

[54] **CIRCUIT FOR FEEDING PRESSURISED FLUID BY TWO MAIN SOURCES AND AN AUXILIARY SOURCE** 3,641,765 2/1972 Hancock et al..... 60/486 X
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[22] Filed: **Apr. 2, 1973**

[21] Appl. No.: **347,134**

[30] **Foreign Application Priority Data**
Apr. 25, 1972 France.....72.14710

[52] U.S. Cl..... **60/486, 60/488, 91/414**

[51] Int. Cl..... **F15b 13/06, F15b 13/09**

[58] Field of Search 60/464, 484, 486, 488

[56] **References Cited**
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[57] **ABSTRACT**

An improved hydraulic circuit for supplying pressurized fluid to two main load elements or motors is disclosed in which a series of distributor valves are connected in a predetermined array to prevent loss of make-up fluid flow to the reservoir when one of the loads or motors is stopped.

6 Claims, 3 Drawing Figures

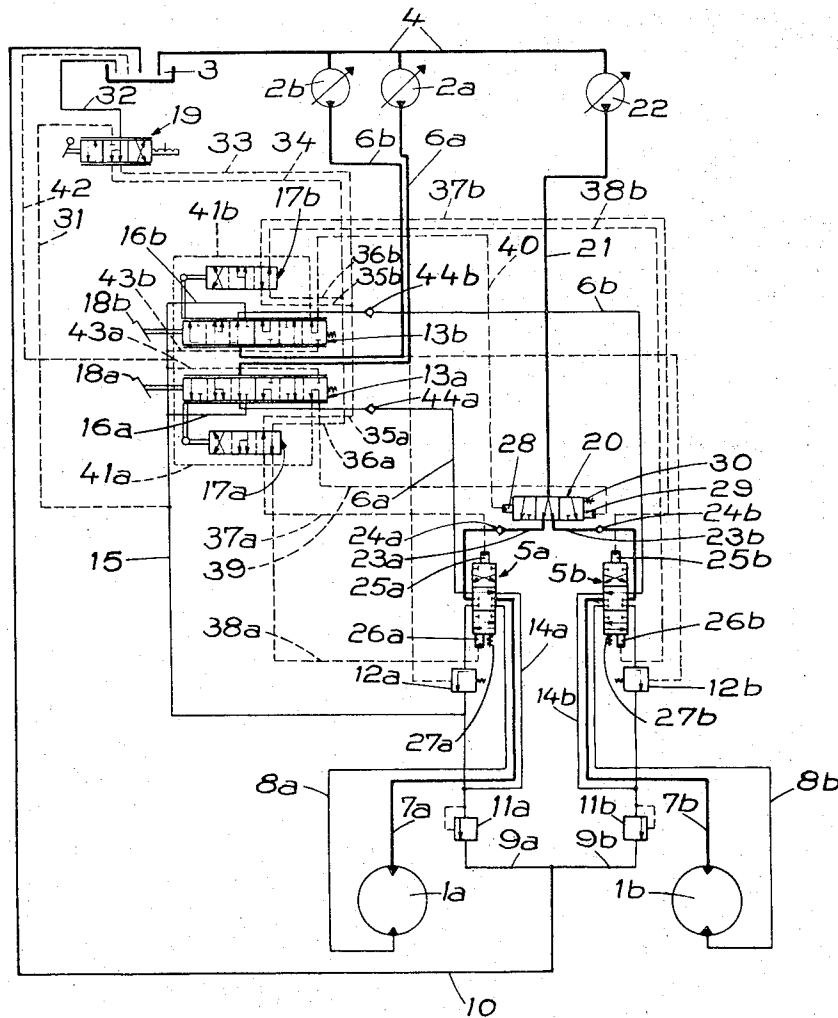
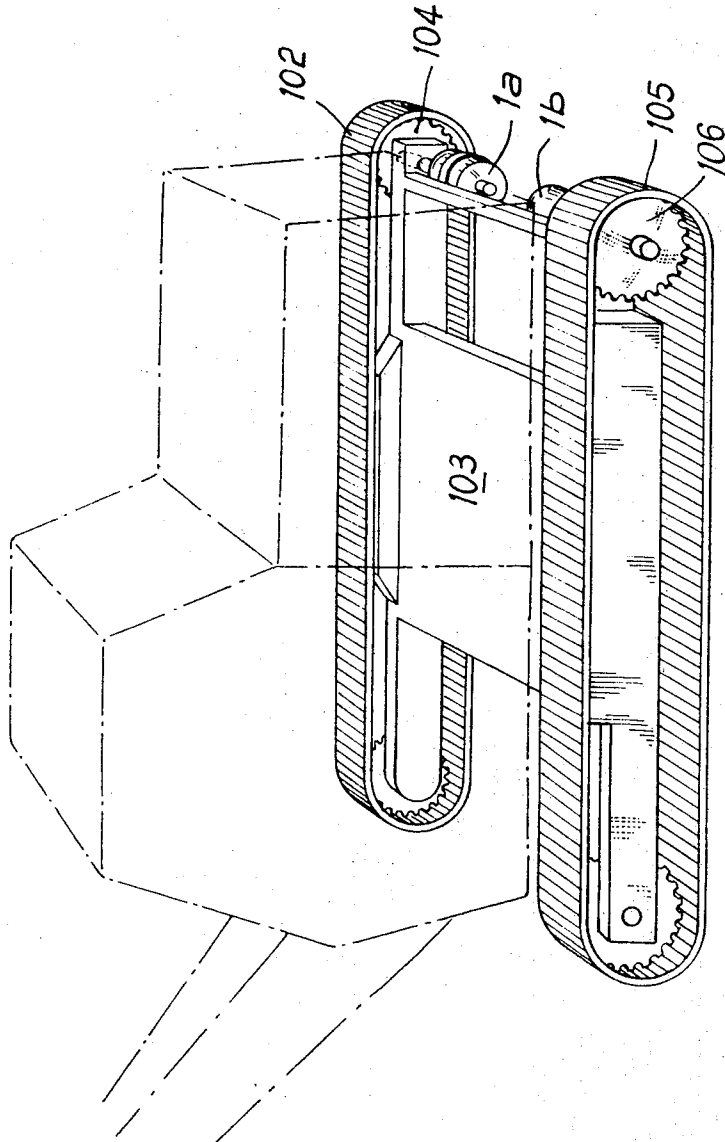


Fig. 1



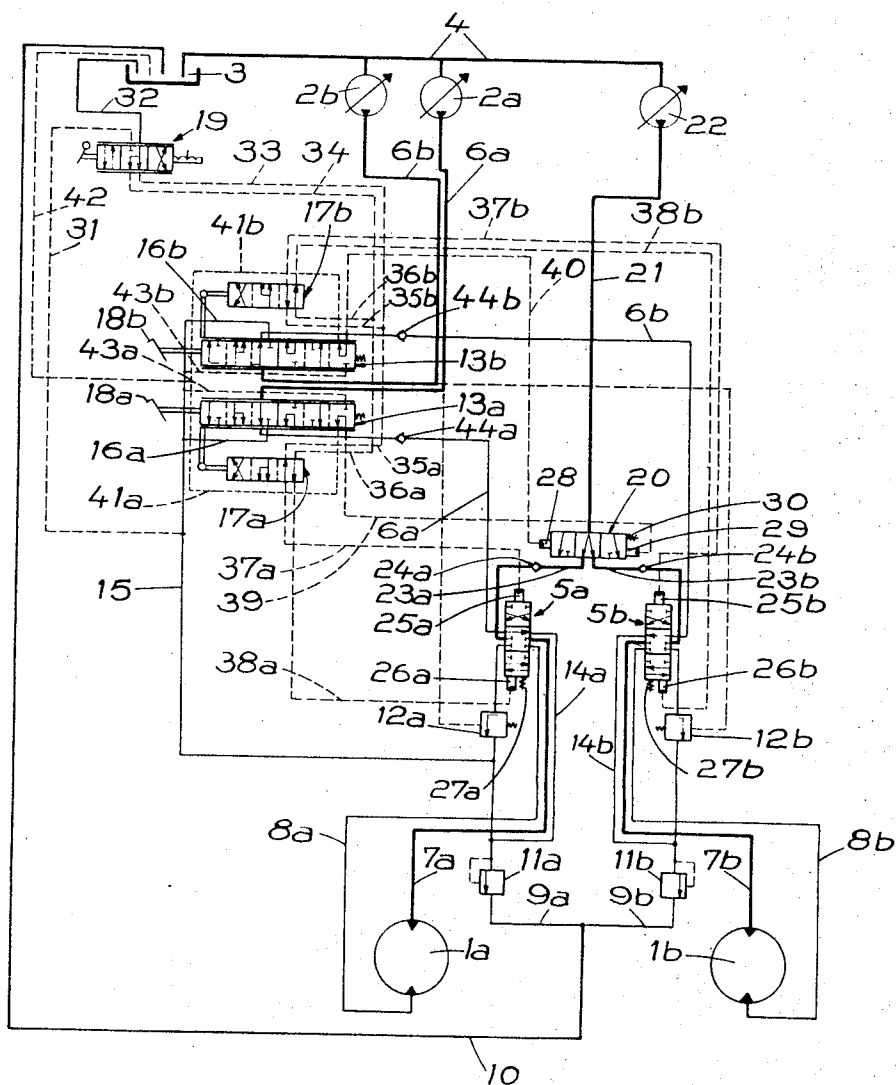


Fig. 2

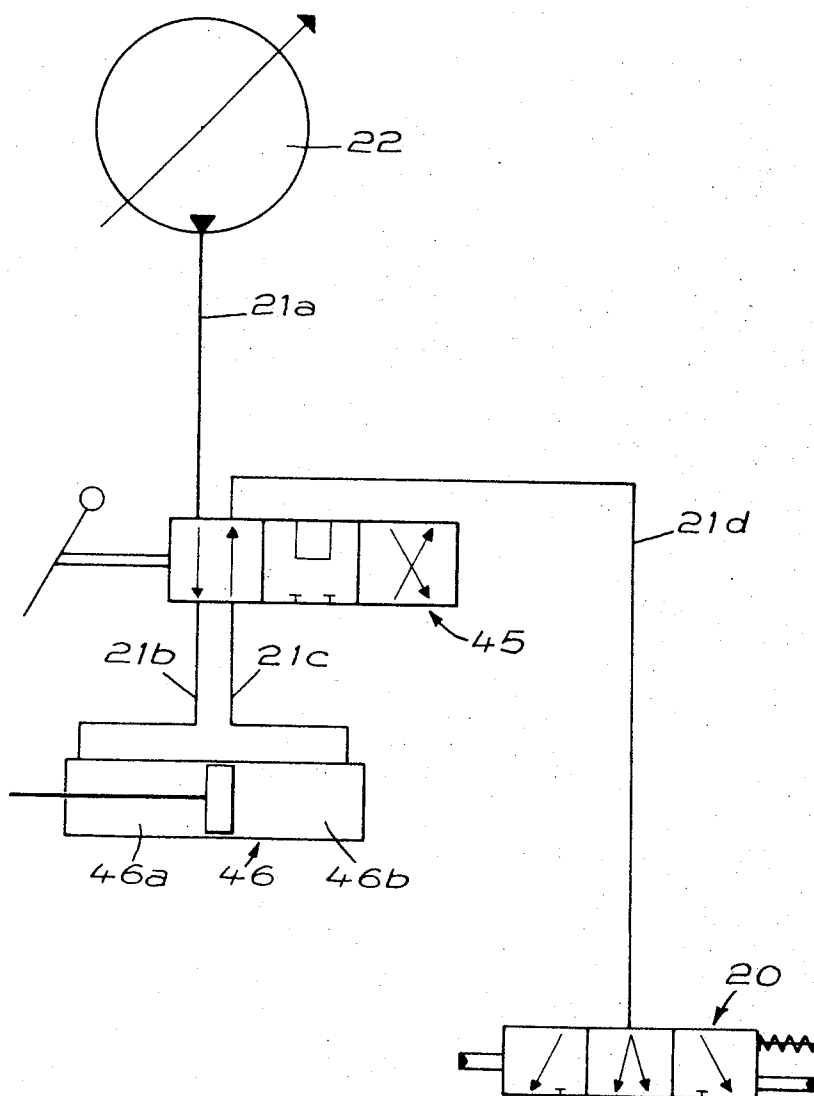


Fig. 3

CIRCUIT FOR FEEDING PRESSURISED FLUID BY TWO MAIN SOURCES AND AN AUXILIARY SOURCE

The present invention relates to a circuit for feeding pressurised fluid by two main sources and an auxiliary source.

Fluid feed circuits are already known which comprise two load elements, which are each fed through a pump and which occasionally receive a make-up flow from a third, so-called auxiliary pump. The drawback of such circuits resides in the fact that the make-up flow is usually directed indistinctively and concomitantly towards the two load elements. When the stopping of one of these load elements has just been controlled, this results, in the known circuits, in the corresponding main pump being placed in communication with the fluid reservoir, but also in the make-up flow being sent to the reservoir, this flow being necessarily conveyed in the direction of least resistance to its flow. This results in the pure and simple loss of this make-up flow.

In order to remedy this disadvantage, the invention proposes a new circuit for feeding pressurised fluid to at least two load elements by three sources of pressurised fluid. This circuit is constituted by:

a first source of pressurised fluid connected to a first load element by a first feed conduit,

a first two-way distributor interposed in the first feed conduit and in a first delivery conduit, with which the first load element is provided, whilst, in its first position, said first distributor effects the continuity of the first feed conduit and the isolation of this conduit from the first delivery conduit and that in its second position, the first distributor effects the connection of said first feed and delivery conduits,

a second source of pressurised fluid connected to a second load element by a second feed conduit,

a third source of pressurised fluid possibly connected to a third load element by a third feed conduit,

a connecting member effecting the connection in parallel, on said third feed conduit, of fourth and fifth conduits, which are connected in shunt, respectively, to the first and second feed conduits.

In this circuit, the connection member consists of a distributor valve with at least two positions. The movable member of said valve is coupled on the one hand to a drive member, on the other hand to an elastic element, the effects of said drive member and elastic element being antagonistic, whilst, when the drive member is actuated, its effect predominates that of the elastic element, said drive member then disposing the movable member of the valve in a first position, in which said valve effects the connection of the third feed conduit with the fifth conduit and isolates the fourth conduit from said third and fifth conduits, and that, when the elastic element acts alone, said elastic element has for its effect to dispose the movable member of the valve in a second position, in which this valve effectively assures the connection in parallel, on the third feed conduit, of the fourth and fifth conduits. A link member connects the first distributor to said drive member and is such that to the second position of said first distributor there corresponds the actuation of said drive member, and that to the first position of this first distributor there corresponds the sole action of the elastic element on the movable member of the valve.

The drive member is advantageously constituted as a pressurised fluid motor. A secondary distributor is coupled to the first distributor and comprises two positions which correspond, the first, to the first position of said first distributor, the second, to the second position of this first distributor. A sixth conduit connects said fluid motor to said secondary distributor, whilst this secondary distributor connects, in its first position, said sixth conduit to a fluid reservoir and, in its second position, this sixth conduit to a source of pressurised fluid.

The fluid motor is preferably constituted as a jack.

Finally, first and second non-return valves are disposed respectively in the fourth and fifth conduits and allow the passage of the fluid in said fourth and fifth conduits solely, towards the first and second conduits respectively.

The invention will be more readily understood on reading the following description with reference to the accompanying drawings, in which:

FIG. 1 is a partial perspective view of a machine applying a feed circuit according to the invention;

FIG. 2 shows the scheme of the feed circuit in accordance with the invention applied in the machine of FIG. 1;

FIG. 3 shows in detail a variant of the scheme of FIG. 2.

The circuit shown in FIG. 2 is intended for feeding hydraulic motors *1a* and *1b* driving right-hand endless tracks *102* and left-hand ones *105*, respectively, of a machine shown in FIG. 1. The frames of the motors *1a* and *1b* are fixed, as is known, on the chassis *103* of the machine (a hydraulic shovel), whilst the respective driven shafts of said motors are coupled to the drive sprocket wheels *104* and *106* of endless tracks *102* and *105*.

Pumps *2a* and *2b* are connected to a reservoir *3* by a conduit *4* and to distributors *5a* and *5b* respectively by conduits *6a*, *6b*. Conduits *7a*, *7b* and *8a*, *8b* also terminate at distributors *5a*, *5b*, said conduits being connected to the supply and delivery ports of motors *1a*, *1b*. Furthermore, conduits *9a*, *9b* connect the distributors *5a*, *5b* to a single conduit *10* which returns to reservoir *3*. Calibrated valves *11a*, *11b* are interposed between the distributors *5a*, *5b* and conduit *10*. Moreover, in known manner, second calibrated valves *12a*, *12b* are interposed between the distributors *5a*, *5b* and valves *11a*, *11b* and are controlled by the pressure of the fluid contained in conduits *6a*, *7b*, upstream of distributors *13a*, *13b* disposed on said conduits between the pumps *1a*, *1b* and the distributors *5a*, *5b*. Conduits *14a*, *14b* connect the distributors *5a*, *5b* to conduits *9a*, *9b*, between valves *11a*–*12a* and *11b*–*12b*.

A conduit *15* is connected in shunt on conduit *9a* between valves *11a* and *12a*. It is divided into two other conduits *16a*, *16b* which are connected to distributors *13a*, *13b*.

It will be noted that distributors *17a*, *17b* are coupled respectively to distributors *13a*, *13b*, which are provided with control pedals *18a*, *18b*. Finally, a general distributor *19* for selecting the direction of rotation of the motors *1a*, *1a* is also provided. Moreover, a last distributor, distributor *20*, is connected to the delivery conduit *21* of a third pump *22*, which is itself connected to reservoir *3* by conduit *4*. Two conduits *23a*, *23b* are connected to distributor *20* and to conduits *6a*, *6b*, respectively. Non-return valves *24a*, *24b* are disposed in these two conduits and allow the passage of the fluid

from distributor 20 towards the conduits 6a on the one hand and 6b on the other hand.

All the above-mentioned distributors are three-way, although, in accordance with the invention, it is necessary for certain of them only to have at least two positions. Furthermore, a jack with two chambers 25a, 26a, is coupled to distributor 5a, as well as a spring 27a. Similarly, a jack with two chambers 25b, 26b is coupled to distributor 5b, as well as a spring 27b. Finally, a jack with two chambers 28, 29 and a spring 30 are coupled to distributor 20.

It will be noted that the following connections are made:

a conduit 31 connects conduit 15 to the distributor 19;

a conduit 32 connects distributor 19 to reservoir 3;

two conduits 33 and 34 are connected to the distributor 19 and are divided, conduit 33, into two conduits 35a, 35b connected to distributors 17a, 17b, and conduit 34, into two conduits 36a, 36b connected to distributors 17a, 17b, respectively.

two conduits 37a, 38a are connected to the distributor 17a, and to chambers 25a, 26a respectively.

two conduits 37b, 38b are connected to distributor 17b and to chambers 25b, 26b respectively;

two conduits 39, 40 are connected, conduit 39 to distributor 13a on the one hand and chamber 29 on the other hand, and conduit 40, to distributor 13b on the one hand and chamber 28 on the other hand.

two conduits 41a, 41b connected respectively to distributors 13a, 13b are connected to a conduit 42 which returns to reservoir 3;

two conduits 43a, 43b, connected to distributors 13a, 13b respectively, are connected to conduit 15.

Furthermore, the distributors effect the following connections as a function of their different positions.

Distributor 5a: in its first position, communication of conduits 8a and 9a, and 6a and 7a, and isolates or prevents flow to and from the conduit 14a; in its second position, isolates or prevents flow to and from conduits 7a, 8a and 9a, and communication of conduits 6a and 14a; in its third position, communication of conduits 6a and 8a, and 7a and 9a, isolates or prevents flow to and from conduit 14a;

Distributor 5b: in its first position, communication of conduits 8b and 9b, and 6b and 7b, and isolates or prevents flow to and from conduit 14b, in its second position, isolates or prevents flow to and from conduits 7b, 8b, and 9b, and communication of conduits 6b and 14b; in its third position, communication of conduits 6b and 8b; and 7b and 9b, and isolates or prevents flow to and from conduit 14b;

Distributor 13a: in its first and third positions, communication of conduits 39 and 41a, and isolates or prevents flow to and from conduits 16a and 43a; in its second position, communication of conduits 39 and 43a and 6a and 16a, and isolates or prevents flow to and from conduit 41a. In the three positions, the conduit 6a receives fluid from the distributor 13a;

Distributor 13b: in its first and third positions, communication of conduits 40 and 41b, and isolates or prevents flow to and from conduits 16b and 43b; in

its second position, communication of conduits 40 and 43b, and 6b and 16b, and isolates or prevents flow to and from conduit 41b. In the three positions, the conduit 6b receives fluid from the distributor 13b;

Distributor 17a: in its first position, communication of conduits 36a and 38a, and 35a and 37a; in its second position, communication of conduits 36a, 37a and 38a, and isolates or prevents flow to and from conduit 35a; in its third position, communication of conduits 35a and 38a, and 36a and 37a;

Distributor 17b: in its first position, communication of conduits 36b and 38b, and 35b and 37b; in its second position, communication of conduits 36b, 37b and 38b, and isolates or prevents flow to and from conduit 35b; in its third position, communication of conduits 35b and 38b, and 36b and 37b.

Distributor 19: in its first position, communication of conduits 31 and 34, and 32 and 33; in its second position, communication of conduits 32, 33 and 34, and isolates or prevents flow to and from conduit 31; in its third position, communication of conduits 31 and 33, and 32 and 34;

Distributor 20: in its first position, communication of conduit 21 with conduits 23a and 23b; in its second position, communication of conduits 21 and 23a, and isolates or prevents flow to and from conduit 23b; in its third position, communication of conduits 21 and 23b, and isolates or prevents flow to and from conduit 23a.

It will further be noted that non-return valves 44a and 44b are arranged, as is known, in conduits 6a and 6b, respectively, between the distributors 13a and 5a, and 13b and 5b. These valves allow the passage of fluid from distributor 13a towards distributor 5a, and from distributor 13b towards distributor 5b, respectively.

Finally, with reference to FIG. 3, there is shown a variant consisting of the circuit which often replaces conduit 21. The presence is noted of a threeway distributor 45, and of a jack 46 of a power-assisted member of the machine with two chambers 46a and 46b. A conduit 21a connects pump 22 to the distributor 45; conduits 21b and 21c connect the distributor 45, respectively, to chambers 46a and 46b; finally, a conduit 21d connects the distributors 45 and 20.

The distributor 45 ensures: in its first position the communication of conduits 21a and 21b, and 21c and 21d; in its second position, the communication of conduits 21a and 21d and the isolates or prevents flow to and from conduits 21b and 21c; finally, in its third position, the communication of conduits 21a and 21c, and 21b and 21d.

The circuit which has just been described functions as follows. However, to simplify matters, the detailed recital of the different phases of operation which are already known per se will not be made. Thus, the stopping of one of motors 1a or 1b is progressive due to the adoption of known means and consequently the particular functioning relative to the implementation of said means has not been described.

Since it has been indicated hereinbefore and since it is known per se, the distributor 19 is also known to allow the choice of the directions of rotation of motors 1a and 1b under permanent working conditions, i. e. in the example of the application described herein, the direction of displacement of the machine. In the follow-

ing, it is assumed that this distributor 19 has been placed in its first position.

Furthermore, it is known that the first parts of the distributors 13a and 13b, by means of which are effected the branching on conduits 6a, 6b or the isolation or closing of conduits 16a, 16b, are precisely used for effecting the passage of the corresponding motors 1a, 1b of the pressurised fluid feed at stop. Hereinafter, two phases of functioning will be envisaged, which correspond respectively, the first phase to distributors 13a and 13b disposed in their first position, and the second phase, to distributor 13a disposed in its second position, the distributor 13b remaining in its first position.

In the first phase of operation, the fluid contained in conduit 15 arrives via conduits 31 and 34 respectively into conduits 36a, 38a and into chamber 26a, and into conduits 36b, 38b, and in chamber 26b. Furthermore, the fluid contained in chambers 25a, 25b returns to reservoir 3 through conduits 37a, 35a and 37b, 35b, and via conduits 33 and 32. The distributors 5a, 5b are then placed in their first position. The motors 1a, 1b are fed by pumps 2a, 2b and the conduits 6a, 7a and 6b, 7b and deliver to reservoir 3 via conduits 8a, 9a, and 8b, 9b, and conduit 10. The fluid discharged by pump 22 and contained in conduit 21 is directed in parallel towards conduits 23a, 23b and is used as make-up fluid in conduits 6a, 6b. Of course, the valves 23a, 23b avoid untimely returns of fluid from conduits 6a, 6b towards conduits 23a, 23b and especially from conduit 6a towards conduit 6b, or vice versa. It will have been noted that the distributor 20 has been disposed in its first position. This has been made possible by the chambers 28 and 29 being placed in communication with the reservoir 3 via conduits 40, 41b, and 39 and 41a, and via conduit 42, and the spring 30 maintaining the distributor 20 in its first position, in the absence of pressurised fluid, in chambers 28 and 29.

In the second phase of functioning, only the distributor 13a is manoeuvred, to be placed into its second position. This has for its effect also to place distributor 17a into its second position, this therefore placing conduits 37a and 38a in communication with conduit 36a and with each other. In this way, the pressures of the fluid in the chambers 25a and 26a are equal, and the spring 27a returns distributor 5a into its second position and holds it there. The conduits 7a and 8a are isolated or closed from distributor 5a and the motor 1a is locked in stop position.

Furthermore, the fluid delivered by pump 2a in the conduit 6a is at the same pressure as that contained in conduit 16a, since these two conduits have been placed in communication. Via conduits 16a, 15, 9a and 10, and through the calibrated valve 11a, this fluid returns to reservoir 3. It is therefore important, in this phase of operation, to avoid directing the make-up fluid, delivered from pump 22 in conduit 21, into conduits 23a, then 6a, because, in that case, this make-up fluid would itself return to reservoir 3, according to what happens in heretofore known circuits.

In accordance with the invention, there is no question of this, and the make-up fluid is then directly solely towards conduits 23b and 6b, and thus towards motor 1b, which has remained in operation. In fact, in its second position, the distributor 13a places conduits 39 and 43a in communication and therefore places chamber 29 in communication with the fluid contained in the

conduits 15, 43a and 39. The action of this fluid in the chamber 29 has as its effect to dispose the distributor 20 in its third position, in which the conduit 23a is isolated or closed and the conduits 21 and 23b are alone placed in communication.

A very similar functioning, which is unnecessary to describe, would have been obtained by disposing the distributors 13a and 13b, respectively, in their first and second position. Of course, in this case, the obturated conduit would have been conduit 23b and conduits 21 and 23a would have been placed in communication.

The advantage of the circuit shown, which resides in the recuperation of the make-up fluid contained in conduit 21, will be easily seen.

Now, in fact, the conduit 21 is very often replaced by the circuit shown in FIG. 3. The driver places the distributor 45 in its first position, for example, in order to actuate the jack 46 in a first direction. The fluid delivered by pump 22 reaches chamber 46a via conduits 21a, 21b. The piston of jack 46 moves and delivers the fluid from chamber 46b into conduits 21c and 21d. It is this fluid which constitutes the make-up fluid.

When, finally, the driver no longer wishes to actuate the jack 46, he places the distributor 45 into its second position. The fluid contained in chambers 46a and 46b is contained in said chambers, this causing the jack 46 to be locked. As to the fluid delivered by pump 22, it is directed in conduits 21a and 21d towards the distributor 20. It is this fluid which, this time, constitutes the make-up fluid.

In any case, it is obviously always advantageous to recuperate the make-up fluid, this enabling the circuit described in FIG. 2 to be adopted.

What we claim is:

1. A circuit for feeding pressurised fluid, to at least two load elements by three sources of pressurised fluid, constituted by:

- a first source of pressurised fluid connected to a first load element by a first feed conduit,
- a first two-way distributor interposed in the first feed conduit and in a first delivery conduit, with which the first load element is provided, whilst, in its first position, said first distributor effects the continuity of the first feed conduit and the obstruction of the first delivery conduit and that in its second position, the first distributor effects the connection of said first feed and delivery conduits,
- a second source of pressurised fluid possibly connected to a second load element by a second feed conduit,
- a third source of pressurised fluid possibly connected to a third load element by a third feed conduit,
- a connecting member effecting the connection in parallel, on said third feed conduit, of fourth and fifth conduits, which are connected in shunt, respectively, to the first and second feed conduits, wherein the connection member is constituted as a distributor valve having at least two positions, the movable member of said valve is coupled on the one hand to a drive member, and on the other hand to an elastic element, the effects of said drive member and elastic element being antagonistic, whilst, when the drive member is actuated, its effect predominates that of the elastic element, said drive member then disposing the movable member of the valve into a first position, in which said valve effects the connection of the third feed conduit with

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the fifth conduit and isolates the fourth conduit from said third and fifth conduits, and that, when the elastic element acts alone, said elastic element has for its effect to dispose the movable member of the valve into a second position, in which this valve effectively assures the connection in parallel, on the third feed conduit, of the fourth and fifth conduits; finally, a link member connects the first distributor to said drive member and is such that in the second position of said first distributor there corresponds the actuation of said drive member, and that in the first position of the first distributor there corresponds the sole action of the elastic element on the movable member of the valve.

2. Feed circuit as claimed in claim 1, wherein the drive member is constituted as a pressurised fluid motor, a secondary distributor is coupled to the first distributor and has two positions which correspond, the first, to the first position of said first distributor, the second, to the second position of this first distributor, a sixth conduit connects said fluid motor to said secondary distributor, and this secondary distributor con-

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nects, in its first position, said sixth conduit to a fluid reservoir and, in its second position, this sixth conduit to a source of pressurised fluid.

3. Feed circuit as claimed in claim 2, wherein the fluid motor is constituted as a jack.

4. Feed circuit as claimed in claim 1, wherein first and second non-return valves are disposed respectively in the fourth and fifth conduits and allow the passage of the fluid in said fourth and fifth conduits solely, towards the first and second conduits, respectively.

5. Feed circuit as claimed in claim 2, wherein first and second non-return valves are disposed respectively in the fourth and fifth conduits and allow the passage of the fluid in said fourth and fifth conduits solely, towards the first and second conduits, respectively.

6. Feed circuit as claimed in claim 3, wherein first and second non-return valves are disposed respectively in the fourth and fifth conduits and allow the passage of the fluid in said fourth and fifth conduits solely, towards the first and second conduits, respectively.

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