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PROTECTION VALVE DEVICE

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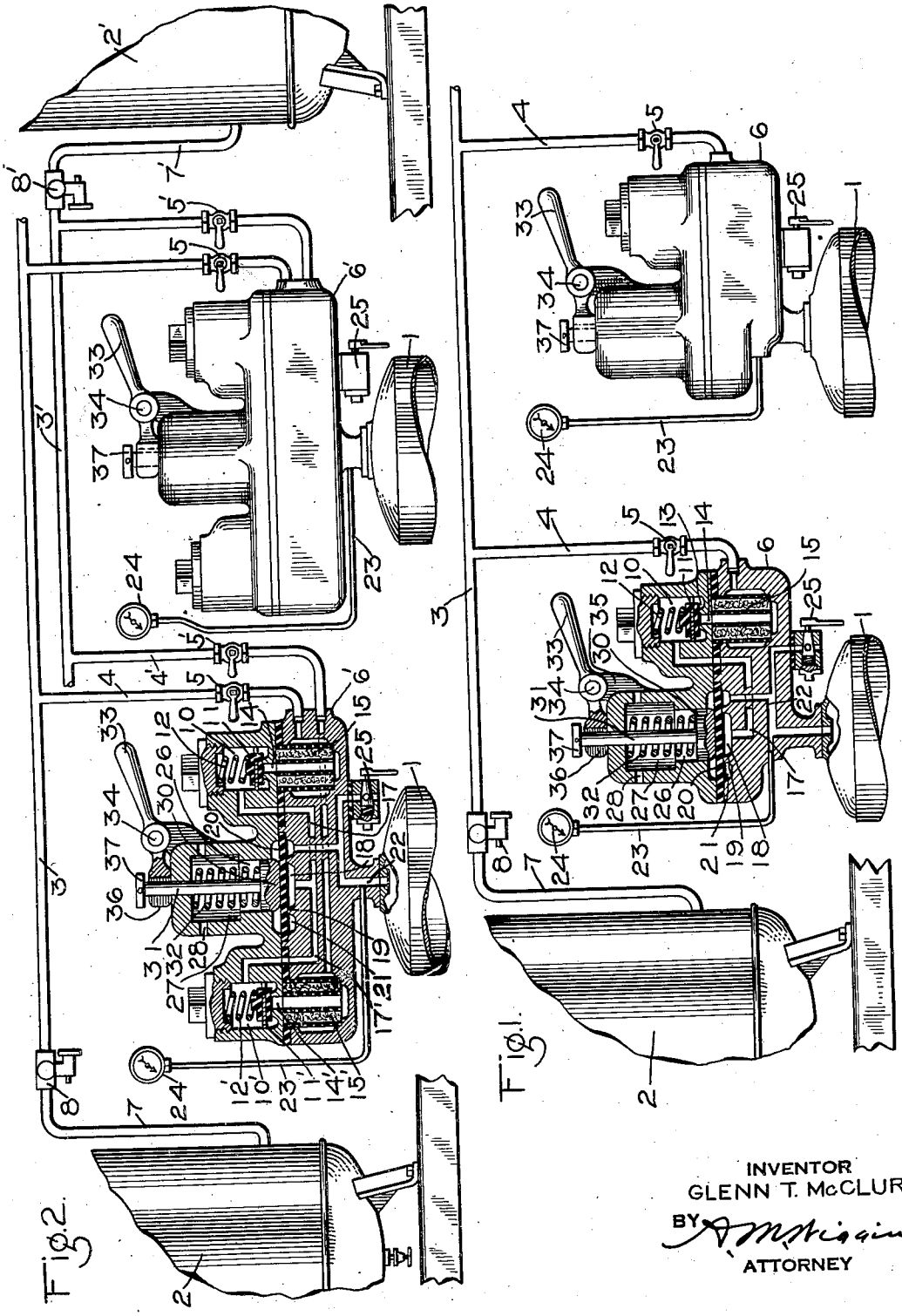


Fig. 1.

Fig. 2.

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PROTECTION VALVE DEVICE

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This invention relates to fluid pressure control systems and more particularly to pneumatic means for controlling electric switches or the like in electric power control stations.

In certain electric power stations compressed air is used for operating circuit breakers or switches to interrupt electric circuits and to also extinguish the electric arcs resulting therefrom. It is very important that the compressed air system for this service be safe and reliable in order to insure that the switches will operate at the proper time and in the proper manner.

The principal object of the invention is the provision of a simple, reliable, and efficient fluid pressure supply system for such service.

This object is obtained by the provision of a main or primary source of fluid pressure and for each switch to be controlled a secondary source of fluid pressure charged from the primary source through two check valves. Compressed air for operating each of the switches is adapted to be drawn directly from the respective secondary source which it is intended will be constantly replenished from the primary source. One of the check valves just mentioned is arranged to prevent loss of fluid under pressure from the secondary source in case of failure of the supply in the primary source due to a broken pipe or any other reason, and this secondary source is of such capacity as to provide for at least one operation of the switch controlled thereby in case such a failure should occur. The other check valve is provided to operate in case of failure of the secondary source to close communication therebetween and the primary source so that none of the other switches controlled from the primary source will be affected. This other check valve is preferably arranged to be opened by hand, so that once closed in response to failure of a secondary source there can be no further supply of fluid under pressure to the secondary source which failed until after the cause of said failure has been corrected.

If desired, there may be more than one primary source of compressed air for the several secondary sources so that failure of one of the primary sources will have no effect upon the system, suitable means being provided to maintain either of the primary sources effective automatically upon failure of the other.

Other objects and advantages will be apparent from the following more detailed description of the invention.

In the accompanying drawing, Fig. 1 is a diagrammatic view, partly in section and partly in outline, of the improved fluid pressure supply system for a plurality of electric switches and embodying one primary source of fluid pressure; and Fig. 2 is a similar view of a system embodying a plurality of primary sources of fluid pressure.

Description of Fig. 1

In the drawing, the reference numeral 1 indicates a secondary source of fluid pressure or a switch operating reservoir. Each of these reservoirs is adapted to be charged with fluid under pressure for controlling the operation of an electric switch and, if desired, the blowing out of the electric arc incident to opening of an electric circuit controlled thereby. There may be any desired number of these reservoirs dependent upon the number of switches or the like in the system to be controlled. The switches are not shown in the drawing since they form no part of the invention and are not essential to a clear comprehensive understanding thereof.

The main or primary source of fluid pressure for the system comprises a reservoir 2 which is adapted to be maintained charged with fluid at a desired pressure, such as two hundred and fifty pounds, by the operation of an automatically controlled air compressor (not shown).

Each of the secondary reservoirs 1 is adapted to be supplied with fluid at a desired reduced pressure from a main supply pipe 3 by way of a branch pipe 4, containing a cut-out cock 5, and through a protection valve device 6 which may be mounted on the associated secondary reservoir 1. The main supply pipe 3 is adapted to be constantly supplied with fluid under pressure from the reservoir 2 by way of a pipe 7 and a feed valve device 8 of any suitable structure.

The purpose of the feed valve device 8 is to reduce the pressure supplied to pipe 3 to a degree lower than in the reservoir 2 and which it is desired for use in the secondary reservoirs 1. The feed valve device is also adapted to maintain the pressure in the main supply pipe 3 and thereby in the secondary reservoirs 1 at a substantially constant value regardless of fluctuations which may occur in the reservoir 2 incident to operation of the compressor employed for charging same.

Each protection valve device 6 comprises a casing having a chamber 10 containing a check valve 11 and a light bias spring 12 acting on the check valve for urging same into seating engagement with an annular rib 13 which surrounds an inlet passage 14. The passage 14 is open to the in-

terior of a ring-like straining device 15 the exterior of which is open to the branch pipe 4.

The check valve chamber 10 is connected by a passage 17 to a chamber 18 provided inside of a seat rib 19 at one side of a diaphragm valve 20. A space 21 surrounding the seat rib 19 is open through a passage 22 to a secondary reservoir 1. The passage 22 is also connected by a pipe 23 to a pressure gage 24 which is adapted to be located convenient to the power station attendant for indicating to him the pressure in the secondary reservoir 1. The passage 22 is also connected to a drain cock 25 which is provided for draining the secondary reservoir 1 whenever desired.

The diaphragm valve 20 is clamped around its periphery in the casing and the side opposite seat rib 19 is in constant communication with the atmosphere through a bore 26, a chamber 27, and a passage 28. A diaphragm follower 30 is slidably mounted in the bore 26 and engages the adjacent face of the diaphragm valve 20. The follower 30 has a stem 31 which extends through the upper end wall of chamber 27. In chamber 27 is a coil spring 32 encircling the stem 31. One end of this spring is seated against the casing while the opposite end acts on the diaphragm follower 30 for urging the diaphragm valve 20 into contact with the seat rib 19. A handle 33 disposed outside of the casing is pivotally mounted on a pin 34 which is secured in a lug 35 projecting from the casing. This handle is provided on the opposite side of pin 34 with a bifurcated end portion 36 through which the follower stem 31 extends, said stem being provided beyond said portion of the handle with a washer 37 for engagement thereby.

In operation, the reservoir 2 is charged with fluid under pressure by an air compressor or the like to a desired degree such as two hundred and fifty pounds, as above mentioned. Fluid under pressure from the reservoir 2 then flows through the feed valve device 8 to the main supply pipe 3, the feed valve device reducing the pressure of fluid obtained in said pipe to a desired degree such as one hundred and fifty pounds. From the main supply pipe 3 fluid under pressure flows through each of the branch pipes 4 and the cut out cock 5 therein to the connected protection valve device 6. Fluid under pressure thus obtained at each protection valve device 6 flows through the strainer device 15 for removing foreign matter therefrom, and thence past the check valve device 11 to chamber 10 and from said chamber through passage 17 to chamber 18 below the diaphragm valve 20.

To charge the secondary reservoirs 1 the attendant depresses the handle 33 on each protection valve device for pulling the stem 31 and diaphragm follower 30 in a direction away from the diaphragm valve 20 against the opposing pressure of the spring 32. The pressure of fluid in chamber 18 then deflects the diaphragm valve 20 in a direction away from the seat rib 19 so as to open communication between said chamber and the space 21. Fluid under pressure then flows to the space 21 and thence through passage 22 to the connected secondary reservoir 1 for charging same to the same degree as acting in the main supply pipe 3.

It is necessary that the operator hold the handle 33 of each protection valve device 6 depressed until the pressure of fluid acting in chamber 18 and space 21 becomes increased to a certain desired degree, such as one hundred pounds, which is sufficient to maintain the diaphragm valve 20 out of contact with the seat rib 19 against the pressure of spring 32. When this pressure obtains the attendent may let go of the handle 33 of the protection valve device and the diaphragm 20 will remain in the position just mentioned so that there can be further flow of fluid under pressure from the main supply pipe 3 to the connected secondary reservoir 1 for maintaining the pressure therein as fluid under pressure is used from said reservoir in controlling the operation of the switch device connected therewith.

The check valve 11 in each protection valve device 6 provides for relatively free flow of fluid under pressure in the direction of the connected secondary reservoir 1 for charging same as just described. However, in case of failure of the supply of fluid under pressure to the protection valve devices due for instance to failure of the compressor to maintain the pressure of fluid in reservoir 2 or to failure of said reservoir or of any of the connections between same and the protection valve device, it will be noted that the check valve 11 in each protection valve device will be seated by spring 12 to prevent back flow of fluid under pressure from the connected secondary reservoir 1. The fluid under pressure acting in the several secondary reservoirs 1 will therefore be bottled under this condition so that the switches depending upon same for control may be operated at least once. The resultant lowering of pressure in each secondary reservoir 1 as indicated by the pressure gage 24, will promptly call the attention of the attendant to the situation so that the cause of failure may be remedied.

In case of failure of one of the secondary sources of fluid pressure, due for instance to rupture of a secondary reservoir 2, it will be apparent that the switch controlled from said reservoir will be inoperative until after the cause of such failure has been corrected. It is desirable however that the failure of one secondary source will not affect the other secondary source, and the diaphragm valve 20 is provided to prevent such. Let it be assumed that one of the secondary reservoirs 1 fails with a resultant loss of fluid under pressure therefrom. As soon as the pressure in the failed reservoir becomes reduced to a certain low degree, such as one hundred pounds, spring 32 in the protection valve device will act to move the diaphragm valve 20 into engagement with the seat rib 19 so as to thereby close communication between the fluid pressure supply passage 17 and passage 22 leading to the secondary reservoir. Thus failure of pressure in one of the secondary reservoirs results in cutting that reservoir out of the system, so that it will have substantially no effect upon the pressure of fluid in the other secondary reservoirs in the system which will therefore continue to function as intended.

It will be noted that the area of diaphragm 20 within the seat rib 19 will, after movement of said diaphragm into engagement with said seat, be subject to the pressure of fluid carried in the main supply pipe 3, but said area is so related to the pressure of spring 32 that said spring will maintain said diaphragm in contact with said rib until the spring is subsequently compressed by manual operation of handle 33 as above mentioned. When the cause for failure has been repaired, the handle 33 must therefore be manually depressed in order that the secondary reservoir 1 associated with the protection valve device will become recharged with fluid at the pressure from the main supply pipe 3 for controlling the oper-

ation of the switch connected to said secondary reservoir.

It will now be apparent that the check valve 11 in the protection valve devices 6 is provided to bottle the fluid pressure in the connected secondary reservoirs upon failure of the main supply of fluid pressure, so that the switch devices dependent upon the several secondary reservoirs may be operated at least once subsequent to such failure. The diaphragm valve 20 in each protection valve device is provided to act in case of failure of the connected secondary reservoir to isolate said reservoir from the remainder of the system which will continue to function in the normal intended manner. The movement of the diaphragm 20 away from the seat rib 19 in each protection valve device is dependent upon manual operation of the handle 33, so that in case an associated secondary reservoir 1 fails, there can be no further supply of fluid under pressure thereto, and consequent loss of fluid under pressure from the main supply pipe 3, until the handle 33 is intentionally manually operated after the damage has been repaired.

Description of Fig. 2

If desired, the system may embody an additional primary source of fluid pressure such as a main reservoir 2' in which case a protection valve device 6' shown in Fig. 2 will be employed, between the two main supply reservoirs 2 and 2' and each of the secondary reservoirs 1. Each of the protection devices 6' embodies all of the elements of the protection device 6 for controlling communication between the main supply pipe 3 and the respective secondary reservoir.

The additional reservoir 2' is connected by way of a pipe 7' and a feed valve device 8' to a main supply pipe 3' paralleling the pipe 3. The main pipe 3' is connected by a branch pipe 4' to each of the protection devices 6' and through same by way of a strainer device 15' and check valve 11' to passage 17' leading to chamber 18 below the diaphragm valve 20. It will be noted that the communication between the additional reservoir 2' and the chamber 18 below the diaphragm 20 in the protection device 6' is thus in parallel with that between the reservoir 2 and said chamber, as described in the embodiment shown in Fig. 1.

In this system a failure of either one or the other of the main sources of fluid pressure supply, for instance of main reservoir 2 or 2' will not necessitate any shut down of the system for repair as in the structure shown in Fig. 1, since the other main reservoir will maintain the system in an operating condition. For instance, let it be assumed that the reservoir 2 fails. In this case the check valve 11 in each protection valve device will seat to isolate that part of the system including the reservoir 2, and the several secondary reservoirs 1 will be maintained charged with fluid under pressure for operating their respective switches from the other main supply reservoir 2'. In case the failure occurs however in the reservoir 2' or in its connections with the protection devices 6', the check valves 11' will close and the pressure in the several secondary reservoirs 1 will be maintained from the main supply reservoir 2. In case of failure of one or another of the secondary reservoirs 1, the diaphragm valve 20 in the associated protection valve device 6' will be moved into contact with seat rib 19 to isolate this reservoir from the remainder of the system which will be thus maintained in an operative condition, the same as in the embodiment shown in Fig. 1.

Summary

From the above description it will now be apparent that both embodiments of the invention provides a safe and reliable control for several electric switches of a power station. In the embodiment shown in Fig. 1 the secondary reservoirs provide for at least one operation of the switches controlled thereby so that in case of failure of the main source of fluid supply the attendant may still operate a switch pneumatically to cut off power in order to permit repair of the cause of failure. In the embodiment shown in Fig. 2 the failure of one main source of fluid supply will have no effect upon the operation of the system since the other main source of fluid supply will automatically maintain the system in an operating condition. In both embodiments the failure of one secondary supply reservoir will have no effect upon the other secondary reservoir so that the switches controlled therefrom may continue to function normally. In the case of failure of a secondary reservoir the diaphragm valve 20 automatically seats to prevent loss of fluid under pressure from the remainder of the system and cannot be unseated except by manual operation of the handle 33, so as to thereby preclude the possibility of unintended reopening of the communication controlled and consequent loss of fluid pressure until after the cause of failure has been repaired and such reopening is desired.

While only two embodiments of the invention have been shown and described in detail, it is not the intention to limit the scope to these embodiments or otherwise than by the terms of the appended claims.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A fluid pressure supply system for a pressure controlled electric switch comprising in combination, a main supply reservoir adapted to be supplied with fluid under pressure, a secondary reservoir adapted to be charged with fluid under pressure from said main reservoir for controlling said switch and having a capacity adapted to provide for at least one operation of said switch, a check valve in the communication between said reservoirs providing for flow of fluid under pressure in the direction of said secondary reservoir and adapted to block flow of fluid under pressure in the opposite direction, valve means also controlling said communication and controlled by the pressure of fluid in said secondary reservoir and an opposing pressure, and so constructed as to be operative by said opposing pressure to close and maintain closed said communication when the pressure in said secondary reservoir is less than a certain degree, and means operative manually to effect operation of said valve means to open said communication, the pressure in said secondary reservoir being adapted to maintain said valve means in its communication opening position when the pressure in said secondary reservoir exceeds said certain degree.

2. A fluid pressure supply system for a pressure controlled electric switch comprising in combination, a main supply reservoir adapted to be supplied with fluid under pressure, a secondary reservoir adapted to be charged with fluid under pressure from said main reservoir for con-

trolling said switch and having a capacity adapted to provide for at least one operation of said switch, a check valve in the communication between said reservoirs providing for flow of fluid under pressure in the direction of said secondary reservoir and adapted to block flow of fluid under pressure in the opposite direction, valve means controlling said communication and controlled by the cooperative action of the fluid pressures supplied to said communication from said main reservoir and acting in second secondary reservoirs and an opposing pressure and so constructed as to be operative by said opposing pressure to close and maintain closed said communication when the pressure in said secondary reservoir is less than a certain degree, and means operative manually to effect operation of said valve means to open said communication, said valve means being adapted to be maintained in its communication opening condition by its controlling fluid pressures when the pressure in said secondary reservoir exceeds said certain degree.

3. A fluid pressure supply system for a pneumatically controlled electric switch comprising in combination, a main supply reservoir adapted to be supplied with fluid under pressure, a secondary reservoir adapted to be charged with fluid under pressure from said main reservoir and from which fluid under pressure is adapted to be drawn for controlling said switch, said secondary reservoir having a capacity adapted to provide for at least one operation of said switch, a check valve in the communication between said reservoirs providing for flow of fluid under pressure in the direction from said main reservoir to said secondary reservoir and adapted to block flow of fluid under pressure in the opposite direction, a spring, valve means also controlling said communication and controlled by the pressure of said spring and the opposing pressures of fluid supplied from said main reservoir to said communication and acting in said secondary reservoir, said spring and valve means being so related as to maintain said communication closed when the pressure in the secondary reservoir is lower than a certain degree and to maintain said communication open when the pressure in said secondary reservoir is greater than said certain degree, and means for effecting operation of said valve means to open said communication.

4. A fluid pressure supply system for a pneumatically controlled electric switch comprising in combination, a main supply reservoir adapted to be supplied with fluid under pressure, a secondary reservoir adapted to be charged with fluid under pressure from said main reservoir and from which fluid under pressure is adapted to be drawn for controlling said switch, said secondary reservoir having a capacity adapted to provide for at least one operation of said switch, a check valve in the communication between said reservoirs providing for flow of fluid under pressure in the direction from said main reservoir to said secondary reservoir and adapted to block flow of fluid under pressure in the opposite direction, a spring, a valve also arranged to control said communication and having a position for closing said communication in which a certain area is subject to the pressure of fluid supplied from said main reservoir and a different area is subject to the pressure of fluid in said secondary reservoir, said spring acting on said valve in opposition to the pressure of fluid thereon, manually operative means for effecting movement of said valve against said spring to a position for opening the communication controlled thereby, the pressure of fluid on the last named valve when the pressure in said secondary reservoir exceeds a predetermined degree being adapted to maintain the valve in open position against the opposing pressure of said spring and when less than said predetermined degree providing for movement of the valve by said spring to its closed position.

5. A fluid pressure supply system for a pneumatically controlled electric switch comprising in combination, a main supply reservoir adapted to be supplied with fluid under pressure, a secondary reservoir adapted to be charged with fluid under pressure from said main reservoir and from which fluid under pressure is adapted to be drawn for controlling said switch, said secondary reservoir having a capacity adapted to provide for at least one operation of said switch, a check valve in the communication between said reservoirs providing for flow of fluid under pressure in the direction from said main reservoir to said secondary reservoir and adapted to block flow of fluid under pressure in the opposite direction, valve means for controlling said communication in series with said check valve and having a position for closing the communication in which a certain area is subject to the pressure in said secondary reservoir and a different area is subject to the pressure of fluid supplied from said main reservoir, a spring acting on said valve means for urging same to said closed position when the pressure of fluid in said secondary reservoir is less than a certain degree, said valve means having an open position for opening the communication controlled thereby and being adapted to be maintained in said open position when the pressure of fluid in said secondary reservoir exceeds said certain degree, and means operative manually to effect movement of said valve means to said open position.

6. A fluid pressure supply system for a pneumatically controlled electric switch comprising in combination, a main supply pipe, a main reservoir adapted to be charged with fluid under pressure, a feed valve device adapted to supply fluid at a desired reduced pressure from said main reservoir to said pipe, a secondary reservoir adapted to be charged with fluid under pressure from said pipe and from which fluid under pressure is adapted to be drawn for operating said switch, said secondary reservoir having a capacity adapted to provide for at least one operation of said switch, a check valve in the communication between said pipe and secondary reservoir providing for flow of fluid under pressure only in the direction of said secondary reservoir, and valve means also adapted to control communication between said pipe and secondary reservoir and being operative to close same when the pressure in said secondary reservoir is at a chosen degree lower than supplied by said feed valve device and having a position for opening the communication controlled thereby and adapted to be maintained in such open position when the pressure of fluid in said secondary reservoir exceeds said chosen degree, and manually operable means for effecting movement of said valve means to its communication opening position.

7. A fluid pressure supply system for a pneumatically controlled electric switch comprising in combination, a main supply pipe, a main reservoir adapted to be charged with fluid under pressure, a feed valve device adapted to supply fluid at a desired reduced pressure from said main

reservoir to said pipe, a secondary reservoir adapted to be charged with fluid under pressure from said pipe and from which fluid under pressure is adapted to be drawn for operating said switch, said secondary reservoir having a capacity adapted to provide for at least one operation of said switch, a check valve in the communication between said pipe and secondary reservoir providing for flow of fluid under pressure only in the direction of said secondary reservoir, and a diaphragm valve arranged to control said communication in series with said check valve and having a position for closing said communication in which a certain portion of its area is subject to the pressure of fluid in said secondary reservoir and another portion of its area is subject to the pressure of fluid supplied from said pipe, a spring acting on said diaphragm in opposition to the pressure of fluid thereon, said spring being operative to urge said diaphragm to its communication closing position when the pressure of fluid in said secondary reservoir is a chosen degree lower than supplied by said feed valve device, the pressure of fluid in said secondary reservoir when greater than said chosen degree being adapted to act in conjunction with that in said pipe to maintain said diaphragm in its communication opening position against the opposing pressure of said spring, and manually operable means for effecting movement of said diaphragm to its communication opening position against the opposing pressure of said spring.

8. A fluid pressure supply system for a plurality of pneumatically controlled electric switches comprising in combination, a main fluid pressure supply pipe, a main reservoir adapted to be charged with fluid at a relatively high pressure, a feed valve device adapted to supply fluid at a lower pressure from said resevoir to said pipe, a secondary reservoir for each of said switches adapted to be charged with fluid under pressure from said pipe and from which fluid under pressure is adapted to be drawn for operating the respective switch, each of the secondary reservoirs having a capacity providing for at least one operation of the switch controlled therefrom, and means for controlling the supply of fluid under pressure from said pipe to each of said secondary reservoirs including a check valve providing for flow of fluid under pressure from said pipe to the respective secondary reservoir and adapted to block flow of fluid under pressure in the opposite direction, valve means also controlling communication between said pipe and secondary reservoir in series with said check valve and being operative to close said communication when the pressure of fluid in said secondary reservoir is a chosen degree lower than supplied by said feed valve device and adapted to maintain said communication open when the pressure in said secondary reservoir exceeds said chosen degree, a spring acting on the last named valve defining said chosen degree of pressure, and manually operable means for effecting operation of said valve means to its communication opening position against the opposing pressure of said spring.

9. A fluid pressure supply system for a pneumatically controlled electric switch comprising, in combination, two independent main supply reservoirs each of which is adapted to be supplied with fluid under pressure, a secondary reservoir adapted to be charged with fluid under pressure from one or the other or both of said main reservoirs and from which fluid under pressure is adapted to be drawn for operating said switch, a check valve arranged in the communication between one of said main reservoirs and said secondary reservoir, another check valve arranged in the communication between the other main reservoir and said secondary reservoir, both of said check valves providing for flow of fluid under pressure only in the direction of said secondary reservoir, and valve means controlling communication between both of said check valves and said secondary reservoir and operative to close such communication when the pressure of fluid in said secondary reservoir is less than a chosen degree and to maintain such communication open when the pressure of fluid in said secondary reservoir exceeds said chosen degree, a spring acting on said valve means for defining said chosen pressure, and manually operable means for effecting operation of said valve means to its communication opening position against the pressure of said spring.

10. A fluid pressure supply system for a pneumatically controlled electric switch comprising in combination, a main supply reservoir adapted to be supplied with fluid under pressure, a secondary reservoir adapted to be charged with fluid under pressure from said main reservoir and from which fluid under pressure is adapted to be drawn for operating said switch, said secondary reservoir having a capacity adapted to provide for at least one operation of said switch, a feed valve device in the communication between said reservoirs adapted to provide a reduced pressure supply to said secondary reservoir, and means for controlling communication between said feed valve device and secondary reservoir comprising a casing secured to said secondary reservoir, a check valve in said casing adapted to be unseated by the fluid pressure supplied from said feed valve device for supplying fluid under pressure to said secondary reservoir, a spring acting on said check valve for seating same to block the flow of fluid under pressure in the opposite direction, valve means in said casing arranged to control communication between the said check valve and the secondary reservoir and having a communication closing position in which a certain area is subject to pressure of fluid in said secondary reservoir and a different area is subject to the pressure of fluid supplied past said check valve, a spring in said casing acting on said valve means for maintaining same in the position closing the communication controlled thereby when the pressure in said secondary reservoir is a chosen degree lower than supplied by said feed valve device, said valve means being movable against said spring to a position for opening the communication controlled thereby, and a lever associated with said casing and operative manually to effect movement of said valve means to its communication opening position.

11. A fluid pressure supply system for a plurality of pneumatically controlled electric switches comprising in combination, a main fluid pressure supply pipe, a main reservoir adapted to be charged with fluid under relatively high pressure, a feed valve device operative to supply fluid at reduced pressure from said reservoir to said pipe, a secondary reservoir for each of said switches adapted to be charged with fluid under pressure from said pipe and from which fluid under pressure is adapted to be drawn for operating the respective switch, each of said secondary reservoirs having a capacity providing for at least one operation of the respective switch, and

means for controlling communication between each of said secondary reservoirs and said pipe comprising a casing secured to the reservoir, a check valve in said casing arranged to supply fluid under pressure from said pipe in the direction of the associated secondary reservoir, a spring acting on said check valve for seating same to block the flow of fluid under pressure in the opposite direction, a diaphragm controlling communication between said check valve and the associated secondary reservoir and having a communication closing position in which a portion of one face is subject to pressure of fluid supplied past said check valve and another portion of said one face is subject to pressure of fluid in the secondary reservoir, said diaphragm being movable to an open position for opening communication between said check valve and secondary reservoir, a spring acting on said diaphragm urging it to its communication closing position, said spring being operative to hold said diaphragm in its communication closing position when the pressure of fluid in the secondary reservoir is a chosen degree below that supplied by said feed valve device and said diaphragm being adapted to be maintained in the communication opening position when the pressure of fluid in said secondary reservoir exceeds said chosen degree, and means carried by said casing and operative manually to effect movement of said diaphragm to its communication opening position against the opposing pressure of said spring.

12. A fluid pressure supply system for a plurality of pneumatically controlled electric switch devices comprising in combination two separate and independent fluid pressure supply pipes, two separate and independent main supply reservoirs adapted to be supplied with fluid under relatively high pressure, a feed valve device for supplying fluid at reduced pressure from one of said reservoirs to one of said pipes, another feed valve device for supplying fluid at the same reduced pressure from the other reservoir to the other of said pipes, a secondary reservoir for each of said switches adapted to be charged with fluid under pressure from one or the other or both of said main reservoirs and from which fluid under pressure is adapted to be drawn for operating the associated switch, and valve means controlling communication between both of said pipes and each of said secondary reservoirs comprising a check valve device arranged to provide for flow of fluid under pressure from one of said pipes to said secondary reservoir and to block flow of fluid under pressure in the opposite direction, another check valve device arranged to provide for flow of fluid under pressure from the other of said pipes to the secondary reservoir and to block flow of fluid under pressure in the opposite direction, and valve means interposed in the communication between both of said check valve devices and the secondary reservoir and having a communication closing position in which a certain area is subject to the pressure of fluid supplied past said check valves and another area is subject to pressure of fluid in the secondary reservoir, a spring acting on said valve means in opposition to the pressure of fluid for urging same to its communication closing position and operative to maintain said valve means in the last named position when the pressure of fluid in said secondary reservoir is a chosen degree below that supplied by said feed valve devices, said valve means having a position for opening the communication controlled thereby and being adapted to remain in such position against the opposing pressure of said spring when the pressure of fluid in the secondary reservoir exceeds said chosen degree, and means operative manually to effect movement of said valve means to its communication opening position.

13. A fluid pressure supply system for a pneumatically controlled electric switch comprising in combination, a main supply reservoir adapted to be supplied with fluid under relatively high pressure, a secondary reservoir adapted to be charged with fluid under pressure from said main reservoir and from which fluid under pressure is adapted to be drawn for operating said switch, said secondary reservoir having a capacity providing for at least one operation of said switch, a feed valve device arranged to reduce the pressure of fluid supplied to said secondary reservoir from said main reservoir, and a protection valve device mounted on said secondary reservoir and comprising a casing having a communication through which fluid under pressure is adapted to be supplied from said main reservoir to said secondary reservoir, a check valve in said communication providing for flow of fluid under pressure in the direction of said secondary reservoir, a spring acting on said check valve to seat same for blocking flow of fluid under pressure in the opposite direction, a strainer device in said communication ahead of said check valve for removing foreign matter from the fluid under pressure supplied from said main reservoir to said check valve, valve means in said casing controlling communication between said check valve and secondary reservoir, said valve means having a position for closing said communication, a spring acting on said valve means for urging same to said position when the pressure in said secondary reservoir is below a chosen degree which is lower than supplied by said feed valve device, said valve means having a position for opening said communication and being adapted to be maintained in the open position when the pressure of fluid in said secondary reservoir exceeds said chosen degree, an element associated with said casing operative manually to effect movement of said valve means to its open position, and a drain valve for said secondary reservoir arranged in said casing and connected to said communication between said valve means and secondary reservoir.

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