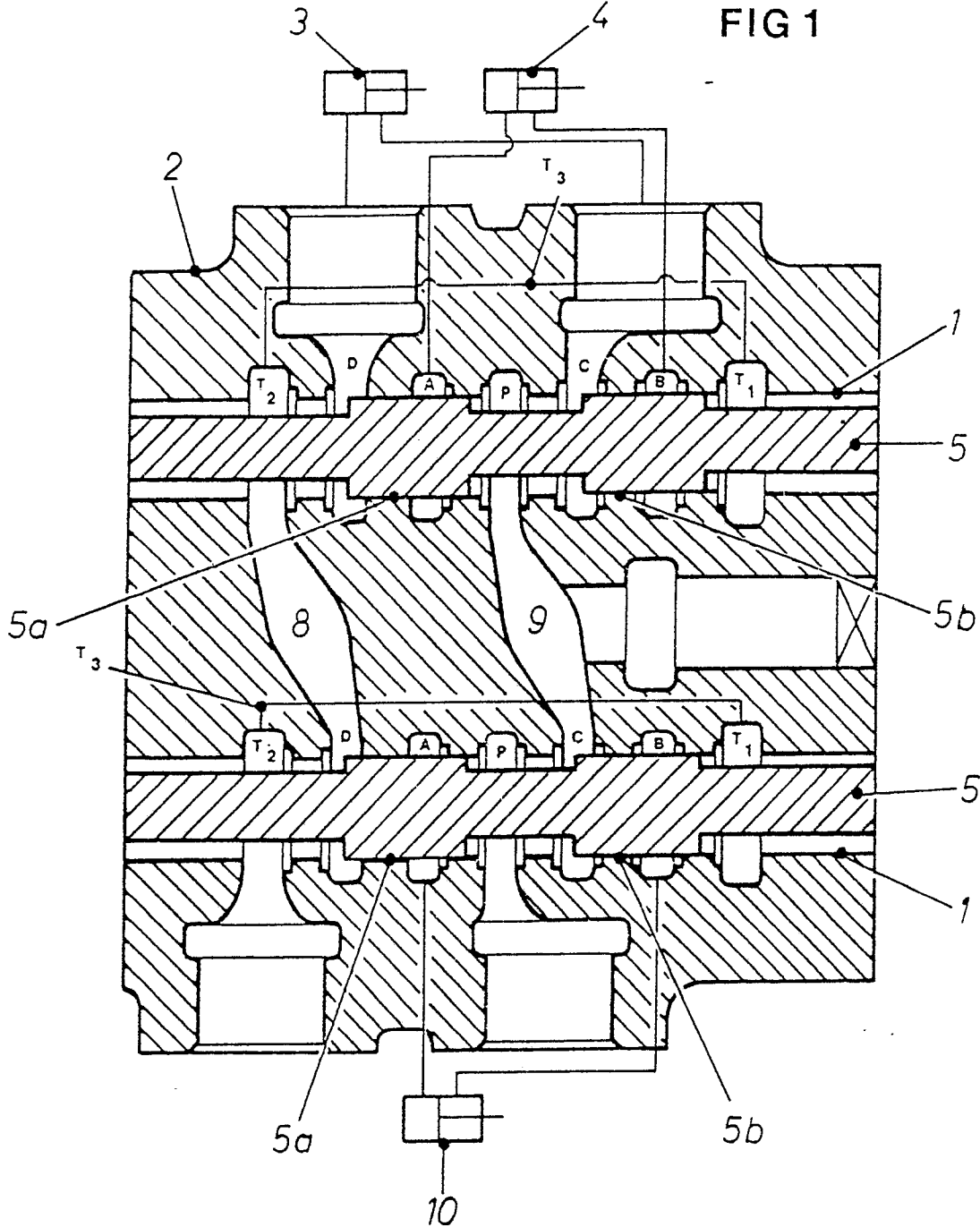
be omitted, providing advantages including simplification of pipe lines, prevention of damage and oil leakage, reduced cost, compact size and reduced installation space.

Claims

A multi-stage selector valve comprising a housing (2) in which ports are formed in a plurality of parallel rows each consisting of a pump port (P) formed in the middle of a spool receiving hole (1), two sets of cylinder ports (D, A and C, B) disposed on opposite sides of said pump port (P), and tank ports (T₁, T₂) at the opposite ends of said hole communicating with each other through a bypass circuit (T₃), wherein the cylinder ports (D, C) in one set in one of the two adjacent rows communicate with the tank port (T₂) and pump port (P) in the other row through communication passages (8, 9), and a plurality of spools (5) independently switchably slidably inserted in said spool receiving holes (1) in said housing (2) and having control sections whereby in one switch position the cylinder ports (A, B) in one set communicate with the pump port (P) and tank port (T₁) while the cylinder ports (D, C) in the other set are blocked, and in the other switch position the cylinder ports (A, B) in said one set are blocked while the cylinder ports (D, C) in the other set are allowed to communicate with the pump port (P) and tank port (T₂).

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FIG 1



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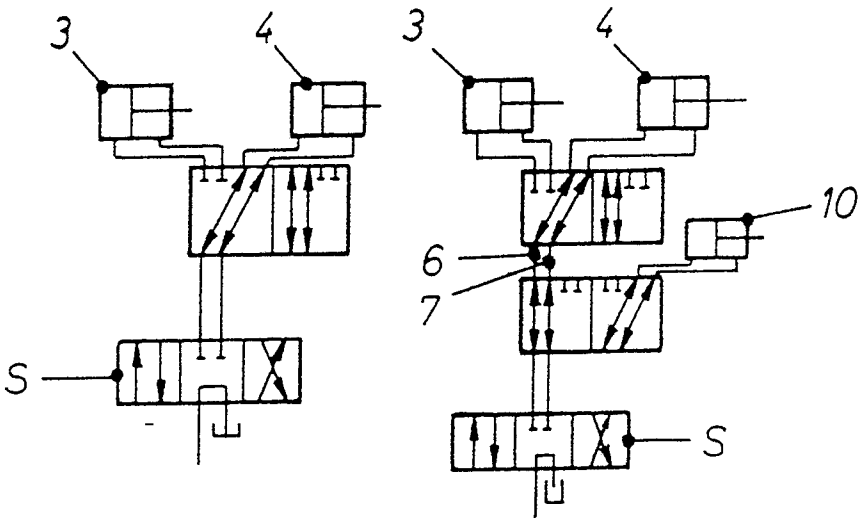
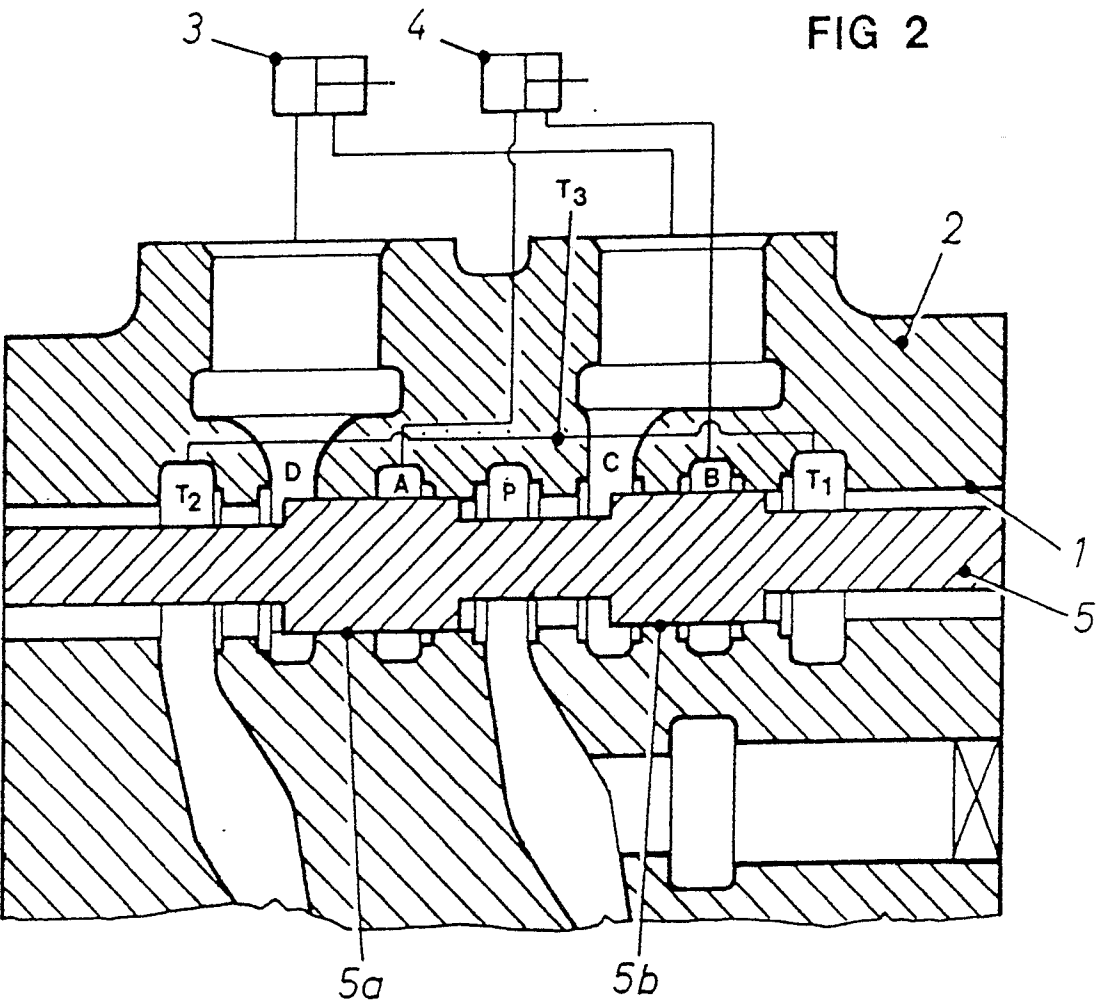


FIG 3

FIG 4



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	US-A-2 362 944 (W.T. STEPHENS) ---		F 15 B 13/06												
A	US-A-2 710 628 (R.F. HODGSON) ---														
A	US-A-3 162 095 (C.W. KOONS) ---														
A	US-A-3 216 443 (H.H. SCHMIEL) ---														
A	GB-A-2 107 434 (TOSHIBA KIKAI K.K.) -----														
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)												
			F 15 B												
The present search report has been drawn up for all claims															
Place of search THE HAGUE		Date of completion of the search 30-10-1989	Examiner THOMAS L.C.												
<table border="0"><tr><td>CATEGORY OF CITED DOCUMENTS</td><td>T : theory or principle underlying the invention</td></tr><tr><td>X : particularly relevant if taken alone</td><td>E : earlier patent document, but published on, or after the filing date</td></tr><tr><td>Y : particularly relevant if combined with another document of the same category</td><td>D : document cited in the application</td></tr><tr><td>A : technological background</td><td>L : document cited for other reasons</td></tr><tr><td>O : non-written disclosure</td><td>.....</td></tr><tr><td>P : intermediate document</td><td>& : member of the same patent family, corresponding document</td></tr></table>				CATEGORY OF CITED DOCUMENTS	T : theory or principle underlying the invention	X : particularly relevant if taken alone	E : earlier patent document, but published on, or after the filing date	Y : particularly relevant if combined with another document of the same category	D : document cited in the application	A : technological background	L : document cited for other reasons	O : non-written disclosure	P : intermediate document	& : member of the same patent family, corresponding document
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