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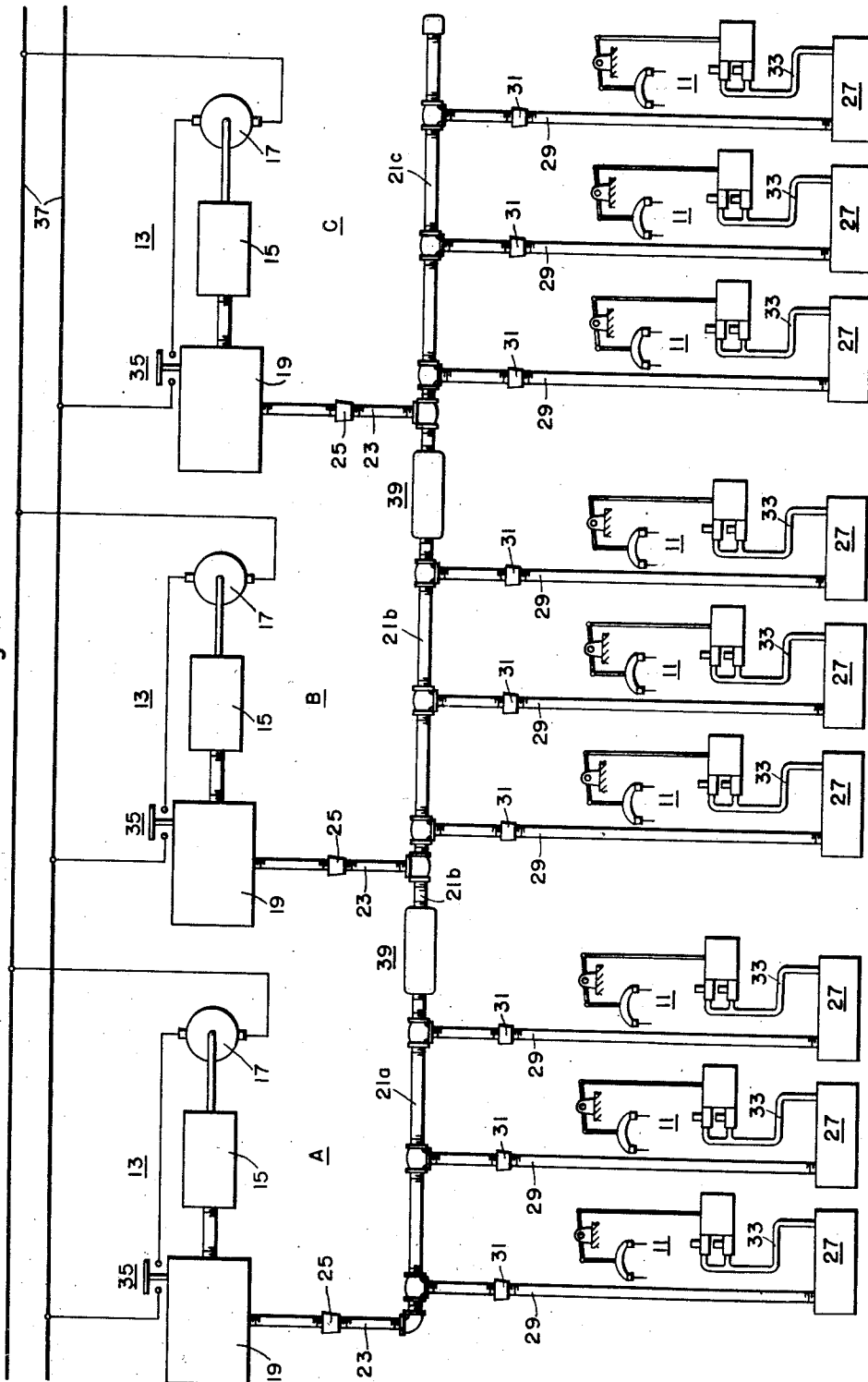
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SECTIONALIZED FLUID CONTROL

Filed June 15, 1954

2 Sheets-Sheet 1

Fig. 1.



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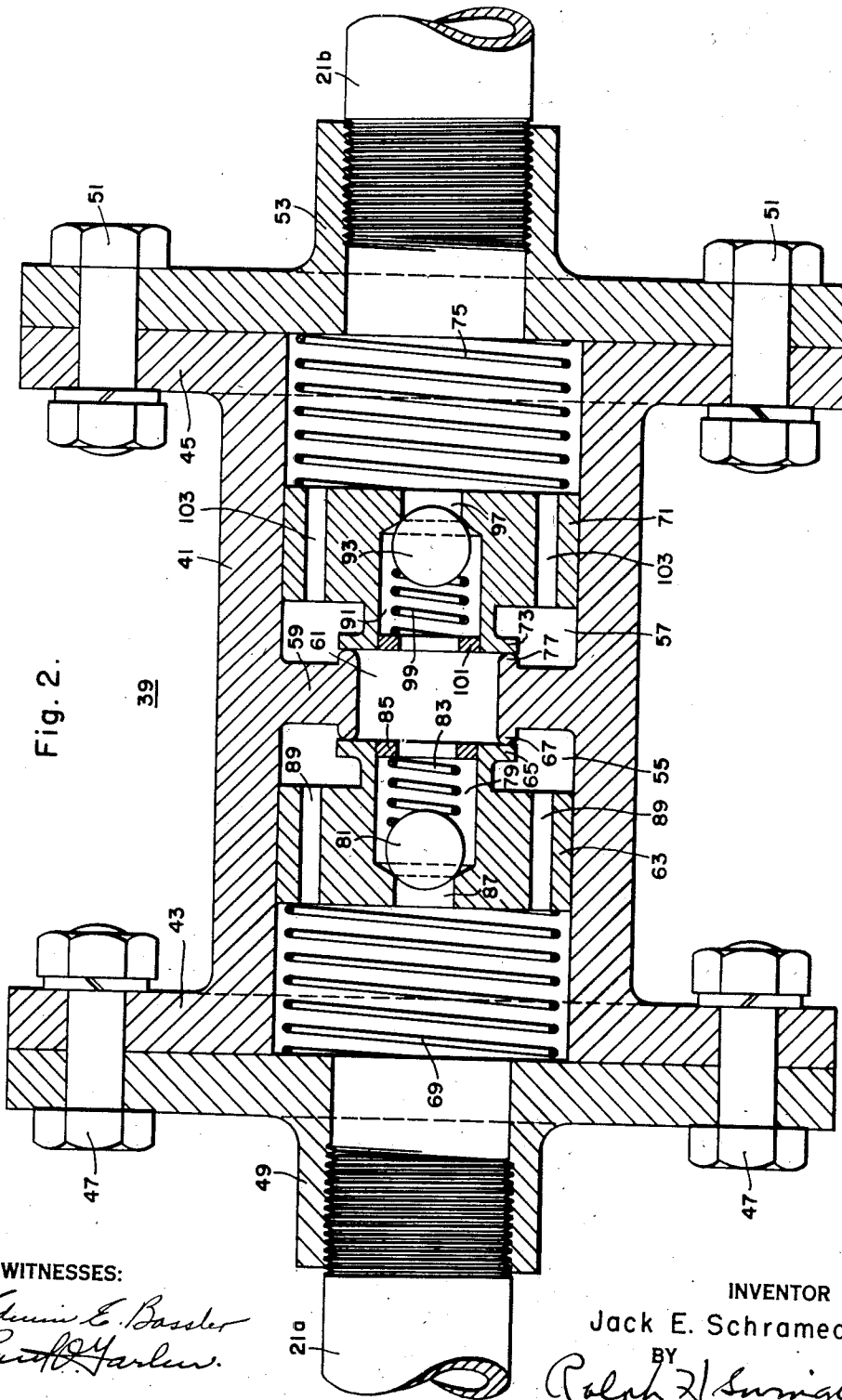
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SECTIONALIZED FLUID CONTROL

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9 Claims. (Cl. 137--255)

This invention relates to fluid pressure supply systems for supplying fluid pressure to a plurality of compressed fluid operated circuit interrupters, and more particularly to sectionalizing valves for automatically controlling the flow of compressed fluid between sections of such systems.

In conventional installations of large, compressed air operated circuit breakers, compressed air for operating a plurality of circuit breakers is supplied by one or more compressor units feeding air under pressure into a common header. Such compressed air supply systems become inadequate when additional circuit breakers are added to the installation, since the amount of system air leakage increases and the demand for bleeding air through tubes for insulating purposes becomes greater. The operating pressure in the system is maintained from the compressors by feed valves such as pressure reducing valves which open at a predetermined drop in pressure in the system, or other pressure sensitive devices. Such devices are not exact in their settings, or in time are subject to changes in their setting. The result is that one of the pressure sensitive devices usually functions to cause one compressor of the system to make up all of the leakage of the system and this compressor will run while the others do not. It is essential, therefore, to control the system so that any one of the compressors does not run substantially more than the other compressors of the system so that one of the compressors does not receive a disproportionate amount of wear.

In order that each of the several compressors will make up its share of the leakage losses and thus run approximately the same amount as the other compressors, the feed valves can be adjusted periodically so that each valve will function at the same predetermined pressure. This is a difficult operation, however, which involves setting each feed valve to gage while the other valves are not feeding the system. Also, the system must be bled down to be certain of the proper functioning of the valves.

Electrically or manually operated sectionalizing valves could be provided, but such valves have a serious disadvantage in the time delay required for their operation for emergency demands, that is, several breaker operations or failure of one or more sections of the system to be supplied from its own compressor.

An object of the invention is to provide a compressed air supply system for a circuit breaker installation, which is automatically sectionalized to distribute compressor operation.

Another object of the invention is to provide a multiple circuit breaker installation having a compressed air supply system comprising a plurality of compressor units with means for automatically sectionalizing the supply system to distribute compressor operation.

Another object of the invention is to provide a multiple circuit breaker installation having a compressed air supply system comprising a plurality of compressor units

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with automatic sectionalizing valves for distributing compressor operation.

Another object of the invention is to provide a compressed air supply system embodying a plurality of compressor units with pneumatically operated sectionalizing valves for distributing compressor operation.

The invention both as to structure and operation, together with additional objects and advantages thereof, will be best understood from the following detailed description thereof when read in conjunction with the accompanying drawings.

In said drawings:

Figure 1 is a schematic view of a compressed air supply system embodying the principles of the invention; and

Fig. 2 is an enlarged sectional view of the sectionalizing valve.

Referring to Fig. 1 of the drawings, the compressed air supply system is divided into sections designated as A, B and C, each of which supplies compressed air for operating a plurality of circuit breakers 11. Each section of the supply system includes its own compressor unit indicated generally at 13. Each compressor unit comprises a compressor 15 driven by a motor 17, and a main storage tank 19. Each of the main storage tanks 19 are connected to a supply conduit or pipe 21 by a pipe 23 which has a feed valve 25 therein. The header or supply pipe 21 for each section is connected to auxiliary storage tanks 27, there being an auxiliary tank 27 provided for each circuit breaker, by means of pipes 29 in each of which is connected a check valve 31. Each of the auxiliary tanks 27 is connected by a pipe 33 to the operating means of the associated circuit breaker 11.

Each of the main storage tanks 19 is provided with a pressure responsive switch 35 which closes and effects energization of the motor 17 when the pressure in the tank drops to, for example, 260 p. s. i., and opens as the pressure in the tank is built up to, for instance, 360 p. s. i. The motors 17 are energized from supply lines 37. The feed valves or pressure reducing valves 25 are set to open when the pressure in the auxiliary storage tanks falls below, for example, 150 p. s. i. The check valves 31 permit compressed air to flow into the auxiliary tanks but prevent the flow of compressed air from the auxiliary storage tanks back into the supply system. This maintains sufficient compressed air in each of the auxiliary storage tanks for several operations of the associated circuit breaker in the event that one or more breakers undergo a severe operating duty.

The sections A, B and C of the supply system are separated by automatic sectionalizing valve units indicated generally at 39 (Figs. 1 and 2). The purpose of the valves 39 is to prevent flow of compressed air from one section of the system to another in response to slight differences in air pressure between the sections, and to permit compressed air to flow between sections of the system in response to a more severe drop in pressure in one of the sections, thus maintaining adequate working pressure in all of the sections of the supply system.

The sectionalizing valve units 39 (Fig. 2) comprises a main cylindrical casting 41 having integral flanges 43 and 45 at opposite ends thereof. The flange 43 is rigidly secured by means of bolts 47 to a flanged coupling 49 threaded onto the header pipe 21a for section A of the system. The flange 45 is similarly secured by means of bolts 51 to a flanged coupling 53 threaded onto the header pipe 21b for section B of the supply system. The casting 41 is provided with cylinders 55 and 57 at opposite ends, which are separated by a partition 59 having a passage 61 axially therethrough. Disposed in the cylinder 55 is a piston 63 having a valve member 65 thereon which co-operates with a valve seat 67 formed on the partition 59,

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the piston 63 being biased by a spring 69 to normally maintain the valve member 65 in closed position against the valve seat 67. A piston 71 disposed in the cylinder 57 has a valve member 73 thereon and is biased by a spring 75 to normally maintain the valve member 73 seated against a valve seat 77 on the partition 59.

The piston 63 has a central passage 79 disposed axially therethrough in which is disposed a secondary or ball valve 81. A coil spring 83 compressed between the ball valve 81 and a spring retainer 85 biases the secondary valve 81 to closed position against a valve seat formed by a reduced portion 87 of the opening or passage 79. The piston 63 is also provided with a plurality of passages 89.

The piston 71 is provided with an axially disposed passage 91 extending axially therethrough. A secondary valve 93 disposed in said passage 91 is biased into the closed position against a valve seat formed by a reduced portion 97 of the passage 91 by means of a coil spring 99 compressed between a spring retainer 101 and the valve 93. The piston 71 is provided with a plurality of passages 103 extending therethrough.

Assuming the previously described system without the sectionalizing valves 39 just described, if the feed valve 25 for any of the sections, for instance, section A, is responsive to pressure higher than the feed valves 25 for sections B and C, then the compressor unit 13 for section A will supply the leakage air for the entire system. Due to the difficulties of setting the feed valves 25, one of them will usually respond to a slightly higher pressure than the others and cause the compressor unit for that section to cut in and build up the pressure in the system, thus causing disproportionate wear on that particular compressor. The excessive running of any one of the compressors is eliminated by the use of the sectionalizing valve 39 (Fig. 2) between adjacent sections of the supply system as shown in Fig. 1.

Under normal system operation, the pressure in each section of the supply system is maintained essentially at breaker operating pressure by the feed valves 25 at the compressor units. The sectionalizing valves remain closed for small differences in pressure between sections. Thus, air flow from one section to another due to leakage or slight differences in the settings of the feed valves 25 for the sections is prevented. This is because the valves 65 and 73 are maintained in closed position by their springs 69 and 75 respectively, and the secondary valves 81 and 93 are held closed by their springs 83 and 99 respectively against such small differences in air pressure between sections.

If, however, due to repeated breaker operation or failure of the compressor in one of the sections, for instance section A, to operate, the pressure in this section drops, for example, five pounds per square inch or more, the pressure in the opening 61 forces the valve 63 off its seat. Then the pressure in section B will open the secondary or check valve 93 of the sectionalizing valve 39 admitting compressed air to the passage 61. This permits air to flow through the passages 89 in the piston 63 to section A of the air supply system, until the pressure in section A builds up and the springs 69 and 99 close their respective valves 65 and 93.

If a section of the compressed air supply system to the right of one of the sectionalizing valves 39, for instance, section B is affected by excessive breaker operation or by failure of the compressor for this section, and the pressure in section B drops five pounds or more, the higher pressure in section A will cause valves 81 and 73 to open and permit air to flow from section A through passages 79 and 61, and through the passages 103 in piston 71 to section B until the pressure in section B is built up and valves 81 and 73 are closed by their respective springs.

If the pressure in one section of the system, for example, section B should drop five pounds or more in

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attempting to build up the pressure in an adjacent section, for instance, in section A, due to breaker operation or failure of the compressor in section A, then the sectionalizing valve 39 between sections B and C would open, thus automatically joining all of the sections of the system under such emergency conditions.

The size of the passages 89 and 103 through the pistons 63 and 71 respectively are selected to provide a predetermined rate of flow of compressed air therethrough and, hence, between the sections of the compressed air supply system, thus controlling the rate of equalization of pressure in the system. By making the passages 89 and 103 larger, quicker equalization can be effected and vice versa.

The pressure differential between sections of the system at which the sectionalizing valves will open can be varied by selecting valve springs of different characteristics.

It will be seen that there is provided an automatically sectionalized fluid pressure supply system for supplying fluid under pressure to a plurality of intermittently operated circuit breakers of the fluid pressure operated type. Each section of the fluid supply system comprises a compressor unit and a main storage tank for normally supplying and maintaining working pressure in its own section for operating the several circuit breakers of its section, and for making up leakage losses in the section. Pneumatically operated sectionalizing valve devices are provided between the sections of the supply system to distribute compressor operation. The sectionalizing valve devices do not function in response to small differences in pressure between sections, such as are occasioned by leakage, to permit flow of fluid pressure between sections of the system, but upon a greater difference in pressure between sections, due to repeated breaker operation or failure of the compressor unit for a given section, the sectionalizing valve will function automatically to admit compressed fluid from the adjacent section or sections to the affected section, thus maintaining the pressure in the entire system at working level.

Having described the invention in accordance with the provisions of the patent statutes, it is to be understood that various changes and modifications may be made in the structural details and arrangement of parts thereof without departing from the spirit of the invention.

I claim as my invention:

1. A fluid pressure supply system for circuit breakers comprising a supply conduit, a plurality of pressure tanks, said supply conduit being independently connected to each of said tanks for supplying fluid under pressure thereto, a plurality of sources of fluid under pressure each comprising a main storage tank and a compressor unit, each of said main storage tanks being connected to said supply conduit independently of each other, pressure responsive sectionalizing valve means connected in said supply conduit between said main storage tanks for separating said system into sections, each of said valve means having biased valve elements preventing flow of compressed fluid between sections in response to a difference in pressure between sections less than a predetermined value, and each of said biased valve elements thereof being responsive to difference in pressure between said sections greater than said predetermined value to permit fluid under pressure to flow from the section of higher pressure to the section of lower pressure.

2. A fluid pressure supply system for supplying fluid under pressure to a plurality of circuit breakers, a supply conduit, valve means connected in said supply conduit for separating said conduit into sections, a plurality of pressure tanks for each section, said supply conduit being independently connected to each of said pressure tanks for supplying fluid under pressure thereto, a source of fluid under pressure for each of said sections comprising a main storage tank and a compressor, each of said main storage tanks being connected to the supply conduit of its section, and each of said valve means having biased

valve elements therein arranged to permit fluid under pressure to flow between the sections of said supply conduit only in response to predetermined difference in pressure between adjacent sections of said supply conduit.

3. A fluid pressure supply system for supplying fluid under pressure to a plurality of circuit breakers, a supply conduit, a plurality of valve means connected in said supply conduit and automatically operable to separate said supply conduit into a plurality of sections, a plurality of pressure tanks for each section of said supply conduit, each section of said supply conduit being connected to the pressure tanks in its section to supply fluid under pressure to said pressure tanks, a separate source of fluid under pressure for each of said sections, each of said sources being connected to the supply conduit for its section, and each of said valve means comprising biased valve elements pneumatically operable to permit fluid under pressure to flow between adjacent sections of said supply conduit only in response to a predetermined difference in pressure between adjacent sections of said supply conduit.

4. A fluid pressure supply system for supplying fluid under pressure to a plurality of circuit breakers including an auxiliary tank for each breaker, a supply conduit, a valve means separating said conduit into sections, each of said sections being connected to supply fluid pressure to a plurality of said auxiliary tanks, a separate source of fluid under pressure for each section, each of said sources of fluid pressure being connected to the supply conduit for its section, and said valve means comprising biased valve elements pneumatically operable in response to a predetermined difference in pressure between adjacent sections of said supply conduit to permit fluid under pressure to flow in either direction between adjacent sections of said supply conduit.

5. A fluid pressure supply system for supplying fluid under pressure to a plurality of circuit breakers, a main supply conduit, valve units connected in spaced relation in said main supply conduit dividing said supply system into sections, a separate source of fluid under pressure comprising a main storage tank for each section, said main storage tanks being connected to the main supply conduit for each section at opposite sides of said valve units, said valve units comprising biased valve elements normally preventing the flow of fluid pressure from one section of said supply system to another, and said biased valve elements being pneumatically operable in response to a predetermined drop in pressure in one of said sections to permit the flow of fluid pressure from one adjacent section to said one section.

6. A fluid pressure supply system for supplying fluid under pressure to a plurality of circuit breakers, a main supply conduit, valve units connected in spaced relation in said main supply conduit dividing said supply system into sections, a separate source of fluid under pressure comprising a main storage tank for each section connected to the main supply conduit for each of said sections at opposite sides of said valve units, said valve units comprising a plurality of biased valve elements normally preventing the flow of fluid pressure between said sections, and said biased valve elements being pneumatically operable in response to a predetermined difference in pressure between adjacent sections of said supply system to permit the flow of fluid pressure in either direction between adjacent sections.

7. In a fluid pressure supply system for supplying fluid under pressure to a plurality of circuit breakers, the combination of sectionalizing valve means dividing said supply system into sections comprising a hollow casing

having a cylinder bore at each end and a central opening therein, a main piston valve member in each of said bores biased to normally close off said central opening in both directions, each of said main piston valve members having a relatively large central passage therein, secondary valve means in each of said central passages biased to normally close off said passages, each of said main piston valve members also having a plurality of relatively small passages therein permitting fluid pressure to flow therethrough when the main piston valve member is in open position and said secondary valve means is closed, each of said secondary valve means being responsive to predetermined pressure to admit fluid pressure to said central opening to actuate the opposite main piston valve member and permit fluid under pressure to flow from one of said sections to another section.

8. In a fluid pressure supply system, a sectionalizing valve device having two conduit connectors for connection in a supply system for dividing the system into sections, said sectionalizing valve device comprising a casing, a partition in said casing having an opening therein, main piston valve members disposed on opposite sides of said partition for normally closing said opening, each of said main piston valve members having a relatively large central passage therethrough, secondary valve means in said passages biased to normally close said central passages, each of said main piston valve members also having a plurality of relatively small passages therein permitting fluid pressure to flow therethrough when the main piston valve member is in open position and said secondary valve means is closed, each of said secondary valves being responsive to a drop in pressure below a predetermined value at the opposite end of said sectionalizing valve device to permit fluid under pressure to flow from the adjacent end of said sectionalizing valve device to said opening to thereby open the main piston valve at the affected end of said sectionalizing valve device and permit fluid pressure to flow to the affected section of the system.

9. In a fluid pressure supply system a sectionalizing valve structure having two connectors at opposite ends thereof for connection in a supply system to divide the system into sections, said sectionalizing valve structure comprising a casing having a cylinder at each end, a partition in said casing between said cylinders having an opening therethrough, a piston valve member in each of said cylinders biased to normally close said opening, each of said piston valve members having a relatively large central passageway therethrough, secondary valve means in each of said central passageways biased to close said passageways, each of said main piston valve members also having a plurality of relatively small passages therein permitting fluid pressure to flow therethrough when the main piston valve member is in open position and said secondary valve means is closed, and said sectionalizing valve structure being constructed and arranged to be responsive to a difference in pressure of predetermined value in the connectors at opposite ends of said valve structure to permit fluid under pressure to flow in either direction from the higher pressure end to the lower pressure end.

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