

[54] **ELECTROHYDRAULIC
REMOTE-CONTROL DEVICES OF SLIDE
DISTRIBUTORS**

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[22] Filed: **Nov. 1, 1972**

[21] Appl. No.: **302,954**

[30] **Foreign Application Priority Data**

Nov. 4, 1971 France 71.39522

[52] U.S. Cl. **91/411, 91/418, 91/459,**
91/461, 91/466, 92/163, 92/169

[51] Int. Cl. ... **F15b 11/08, F15b 11/16, F15b 13/08**

[58] Field of Search 251/367; 137/270, 271;
91/418, 411, 459, 461, 462, 466; 92/163,
146, 161, 164, 169

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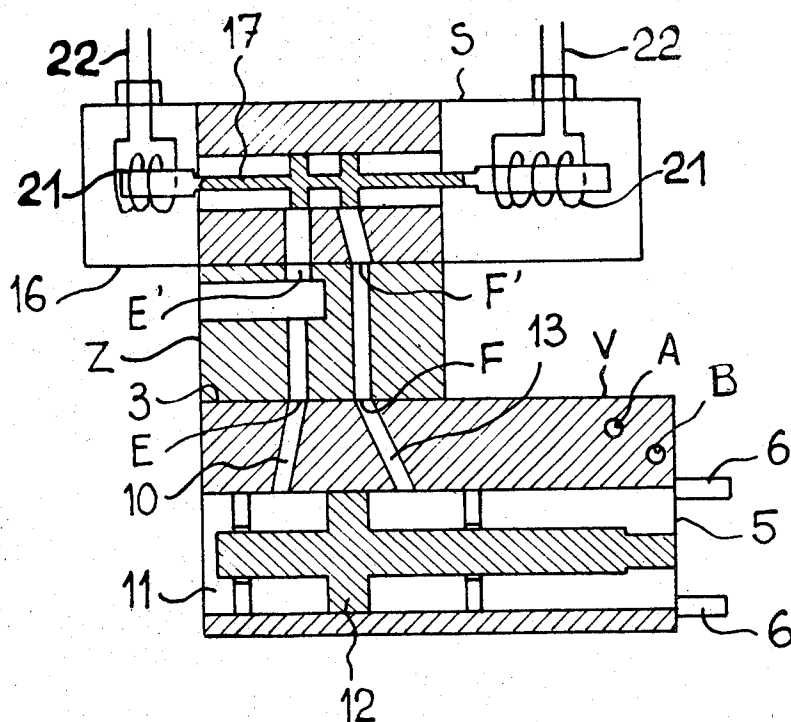
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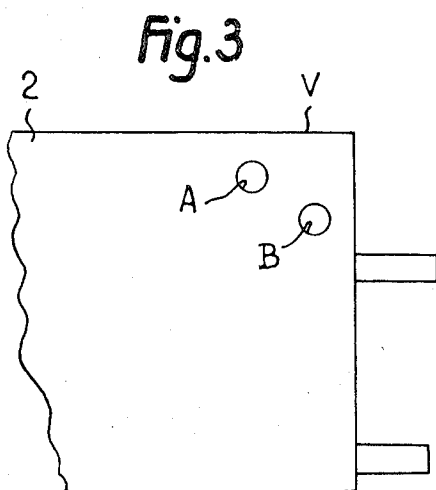
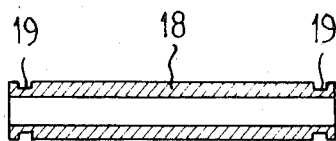
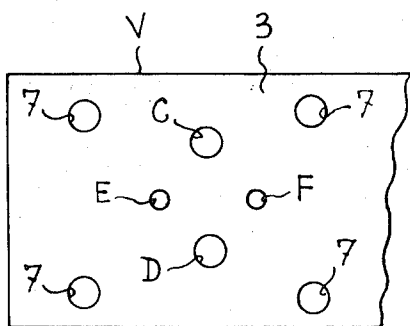
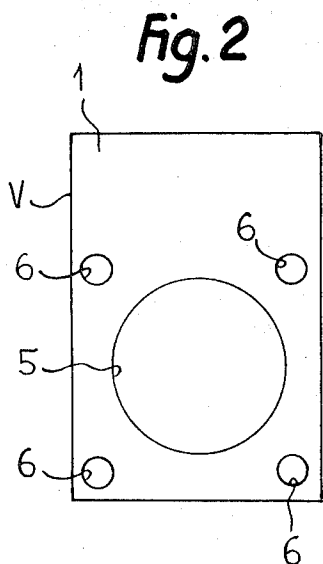
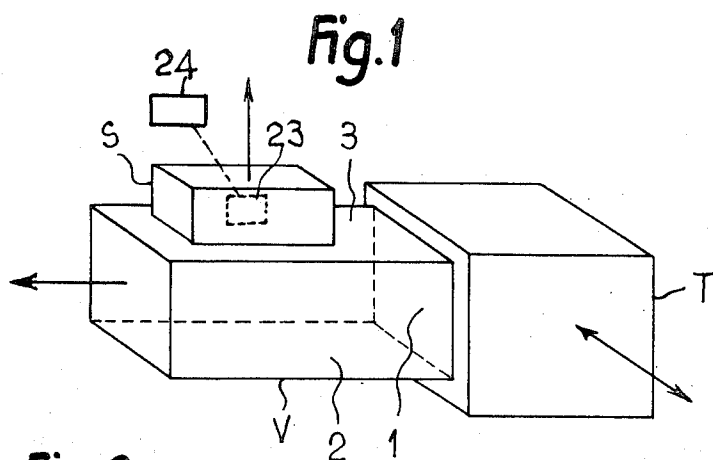
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[57] **ABSTRACT**

In electrohydraulic remote-control devices for distributor slide valves having manual or mechanical control, the control actuator of each distributor comprises a first face provided with means for fixing the actuator to the distributor such that the actuator and distributor are separable by a movement of translation of axis perpendicular to the said face, a second face of functional connection with the said forward conduit and the said return conduit, and a third face provided with means for mounting an electrovalve on the actuator such that the electrovalve is separable from the actuator by a movement of translation perpendicular to this face.

9 Claims, 8 Drawing Figures





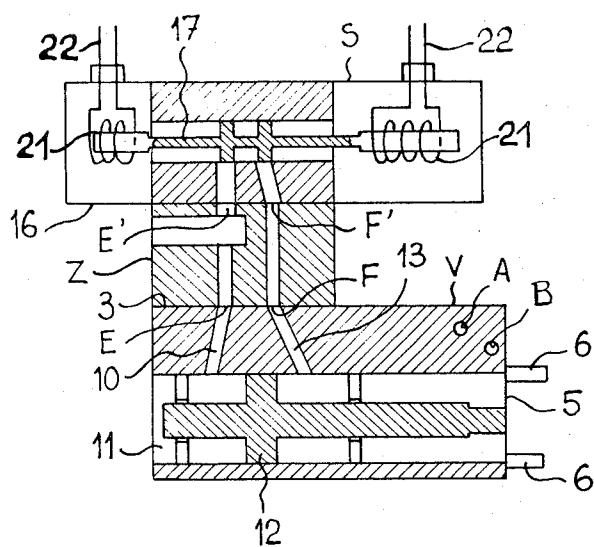


Fig. 5

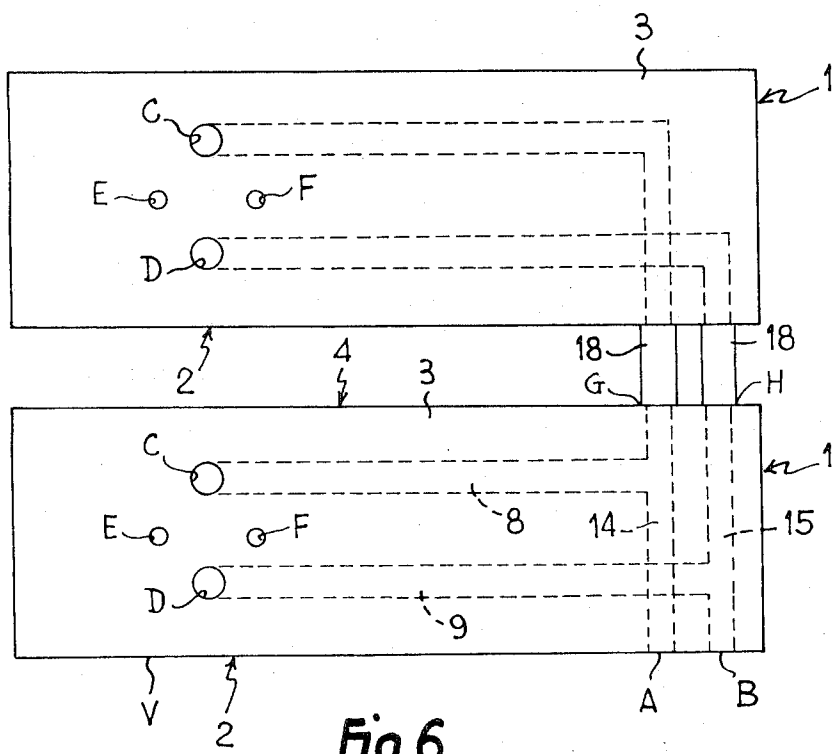


Fig. 6

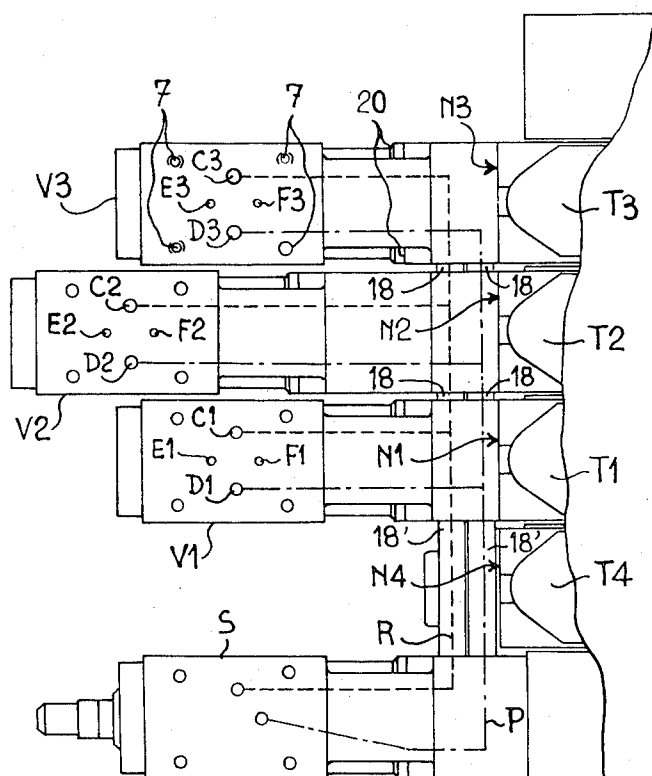


Fig. 8

ELECTROHYDRAULIC REMOTE-CONTROL DEVICES OF SLIDE DISTRIBUTORS

BACKGROUND OF THE INVENTION

The present invention concerns electrohydraulic remote control devices having a manually or mechanically operated distributor slide valve.

It is applied to remote-control devices which comprise, for each distributor, a hydraulic actuator having its piston connected to the distributor slide such that the movements of the piston are transmitted to the slide, a forward conduit and return conduit for a circuit supplying a hydraulic fluid to the actuator cylinder and a valve for controlling the conditions of supply of hydraulic fluid to the actuator cylinder.

An object of the invention is to provide a device such that the fluid conduits necessary for connecting together the different parts of the device are reduced to a minimum, so that the device is compact; an aim of the invention is also to provide a device such that any one of the distributors, actuators and valves can be easily removed as desired from the device, without this removal necessitating dismounting the remaining parts of the device.

BRIEF DESCRIPTION OF THE INVENTION

This is achieved, according to the invention, by the fact that the control actuator of each distributor comprises a first face provided with means for fixing the actuator to the distributor slide valve such that the actuator and distributor slide valve are separable by a movement of translation of axis perpendicular to the said face, a second face having an operational connection with the said forward conduit and the said return conduit, and a third face provided with means for mounting a valve on the actuator, such that the valve is separable from the actuator by a movement of translation of axis perpendicular to the said face, these three faces being mutually perpendicular, the said first face containing a passage for the mechanical connection of the piston of the actuator to the distributor slide, the said second face containing two orifices A and B, one for connection to the forward conduit and the other to the return conduit for the hydraulic fluid, and the said third face containing the orifices C, D, E, F, of four ducts formed in the body of the actuator and connecting respectively the orifice C to the said orifice A, the orifice D to the said orifice B, the orifice E to the actuator cylinder on one side of the piston and the orifice F to the actuator cylinder on the other side of the piston.

The teaching of the invention is applicable to known distributors, and in particular to distributors which, in addition to their control by an actuator, have the possibility of direct manual control or again a possibility of control by microswitch for producing control of a succession of movements.

Generally, these distributors are used in the hydraulic control circuits of a variety of machines or installations.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described solely by way of example in the accompanying drawings, in which:

FIG. 1 is a diagrammatic perspective view of an elementary system comprising a slide distributor and its

associated pilot unit comprising an actuator and a valve;

FIG. 2 is a diagrammatic plan view of the face for assembling the actuator with the distributor;

FIG. 3 is a diagrammatic plan view of the face for connecting the actuator to the hydraulic circuit;

FIG. 4 is a diagrammatic plan view of the face for mounting the actuator and the valve;

FIG. 5 is a diagrammatic section of a pilot unit comprising an actuator, a valve and an intermediate functional element;

FIG. 6 is a diagrammatic view from above of two actuators hydraulically connected together;

FIG. 7 is a longitudinal section of a hydraulic connecting tube for the hydraulic connection of the actuators, and

FIG. 8 is a view from above of an assemblage of distributors with their associated pilot units.

The dimensions of the various figures are not necessarily uniform, each figure being of a format most suitable for the purpose of explanation, and for that reason some of the figures are only partial views.

FIG. 1 shows a basic diagram of an elementary assemblage comprising a slide distributor T with its associated pilot unit comprising an actuator V and a valve S.

DESCRIPTION OF PREFERRED EMBODIMENTS

In FIG. 1, the references 1, 2 and 3 denote the face 1 of the actuator V serving for mounting the actuator V on the distributor respectively, the face 2 of the actuator serving for connecting the actuator to the forward and return conduits of the hydraulic fluid of the actuator and the face 3 of the actuator serving for mounting the valve on the actuator.

The word actuator is here used to denote the unit formed by the body of the actuator and its internal parts.

According to the present invention, these three faces are arranged respectively along the three planes of a trihedral trirectangle and are thus mutually perpendicular, so that the three parts are each separable from the part to which it is fixed by a movement of translation such that the axes of the three translations are together like the axes of a trirectangular system (or orthogonal cartesian system) of coordinates, as indicated by the arrows in FIG. 1.

FIGS. 2 to 4 illustrate diagrammatically the features of faces 1 to 3 of the actuator.

FIG. 2 shows the face 1 of the actuator which is characterised by the presence of an opening 5 for the passage of the elements connecting the piston of the actuator to the slide of the distributor, and the orifices of four bores 6 for the passage of screws for fixing the actuator to the distributor.

FIG. 3 shows the face 2 of the actuator which is characterised by the presence of two orifices A and B, one for connection to the forward conduit and the other for connection to the return conduit for the hydraulic fluid.

FIG. 4 is a diagrammatic view of the upper face 3 of the actuator showing four orifices C, D, E, F, which will be discussed later, as well as the orifices of four bores 7 for the passage of screws for fixing the valve to the actuator.

As shown in FIGS. 5 and 6, the orifices A, B, C, D, E, F of the actuator V are the termination of ducts formed in the body of the actuator and comprising:

a duct 8 connecting orifice C of face 3 of the actuator to orifice A of face 2 of the actuator;

a duct 9 connecting orifice D of face 3 of the actuator to orifice B of face 2 of the actuator;

a duct 10 connecting orifice E of face 3 of the actuator to the interior of the cylinder 11 of the actuator on one side of the actuator piston 12, and

a duct 13 connecting orifice F of face 3 of the actuator to the actuator cylinder 11 interior on the other side of the piston 12.

The actuator may also comprise ducts 14 and 15 for putting orifices A and B of face 2 of the actuator into communication with corresponding orifices G and H of an opposite face 4 of the actuator (FIG. 6) for reasons which will be explained later.

The valve S which is fixed to the actuator V by screws passing through the bores 7 opening on the face 3 of the actuator, also comprises on its lower face 16 four orifices C', D', E', F', connected respectively to the corresponding orifices C, D, E, and F of face 3 of the actuator (only the orifices E' and F' are shown in FIG. 5, which is a diagrammatic section of the assembly on a vertical plane passing through the orifices E and F, E' and F').

The valve S may be directly in contact with the actuator or may be separated from it by an intermediate functional element shown diagrammatically for example at Z in FIG. 5, which intermediate element is connected between the body of the actuator and that of the valve and has passing through it the screws for mounting the body of the valve on the body of the actuator.

Of course, the element comprises ducts respectively connecting the orifices of face 3 of the actuator to the corresponding orifices of the face 16 of the valve.

The operational element Z is, for example, a flow or pressure regulating element acting on a fluid passing through the ducts of the said intermediate element for regulating the progressiveness of operation of the distributor slide or locking it in position. The element Z may for example be a non-return valve or combined throttle and non-return valve.

The valve S comprises ducts which connect together some of the orifices C', D', E', and F' of the face 16 of the valve, such that the closure member 17 of the valve determines according to its position the establishment of fluid communication between the orifice C' and one of the orifices E' and F' with, simultaneously, the establishment of a fluid communication between the orifice D' and the other of the orifices E' and F'.

The structure of the closure member of the valve or the control means associated with it will not be described in detail, since the principles of construction of the said structure and means are well known.

An assemblage of distributors and pilot units according to the present invention has in addition the following features:

The distributors are arranged side by side on a support, such that the assembly faces of the distributors with the corresponding actuators are in line in the same plane, as is shown for example in FIG. 8, which shows a view from above of such an assemblage, with the exception of the valves, the said faces bearing the references N1 to N4 in the figure;

the distributors are mounted on their support so as to permit the removal of any one of the distributors of the assemblage after a movement of translation of the other distributors along an axis parallel to the axis of the said line;

the communication of fluid from one actuator to the next is effected by means of small pipes such as the tube 18 of FIG. 7 or the like, the ends of which are engaged in the orifices to be connected together. To ensure fluid-tightness, the end of each tube comprises for example a groove 19 for receiving a sealing ring. FIG. 6 thus shows the two pipes 18 connecting the orifices G and H of face 4 of a distributor to the orifices A and B of face 2 of another distributor which is at the end of the line. FIG. 8 shows a more complex assemblage comprising three actuators V1 to V3 with short pipes 18 between the actuators, and comprising an inlet element S connected by long pipes 18' to the first actuator V1, so that the different connecting pipes and the internal ducts such as 14 and 15 of the actuators form step-by-step a hydraulic circuit comprising a pressure conduit P and a return conduit R, starting from the element S suitably connected to a source of hydraulic fluid, not shown.

It is possible to remove any of the actuators by unscrewing the corresponding screws 20, and it is also possible to remove any of the valves by unscrewing the screws passing through the bores 7.

By way of example, it has been assumed in the figure that the actuator corresponding to the distributor T4 has been removed and suitably replaced by the long pipes 18' so that there will be no interruption of the hydraulic circuit.

The distributors T1 to T4 will not be described in detail, since they are known elements, in which the invention does not introduce any modification. In particular, it is possible to use distributors which, opposite the faces by which they are assembled with their respective actuators, are provided with means permitting manual control of the slide of each distributor.

It will be noted that in the assemblage formed according to the invention:

The circuit remains distinct from the power circuit in the interior of the same unit. In fact, the principal distribution is generally an "open centre" one, that is to say in by-pass at zero pressure when all the slides are at neutral point and, under these conditions, a common pilot circuit would not permit the rise in pressure for ensuring the control of the pilots,

separate pilot feed is effected at the level of the inlet body of the unit. It passes through a by-pass valve which, in the resting position, ensures the return to the reservoir; on energization, the circuit increases in pressure and can then actuate a pilot on the control of the corresponding valve. The pilot circuit is protected by a pressure limiter situated at the level of the inlet body;

the pilot actuator ensures the movement of the corresponding slide while it remains under pressure. When the valve is no longer energized, the two chambers of the actuator are connected to the reservoir and the spring of the slide returns the pilot-slide assemblage to the inoperative position;

the addition of a locking system (between actuator and valve) permits the slide to remain in the operative position once the pilot pressure ceases. A fresh control-

operation of the valve becomes necessary for return to the central position;

each valve is flanged onto the pilot which it controls, thereby permitting its immediate replacement in case of failure. This arrangement in addition permits the addition of sandwich-mounted regulating elements, such as non-return valve or a throttle combined with non-return valve for regulating the speed of movement of the slide and thus ensuring progressiveness of passage.

This arrangement retains the conventional advantages of distribution in juxtaposed elements which are briefly as follows:

Multiple distribution system, independent, parallel, series or combined;

numerous combinations in the establishment of circuits, single at one pressure, selective with staging of pressure, double with central return, etc.;

varied internal changes of connections of the power circuit;

linking of controls; piloted, manual or mechanical, permitting either an adjustment or emergency control;

possibility of adding numerous accessories, such as over-pressure valves with forcing or forcible supply, piloted non-return valves, intermediate pressure limiters, micro-switch control, etc.

It should be noted that the control of the valve S of the device of the invention may be any one of the known types of control. For example, this control is of the electrical type, in which case the valve is an electro-valve, as in the case shown, in which the control solenoids have been shown diagrammatically at 21 with their supply leads 22 (FIG. 5); it is also possible to use a hydropneumatic pilot valve, in which case the solenoid or solenoids are replaced by a pneumatic control element 23, controlled in turn by an external electric circuit 24 (FIG. 1) by either electro-valves or a logical circuit. Since the structure of the control elements in itself does not form part of the invention, these elements have been shown only diagrammatically in the figures.

The devices of the present invention have their applications in distributors used for the control of various movements, independent or coupled, and are applied particularly to machine tools, handling devices and other machines used in various technical fields, such as in particular public works, mining operations and transport and agricultural industries.

I claim:

1. A hydraulic actuator comprising:

a. a body having first, second, and third mutually perpendicular faces, a cylinder formed in said body, a piston slidable within said cylinder, and a rod fixed to and movable with said piston,

b. said first face having an opening aligned with said cylinder through which said rod can move to transmit movement of said piston to a device being operated by said actuator, said first face also being

provided with means for securing the actuator to such a device,

c. said second face having two ports for connection to the supply and return conduits of a source of pressurized hydraulic fluid,

d. said third face having four orifices, duct means within said body connecting a first pair of said orifices to said two ports, respectively, and duct means within said body connecting a second pair of said orifices to said cylinder, one on each side of said piston, and

e. a valve mounted on said third face for controlling the flow of hydraulic fluid between said orifices, thereby controlling the movement of said piston.

2. A hydraulic actuator as defined in claim 1 wherein said body has a fourth face opposite its second face, said fourth face having two ports, and duct means within said body for connecting said two ports in said second face to said two ports in said fourth face, respectively.

3. A hydraulic actuator as defined in claim 1 wherein said means for securing the first face of said actuator to a device include screws whose axes are perpendicular to said first face, and including screws for securing said valve to said third face of said actuator, the axes of said screws being perpendicular to said third face.

4. A hydraulic actuator as defined in claim 1 wherein said valve has four orifices connected to the four orifices, respectively, in said third face, and a movable valve member for permitting communication either between a first of said orifices and a third and fourth of said orifices or a second of said orifices and said third and fourth of said orifices, said third and fourth orifices communicating with said second pair of orifices in said third face.

5. A hydraulic actuator as defined in claim 4 wherein said valve has a single face formed with said four orifices, said valve face being in contact with said third face of said body.

6. A hydraulic actuator as defined in claim 4 including a member between said valve and said third face of said body, screws passing through said valve, member, and third face to secure said valve and member to said body, said member having duct means for interconnecting said four orifices of said valve to said four orifices in said third face, respectively.

7. A hydraulic actuator as defined in claim 1 wherein said valve is electrically controlled.

8. A hydraulic actuator as defined in claim 1 wherein said valve is pneumatically controlled.

9. A hydraulic actuator as defined in claim 1 assembled side-by-side with a plurality of other identical actuators, all of said first faces of the actuators being in a single plane, said second faces of each pair of adjacent actuators facing each other, said two ports of said facing second faces being interconnected by separate conduit means.

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