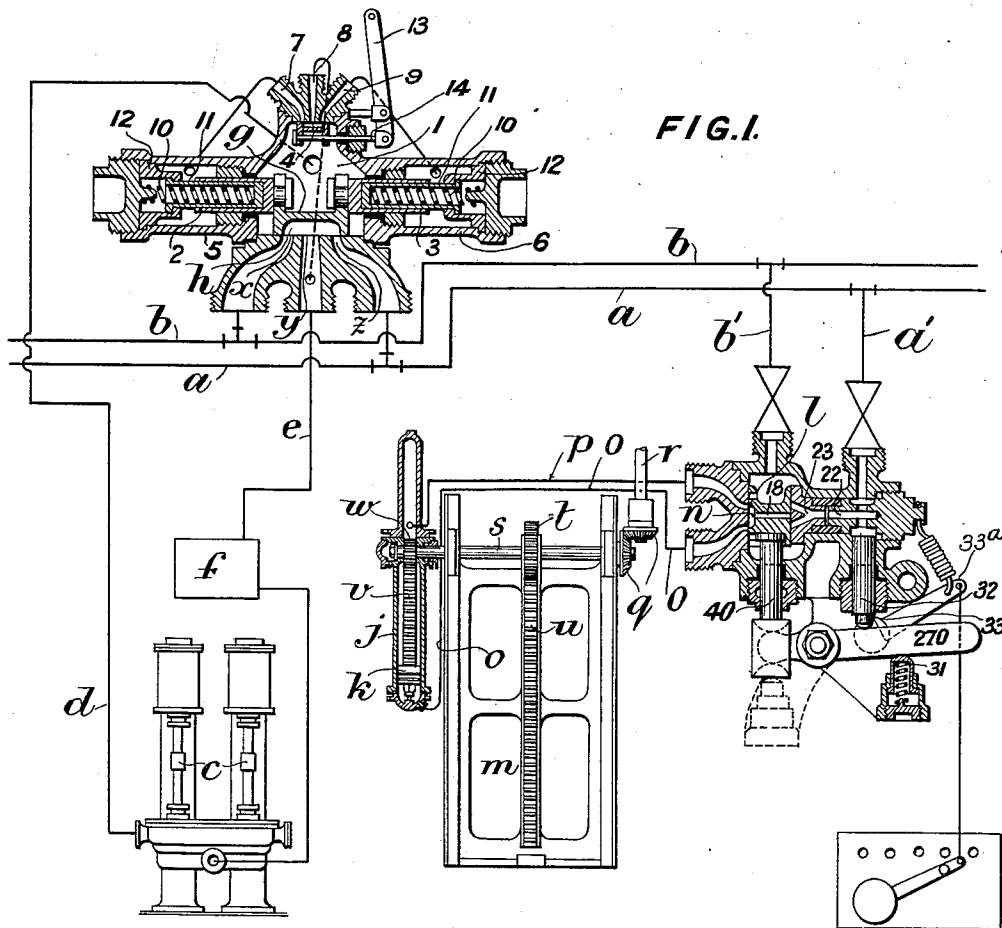


F. J. PIKE & H. NEVILLE.
 FLUID PRESSURE SYSTEM FOR OPERATING BULKHEAD DOORS.
 APPLICATION FILED DEC. 7, 1912.

1,095,593.

Patented May 5, 1914.

2 SHEETS—SHEET 1.



Witnesses:
 B. Rommers
 C. Leckert.

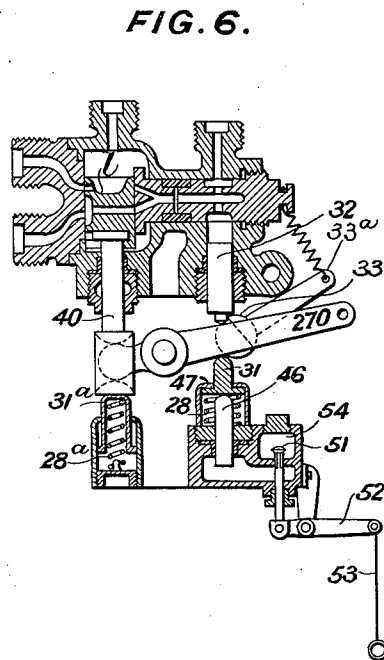
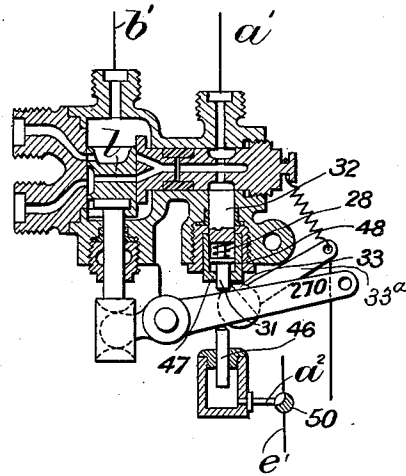
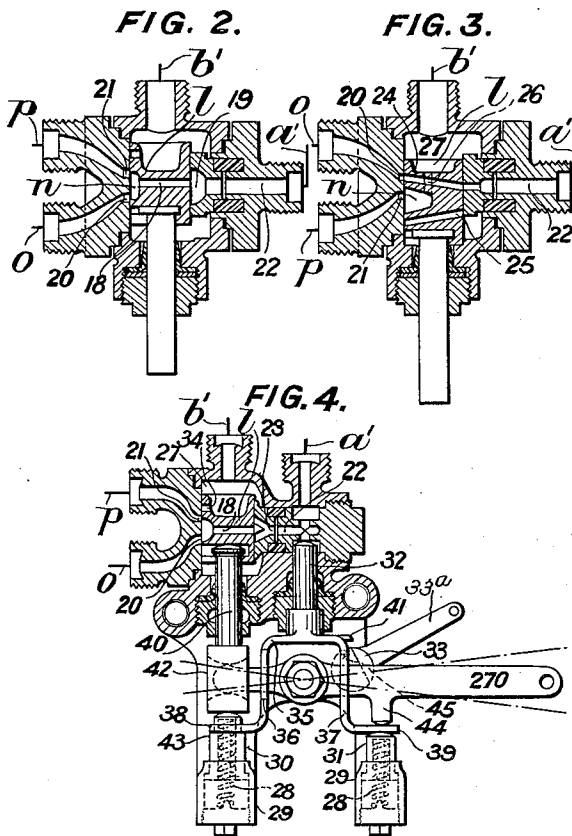
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Witnesses:
 B. Kommers
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UNITED STATES PATENT OFFICE.

FREDERIC JOHN PIKE, OF BECKENHAM, AND HERBERT NEVILLE, OF FOREST HILL, ENGLAND, ASSIGNORS TO J. STONE & COMPANY, LIMITED, OF DEPTFORD, ENGLAND.

FLUID-PRESSURE SYSTEM FOR OPERATING BULKHEAD-DOORS.

1,095,593.

Specification of Letters Patent.

Patented May 5, 1914.

Application filed December 7, 1912. Serial No. 735,441.

To all whom it may concern:

Be it known that we, FREDERIC JOHN PIKE and HERBERT NEVILLE, subjects of the King of Great Britain, and residing, respectively, at 75 Cedars road, Beckenham, in the county of Kent, England, and 31 Elsinore road, Forest Hill, in the county of Kent, England, have invented new and useful Improvements in Fluid-Pressure Systems for Operating Bulkhead-Doors, of which the following is a specification.

This invention comprises improvements in and relating to fluid pressure systems for operating bulkhead and like doors and the valves employed therein.

Door closing and opening systems are mostly used on board ships in connection with the doors in the bulkheads of watertight compartments and are generally hydraulic systems having central valve controls, as for example at the bridge, local valve controls, as for example a manual control at the door, and an automatic control which is permitted to operate by the rising of water in a bilge tank or in the compartment. In some circumstances, as for example when the ship is lying by, or is in dock, or when a stoppage occurs in the system owing to failure of the pumps, or accumulators, or when for any other reason, the system becomes inert, that is to say when there is no pressure available for the operation of the doors, it frequently becomes necessary to open or close a door wholly or partially by mechanical means such as a manually operated gear connected with the door. In some circumstances it may be desired not to employ the hydraulic pressure, although available, in which case also the manually operated gear is used. In order to remove the water-lock, due to the presence of water in the ram cylinders, which otherwise would prevent mechanical operation of the doors, pet-cocks have been fitted to the cylinders, which cocks could be opened to allow of escape of water from the cylinders in order to permit of the travel of the ram which moved with the mechanically operated door. These pet-cocks are a source of inconvenience and even of danger, as they may be left open by careless individuals and so prevent proper operation of the doors

hydraulically when pressure has been subsequently restored to the system, supposing that such pressure has been cut off temporarily. Consequently it has been proposed to employ by-pass valves for the purpose of short-circuiting the two ends of a door-operating cylinder when it is desired to manually operate the door opening and closing gear, and such by-pass valves have been manually operated both for producing by-passing and for restoring normal conditions after such by-passing.

The objects of the present invention are to provide valves which permit of adjustments for producing by-passing or short circuiting for enabling several doors of a system, or individual doors only to be mechanically operated whenever desired, the by-passing or short circuiting conditions being obtained without prejudicially affecting the hydraulic control, and without the possibility of any valve being left by any careless person in an unsafe position, so that whenever hydraulic control is restored after temporary removal, the parts will be found in proper working position in spite of the by-passing which has taken place. An unsafe position of the valve would be one in which pressure fluid in either of the mains but particularly in the closing main, could not obtain access to a door cylinder for the purpose of closing the corresponding door in an emergency or otherwise.

According to this invention provision is made for enabling by-passing or short-circuiting of the whole of a system or of certain parts only, when desired or when such system becomes inert or deenergized by loss or absence of pressure, the by-passing being accomplished in such a manner in the case of local control valves that whenever pressure fluid is introduced into the closing main, or in certain circumstances into the opening main (as for example when a bilge float has operated to reverse a door controlling valve) the local control or door valves will all be responsive to such pressure for bringing about the closing of the doors, in spite of the by-passing operations which have been previously performed. Thus no manual adjustment or operation is necessary at any door valve in order to restore

safety working conditions thereat after by-passing has taken place. A general by-pass or short circuit may be advantageously accomplished by an operation of a distributing or control valve belonging to the system.

This invention completely avoids the use of accessory devices which may be left in dangerous conditions. In some cases the by-passing and restoration to normal conditions may be accomplished automatically, in other cases the by-passing may be accomplished by manual operation and the restoration may be accomplished automatically and in the case of the central control or bridge valve both the by-passing and restoration to normal conditions may be accomplished by manual operation. In the case of every local control or door valve, however, whenever pressure fluid is introduced into the closing main, or in certain cases, into the opening main, of the system, every door controlling valve will respond to such pressure, whether any such valve has been individually employed for by-passing or not and no human intervention is required for making the valves so responsive. The system therefore under all conditions always stands ready for performing general closing of all doors upon the closing main being put to pressure.

Local control valves may be arranged to have a normal position in which they by-pass the opposite ends of a ram cylinder and the advantage of an arrangement in which the door cylinder is or may be normally by-passed, or in which the door cylinder is automatically by-passed when pressure is removed from the mains, is that the corresponding door is capable under those conditions of being opened and closed mechanically from the deck above or elsewhere without a man having to descend to the door and adjust the valve at the door, or find or adjust any other fitting, in order to produce by-passing. Therefore the hand gear for raising and lowering a door may in some cases be brought into operation whether the hydraulic power be available or not.

In carrying the invention into practice and when it is desired to obtain by-passing automatically upon the failure or shutting off of the pressure fluid supply there may be combined with the controlling valve arrangements certain spring contrivances known as centering or equilibrating springs. These contrivances consist of two springs arranged to act equally and oppositely upon a valve when the latter is in the central or other desired position, so that unless the valve is forcibly held in another position by the fluid pressure, the springs automatically shift the valve into the position in which the efforts of the springs balance or nullify one another as will be hereinafter described.

In order to enable this invention to be

readily understood reference is made to the accompanying drawings in which:—

Figure 1 is a general view of a system comprising controlling valves adapted for bringing about short-circuit connections. Figs. 2, 3 and 4 are central vertical sections of modified constructions of the improved door controlling valves and; Figs. 5 and 6 are vertical sections of further modifications.

In Fig. 1, *a* is the opening main which is normally under pressure, and *b* is the closing main which is normally open to exhaust. *c* is the pump with delivery *d* for supplying pressure fluid to the system and *e* is the exhaust pipe leading to a suitable tank *f*. These are well known parts of a so-called two-main system in which pressure fluid is admitted to the main *a* for driving all of the rams *k* in one direction for opening all doors and such fluid is cut off from the main *a* and admitted to the main *b* for driving the rams *k* in the opposite direction for closing all doors.

A general description will now be given of the mode of by-passing after which the particular arrangements and constructions will be described. Reference will be made first to the so-called "bridge control valve" which is a main control or distributing valve *g* and in the example shown is of the slide valve variety, and is adapted to connect either the main *a* with the pressure space in the valve chest and the main *b* with the exhaust *e*, or the main *b* with the pressure space in the chest and the main *a* with the exhaust *e*. Now this bridge control valve may be formed with a port or ports, or with a cavity *h* as shown, in such a position or of such a shape or length that, by moving the valve *g* to an abnormal position, which may be for example a mid-position as shown in Fig. 1, the normal pressure main *a* and exhaust main *b* are by-passed or short-circuited, which means that they are, as shown, directly connected through the cavity *h*, thereby permitting the movement of any door-operating ram *k* to displace water from one end of its cylinder *j* into one main, an amount of water equal to that so displaced flowing through the by-pass into the other main and the same amount flowing from the latter main into the opposite end of the door cylinder *j*, or to the tank *f*. In the case of a valve *g* which is operated by a lever moved to one extreme position for opening all doors, and to another extreme position for closing all doors, the mid-position for by-passing the mains is advantageously adopted as shown in Fig. 1, as such position can be recognized instantly.

Door controlling valves *l* which are operated for closing or opening respective doors *m* may also be formed with a port or ports or cavity *n* in such a position or of such a shape that by moving the valve to

a certain position, such as the mid-position as shown in Fig. 1, the two ends of the cylinder *j* are by-passed or placed in direct communication by the pipes *o p* and cavity *n*, so that the door can be readily moved by mechanical means indicated generally and by way of example by the bevel wheels *q* and shaft *r*, the wheels *q* gearing the shaft *r* with the shaft *s* of the pinion *t* which meshes with the rack *u* on the door *m*, the shaft *s* being usually hydraulically driven by the rack *v* on the ram *k* gearing with a pinion *w*. The two ends of the cylinder *j* may, as hereinafter described, be placed in communication simultaneously with the pressure main *a*, or with the exhaust main *b*, but the resultant effect is the same in all cases, as in any event the two ends of the cylinder when short-circuited are under the same pressure and the fluid will be free to escape from one end of the cylinder *j* and to enter the other, as the door *m* and ram *k* are moved by the hand gear *q*.

When the by-passing is effected by the moving of a valve to a mid-position, springs or the equivalent hereinafter described may be so arranged as to operate upon the valve and automatically move it to mid-position whenever the pressure in the system falls sufficiently or fails.

As already stated the "bridge-control" valve chosen for illustrating the invention is of the slide valve type and is shown in connection with a reversible two-main system. Now by lengthening the cavity *h* of the valve *g* as stated, the cavity extends over all three ports *x y* and *z* in the slide-valve seating, and thereby connects the normal pressure main *a*, called the opening main, with the normal exhaust main *b*, called the closing main, and both of these mains *a* and *b* with the port or connection *y* leading to the exhaust *e*. Thus the mains *a* and *b* are by-passed or short-circuited in the mid-position of this valve *g* and are moreover connected with the exhaust *e*, so that any change in volume of liquid, or of capacity of the system due to movement of the rams, is provided for. When the valve *g* is moved to one extreme position or the other, the valve cavity *h* merely connects one main *a* or *b* with the exhaust *e* in the ordinary way, the other main *b* or *a* having its port *x* or *z* uncovered by the valve *g* for the entry into such main of pressure fluid from the valve chest 1 as hereinbefore stated. If the slide or other valve is of the type operated by a double acting ram, or by two oppositely working rams 2 and 3, controlled by a small hand-operated slide valve 4 capable of connecting either of the sides of the ram, or either of the ram cylinders 5 or 6, with a source of pressure such as the chest 1 and the other with the exhaust *e*, the cavity of this valve 4 also may be elongated, as

shown, so as to cover all three ports 7, 8, 9 simultaneously, the port 7 being connected with the cylinder 5, the port 8 with the exhaust *e* and the port 9 with the cylinder 6. Here again, as the middle port in the seating is the exhaust port, any pressure on the two sides of the ram, or on the two rams 2, 3 is equalized when the valve 4 is in the mid-position and the ram cylinders being both connected with the exhaust as well as with one another no difficulty can arise due to change in capacity of the ram cylinders. Springs 10 may be arranged in the ram cylinders 5, 6 and may be restrained, as described a little later, so as to only move the main valve *g* to mid-position when the pressures upon the two rams 2 and 3, or ram areas, are equalized in this manner; also if the pressure in the system fails, the springs 10 will automatically move the main valve *g* to a middle, or by-passing position, as pressure is no longer available for pressing the ram 2, or the ram 3, for holding the valve *g* in one extreme position or the other. For example the rams 2, 3 may be hollow and the springs 10 may be inclosed by open ended casings 11 having one end inserted loosely into the hollows of the rams 2, 3 and the other end slidable in sockets 12 in the ram cylinders 5 and 6, in which sockets the springs are seated. The loose fitting of the casings 11 permits, or suitable ports permit, of the entry and exit of pressure fluid to and from the interior of the hollow spaces of the rams 2 and 3. If the hand valve or pilot valve 4 is moved to one extreme position or the other by its lever 13, one or other of the ram cylinders 5, 6 is put to pressure and the other to exhaust, and one or other of the rams 2, 3 will move the main slide-valve *g* to a position for connecting one or other of the mains *a* or *b* with the source of pressure.

When the hand valve 4 is moved to the mid-position, the pressure in the ram cylinders 5 and 6 are equalized and the rams, being no longer pressed hydraulically, permit the oppositely acting or equilibrating springs 10 to bring the main valve *g* to the mid-position in which both mains *a* and *b* are directly connected or by-passed, so that it will therefore be possible to move any of the doors *m* by a mechanical gear *q*, as the pressure on opposite sides of the door operating ram *k* will be equal or balanced, providing one end of the ram cylinder *j* is in communication through the valve *l* with one main and the opposite end is in communication with the other main as will be the case if the valve *l* is in one or other of its extreme positions.

In systems comprising door controlling valves of the slide-valve type, as for example the slide-valve described in the specifications belonging to our previous applications

which type of valve has been selected for illustration in the accompanying drawings, it is possible to modify such valves so that each one will allow of the short-circuiting or by-passing of the two ends of the corresponding ram cylinders. For example and as hereinbefore stated, the slide valves l may be formed with elongated cavities or ports n and they may have means hereinafter described for moving them automatically, or otherwise, to the mid-position in which the two ends of the ram cylinder j are connected directly through the valve cavity n , so that such ends will be by-passed by the cavity n .

In the case of a through-ported double-faced slide valve l , such as is shown in Fig. 2, this valve may normally rest in the lowest position in which the through port 18 is opposite an elongated inlet port 19 communicating with the branch a' of the opening main a on one side and opposite a port 20 communicating with the pipe o leading to the opening end of the corresponding door-operating cylinder j on the other side. The through port 18 may remain in connection with the branch a' of the opening main a even when the valve is moved to a position, as for example the mid-position shown in Fig. 2, in which the cavity n covers the two ports 20 and 21 for by-passing the two ends of the cylinder. It is of no consequence whether or not the main a is under pressure, because if the two ends of the cylinder are by-passed as described, the pressures in the pipes o and p will be equalized in either case. If it be preferred, however, to shut off the pressure of the opening main a in the by-passing position of the valve l , the inlet passage 22 from the opening main may be bifurcated as at 23 in Fig. 1, and the branch passages have respective ports in the rear seating which are situated opposite the positions occupied by the through port 18 in respective extreme positions of the valve l , to which positions the valve is moved for connecting the opening and closing ends of the door cylinder j respectively with the passage 22. Thus when the valve is moved to the mid-position shown, the through port 18 thereof is blanked at the rear by the intermediate face lying between the two ports of the bifurcated inlet passage 22 and communication with the opening main a is shut off.

If desired, the inlet port need not be elongated as at 19, Fig. 2, and the inlet passage 22 need not be bifurcated as at 23 in Fig. 1, as the valve l may be formed with two through ports or passages 24, 25 as shown in Fig. 3. The port 24 is so disposed that in the lowest position of the valve l it affords communication between the inlet passage 22 and the door opening port 20, and the port 25 is so disposed that, in the highest position of the valve l , it affords communication between the inlet passage 22 and the door clos-

ing port 21, the ports 20 and 21 having their positions interchanged as compared with the corresponding ports in Figs. 1 and 2. In the mid-position of this valve, the inlet port 22 would be covered by the blank portion of the rear face of the valve l lying between the two through ports 24 and 25 referred to and the ends of the cylinder would be by-passed by the cavity n in the valve, which cavity is connected for example by a passage 26 with the space 27 in the valve casing which is normally an exhaust space connected by the branch b' with the closing main b which is normally open to exhaust.

From the above description it will be apparent that the by-passing will be equally effective supposing that both ends of the ram cylinder be connected together and with the normal exhaust main b , instead of with the normal pressure main a as in Fig. 2, and this may be done advantageously in some cases. By-passing on to the pressure main may be advantageous in some cases, as for example, when the door cylinders or rams are slightly differential.

If door controlling valves of the type above referred to are used in connection with a main by-passing device also of the kind above described, it follows that if the door valve be left in either of the extreme positions, the corresponding ram cylinder will be by-passed through the main valve g when the latter is in mid-position, but if the door valve l be left in mid-position the said cylinder will be by-passed by its own door valve.

In the case of vertical doors which might creep down and close under their own gravity when by-passing or short-circuiting of the cylinder or cylinders is the normal condition, such creeping or self-closing may be avoided by the application of suitable frictional devices or brakes, or by increasing the tightness of glands or packings. Where hand operated gears g are always in mesh with devices on the door, however, such creeping or self-closing is not likely to take place. Or with a valve or valves as shown in Fig. 2 and slightly differential door operating rams the effective area or load of the latter will act so as to balance the door and likewise prevent creeping down or self-closing of the door.

In cases where a door valve is normally left in, or returned to, a mid-position so as to prevent pressure fluid in the opening main a from opening the corresponding door, such a valve will be normally in a position for by-passing or short-circuiting its door-operating cylinder or cylinders as will be readily understood. Valves which are moved one way or the other by hydraulic pressure may be fitted with so-called equilibrating springs operating upon the hand levers or the like, so that, upon failure of the hy-

draulic pressure in the opening main *a* (or in some cases in the closing main) such springs will move the valves to mid-position for by-passing as described. For example the
 5 equilibrating springs 28 may be arranged as will now be described with reference to Fig. 4 and may be inclosed in respective casings 29 and be adapted to press stops or plungers 30, 31 out of such casings and into engage-
 10 ment with respective sides of the valve operating lever 270. The valve *l* is similar to that shown in Fig. 1 and is provided with a ram 32 which is normally subjected to pressure of fluid in the opening main *a* and
 15 branch *a'* but which is restrained from depressing the long arm of the double armed lever 270 by a catch device 33 which is capable of being released by the rising of the bilge float. Under normal conditions,
 20 the lever 270 may be operated by hand to bring the valve *l* to the lowest position in which the through port 18 communicates between the port 20 and one of the branches of the passage 22 which is bifurcated at 23,
 25 so that pressure fluid from the opening main has access to the opening end of the door cylinder *j* through the pipe *o*, and exhaust takes place from the closing end of the cylinder *j* through pipe *p* port 21, port 34 in
 30 valve *l*, and branch *b'* to main *b*. Or the valve may be raised to mid-position in which the cavity *n* by-passes the two ends of the cylinder *j* through the pipes *o* and *p*. Or the valve may be raised to the highest position
 35 in which the port 20 is uncovered to the interior of the valve chest and exhausts through *b'* while the through port 18 places the passages 22, 23 in communication with the port 21 so that pressure fluid has access
 40 to the closing end of the cylinder *j* through the pipe *p*. Owing to the pressure on the back face of the valve, the latter will stay in whatever position it is moved to if the springs 28 be held out of operation.

45 Now the ram device 32 is fitted with a fork 35 having two prongs 36 and 37, each of which has a laterally projecting part or end 38 and 39 respectively taking under res-
 50 pective arms of the lever 270. The ends 38, 39 bear, moreover, upon respective spring plungers 30, 31 the springs 28 of which force the plungers against stops provided by the flanges on the upper ends of the casings,
 55 in which position the plungers balance the two arms of the lever 270 in mid-position when the action of the plungers is not opposed by the effort of the ram 32 due to pressure in the branch *a'*, or by manual effort exerted on the long arm of the lever
 60 270, or by the effort of the valve stem 40 due to the admission of pressure fluid to the main *b* and branch *b'* when the mains are reversed. The plungers 30 and 31 are, how-
 65 ever, normally depressed against the action of their springs by the ram 32 and fork 35,

which latter are caused to descend below the position shown until the projection 41 on the fork 35 engages the catch 33, which is simply a segmented projection on the hub of the bilge float lever 33^a, the action of
 70 which latter is readily seen by reference to Fig. 1, whereupon the ram 32 is arrested, so that normally the ram 32 is in this position in which it holds the plungers 30 and
 75 plunger 30 is shown pressing directly against the foot 42 of the valve stem 40 with which the short arm of the lever 270 is suitably connected and this plunger 30 may be formed with a shoulder 43 which is en-
 80 gaged by the end 38 of the prong 36, as for example by perforating the end 38 so as to pass over the reduced end of the plunger 30 and rest upon the shoulder 43. The plun-
 85 ger 31 may press against the imperforate end 39 of the prong 37 which lies beneath a depending lug or projection 44 on the long arm of the lever. With this arrangement and with the parts in the position shown in
 90 Fig. 4, the valve *l* can be lowered against the action of only one of the springs 28, namely that one beneath the plunger 30. The prong 37 when it descends below the
 95 normal position is adapted to depress the long arm of the lever 270 and for this purpose the long arm may pass through a slot in the prong 37, the edge 45 bounding the top of the slot striking the lever arm (when the ram is released and descends) and carry-
 100 ing with it the fork 35. The slot is long enough to permit of freely manually operating the lever 270 in relation to the prong 37, when the latter is in the normal position for giving the various valve positions for open-
 105 ing the door, or for closing the door, or for by-passing the two ends of the door cylinder as above described. If the bilge float should rise and cause the catch 33 to turn and release the ram 32, the latter descends and depresses the spring plungers 30, 31 still
 110 further and the edge 45 on the prong engages the long arm of the lever 270 and depresses it, thereby raising the valve *l* to door closing position, providing that the door has not been closed by hand already.

115 Whenever reversal of the mains puts the door closing main *b* and branch *b'* under pressure and the door opening main *a* and branch *a'* to exhaust the pressure upon the ram 32 is removed and the ram no longer
 120 depresses the fork 35 and spring plungers 30 and 31. The valve *l* however is depressed, in known manner, to the position for closing the door, by pressure fluid entering at *b'*, the stem 40 offering an effective area for the
 125 hydraulic pressure, consequently the foot 42 on the stem 40 directly depresses the plunger 30. If, now, a person desires to escape from the compartment in which he may be im-
 130 prisoned, he lowers the long arm of the

lever 270, thereby reversing the valve *l*, whereby the pressure fluid passes from the top of the valve chamber around the valve and enters the port 20 and opening pipe *o* so that the door is opened and allows the escape of a person. Immediately such person releases the lever 270, the pressure fluid entering at *b'* will depress the valve *l* into the position for door-closing with the closing main under pressure. If desired the two prongs of the plunger may be made alike, that it to say, they may both be like prong 37 with the imperforated bent end 39. In this case the descent of the valve would depress both spring plungers.

If pressure be cut off from the mains *a* and *b*, the ram 32 and the valve stem 40 will both be idle or inert and the spring plungers 30, 31 will be free to rise under the action of their springs. Suppose that the valve *l* is in its lowest position with the long arm of the lever 270 raised, as will usually be the case, then the plunger 30 in rising raises the valve *l* and the long arm of the lever 270 is correspondingly depressed until the lug 44 strikes the end 39 of the prong 37 against which the plunger 31 is pressing. It will thus be seen that the lever 270 comes to rest in an intermediate position determined by the positions in which the spring plungers are stopped and the cavity *n* covers the ports 20 and 21 and by-passes the two ends of the door cylinder. At any time the restoration of pressure to the opening main will re-set the parts, so that they will re-assume their normal functions, without any manual adjustment being required for this purpose. Also at any time and in any condition of the valve *l*, the admission of pressure to the main *b* and branch *b'* insures the descent of the valve *l* to the position for door closing with the main *b* under pressure. If when pressure is restored to the opening main *a* after a reversal of the mains, it is desired to insure that a valve *l* which has been in door closing position shall remain in that position so as to open the corresponding door, it may be advisable to provide retarding means for delaying the operation of the equilibrating springs 28 in order to prevent the latter from moving the valve *l* to the by-passing position during the short interval which may elapse between the removal of pressure from the closing main *b* and the restoration of such pressure to the opening main *a*. Such retarding means may conveniently take the form of dash pot devices or brakes applied to the two spring plungers 30, 31 or the outlet from the valve chest 27 to the branch *b'* of the closing main may be restricted as for example by a ported diaphragm, for the purpose of delaying the movement of the valve *l* under the action of the springs 28 so as to give full opportunity for the restoration of pressure to the main *a*

before the valve can reach the by-passing position.

When the bilge float control is not required, the catch 33 is not present. Normally, therefore, the ram 32 of such an arrangement, being free to descend under pressure, has the function of merely depressing the spring plungers 30 and 31, so that they are held out of operation and do not interfere with the ordinary working of the valve. As soon, however, as pressure is cut off from the mains, the plungers 30 and 31 are free to lift the fork device and to move the lever 270 into mid-position and maintain it there until pressure conditions are restored to the mains. In this arrangement there need be only one plunger 30 or 31, or a single spring or spring plunger, arranged directly beneath the ram 32, as it is only necessary to raise the fork device 35 and, while one arm of the lever is raised by the corresponding bent end 39, the other arm of the lever will approach the other bent end 38, and upon engaging the same, the lever 270 and valve *l* will be arrested in the intermediate or by-passing position.

In Fig. 1 a single spring plunger 31 is shown pressing upwardly against the long arm of the lever 270. This plunger 31 serves to normally maintain the valve *l* in the mid-position for by-passing, for it constantly presses the long arm against the ram 32 which is arrested by the catch 33 in such a position as to act as a stop for the lever 270 in the intermediate position of the latter. It will be understood that with the arrangement shown in Fig. 1 the lever may be operated under normal conditions to raise the valve *l* for closing the door wholly or partially, or to lower the valve *l* for opening the door, and that immediately upon release of the lever 270 the ram 32 or plunger 31 will return the lever to the by-passing position. The door is not affected by the by-passing and will remain in the position to which it has been moved as there is no hydraulic pressure tending to move it up or down. A second spring plunger similar to the plunger 31 may be arranged beneath the valve stem 40, as indicated by the dotted lines, in which case the springs will return the valve to mid-position under all conditions except when pressure is on from the "bridge" to close, or when pressure is in the opening main and the plunger 32 is released.

It may be arranged for a door-controlling valve to be maintained by fluid pressure in the opening main normally in a position for the door to be opened by the pressure fluid in that main. In this modification, which is illustrated in Fig. 5, there may be one ram 46 which is normally raised by pressure fluid admitted at *a'* from the main *a*, and the bilge float catch 33 normally restrains the ram 32, which latter is of larger area

than the ram 46 and is likewise acted upon by the pressure in the opening main admitted through the branch *a'* as before. Consequently, this ram 32, if released by the operation of the bilge float, overcomes the other ram 46 and reverses the valve *l*. With the ram 32 may be combined a spring 28 for moving the lever 270 to the intermediate position when pressure in the opening main is cut off. For example the ram 32 may be formed with a hollow end to receive the spring 28 and plunger 31 and the hollow end may be formed or fitted with a shoulder or flange 47 which is engaged by a flange 48 on the plunger 31, the action of the spring being limited say by the flange 48 abutting against the flange 47. The ram 32 is suitably prevented from rising above the position seen in Fig. 5. Normally, the ram 46 maintains the lever and valve *l* in the position shown for keeping the door open and the spring 28 is compressed by the forcing of the plunger 31 into the hollow end of the ram 32. If pressure be cut off from the mains, the ram 46 will no longer press the long arm of the lever 270 upward and the spring 28 will expand and force the plunger 31 downward until the plunger 31 is arrested by the flange 47. Thus the plunger 31 moves the lever 270 and valve *l* to by-passing position whenever pressure is cut off from the mains. If desired, a cock 50 which may be a two-way cock, may be fitted on the branch *a*² for the purpose of admitting pressure to the ram 46 when desired but when it is preferred to put the ram 46 out of action, the cock 50 may be turned to shut off the pressure in the branch *a*² and if desired to exhaust the cylinder of the ram 46 through a pipe *e*.

In the modification shown in Fig. 6 the spring 28 and plunger 31 are combined with the smaller ram 46 and the casing containing the spring 28 and plunger 31 and formed with the flange 47 for limiting the movement of the plunger 31 under the action of the spring is fixed to the chamber of the ram 46. A second spring plunger 31^a acted upon by a spring 28^a is arranged beneath the valve stem or rod 40. In this arrangement the valve for admitting pressure to the chamber of the ram 46 may be a lift valve 51 which can be held open by pulling down the long arm 52 of the valve lever and hooking the chain 53 to a suitable fixture. In order to shut off pressure fluid from the ram 46 the latter is lowered and the chain 53 is released whereupon the valve 51 seats itself under the pressure of the fluid admitted to the chamber 54 from the opening main. In this arrangement the larger ram 32 is normally restrained by the catch 33 and the long arm of the lever 270 is normally raised by the ram 46 forcing the plunger 31 upward. If pressure

fluid be cut off from the ram 46, then the spring 28^a forces the valve stem 40 upward until the efforts of the two springs 28 and 28^a balance, which conveniently takes place when the lever 270 is horizontal and the valve is in the mid-position for by-passing. Supposing that the parts are in the position shown in Fig. 6 and that the bilge float operates to release the catch 33 and permit the ram 32 to reverse the valve *l*, the plunger 31 will be fully depressed and the spring 28 compressed, whereas the plunger 31^a will rise under the action of its spring 28^a and will follow the valve stem 40. If now the pressure is cut off from the mains altogether the ram 32 being deenergized will allow the spring 28 to force the plunger 31 and the long arm of the lever 270 upward until the efforts of the two springs 28, 28^a balance one another, as before and the valve is then in the mid-position for by-passing as will now be readily understood.

What we claim and desire to secure by Letters Patent is:—

1. Control valve arrangement for fluid pressure door-operating systems comprising a valve casing, a valve movable therein, said casing and valve being constructed and arranged so that extreme positions of said valve correspond respectively with door-opening and door-closing operations and an intermediate position corresponds with by-passing or short circuit conditions of the motive power door-operating means, a normal pressure fluid inlet connection on the valve casing and a normal pressure fluid outlet connection on said casing said outlet connection and said valve member being so relatively disposed that if pressure fluid be admitted to said outlet connection said valve member will be automatically responsive in any position to said change of fluid pressure admission in order to produce door-closing conditions.

2. A fluid pressure system for opening and closing doors comprising in combination a central station or "bridge" valve, normal pressure main and normal exhaust main connections therewith, said valve being adapted to short circuit such mains as well as to distribute pressure fluid to either, and local control valves between said mains and respective motive power door-operating means said valve being adapted to short circuit said motive power means in addition to distributing pressure fluid thereto.

3. Control valve arrangement for fluid pressure door-operating systems comprising a valve member adapted to short circuit two pipe connections to motive power means in addition to being capable of distributing pressure fluid to either, means constantly active upon said valve member and tending to move same to a position corresponding with short circuit conditions, and

an effective ram area operative upon said valve in opposition to said means and adapted with normal pressure to produce an effort greater than that produced by said means substantially as set forth.

4. Control valve arrangement for fluid pressure door-operating systems comprising a valve casing main pressure and main exhaust connections thereon and a valve member adapted to distribute pressure fluid to either one of two ports leading to motive power door-operating means and to exhaust the other, said valve member being further adapted to simultaneously connect both of said ports with one of said main connections substantially as set forth.

5. Control valve arrangement for fluid pressure door-operating systems comprising a valve chest, main pressure and main exhaust connections thereon, and a slide valve so ported that in extreme positions it is adapted to distribute pressure fluid to either one of two ports leading to motive power door-operating means and to exhaust the other but in an intermediate position it is adapted to by-pass said two ports and at the same time to place them both in communication with one of said main connections substantially as set forth.

6. Control valve arrangements for fluid pressure door-operating systems comprising a valve member adapted to be moved to a mid-position to short circuit two pipe connections to motive power means in addition to being capable of distributing pressure fluid to an appropriate one of said connections when said valve is in either of its extreme positions, means constantly active upon said valve member and tending to move same to the mid-position and hydrostatic means adapted to move said valve member to either of the extreme positions in spite of the action of said means substantially as set forth.

7. Control valve arrangement for fluid pressure door-operating systems comprising a valve member adapted to be moved to a mid-position to short circuit two ports communicating with motive power means in addition to being capable of distributing pressure fluid to an appropriate one of said ports when said valve is in either of its extreme positions, a spring constantly active upon said valve member in the direction of the mid-position, a stop adapted to arrest the action of said spring when said valve is in the mid position and a ram adapted when effective to be operative upon said valve in opposition to said spring and to overcome the latter substantially as set forth.

8. Control valve arrangement for fluid pressure door-operating systems comprising a valve member adapted to be moved to an intermediate position to short circuit two ports communicating with motive power

means in addition to being capable of distributing pressure fluid to an appropriate one of said ports when said valve member is in either of its extreme positions, two springs constantly active upon said valve member in opposite directions and adapted by themselves to shift said valve member to said intermediate position and to maintain it in said position and hydrostatic means adapted normally to hold said valve member in an extreme position against the action of one of said springs substantially as set forth.

9. Control valve arrangement for fluid pressure door-operating systems comprising a valve member adapted to be moved to a position for short circuiting two ports communicating with motive power means in addition to being capable of movement to positions for distributing pressure fluid to an appropriate one of said ports, a spring adapted to operate upon said valve member and shift same to the short circuiting position, and a single acting ram adapted when effective to restrain the action of said spring said ram being in connection with the normal pressure main of a system substantially as set forth.

10. Control valve arrangement for fluid pressure door-operating systems comprising a valve member adapted to be moved to a position for short circuiting two ports communicating with motive power means in addition to being capable of movement to positions for distributing pressure fluid to an appropriate one of said ports, a ram adapted to operate said valve in one direction, a spring device constantly opposing said ram and adapted to produce movement of said valve whenever said ram is deenergized and a releasable stop normally limiting the operative movement of said ram substantially as set forth.

11. Control valve arrangement for fluid pressure door-operating systems comprising a valve member adapted to be moved to a position for short circuiting two ports communicating with motive power means in addition to being capable of movement to positions for distributing pressure fluid to an appropriate one of said ports, hydrostatic means adapted to operate upon said valve to shift same to one or other of the distributing positions, and elastic means adapted to operate upon said valve to shift same to bypassing position at such times as said hydrostatic means are not operative upon said valve substantially as set forth.

12. Control valve device for fluid pressure door-operating systems comprising a slide valve so ported that in one or other extreme position it distributes fluid pressure to either one of two ports communicating with motive power means and in an intermediate position it by-passes these two ports, covering means operative upon the back of

said valve the normal pressure admission taking place by way of said covering means and a through port in said slide valve, and a manual control operative upon said valve.

5 13. Control valve device for fluid pressure door-operating means comprising a slide valve so ported that in one or other extreme position it distributes fluid pressure to either one of two ports communicating
10 with motive power means and in an intermediate position it by-passes these two ports, covering means operative upon the back of said valve the normal pressure admission taking place by way of said covering means
15 and a through port in said slide valve, an unbalanced valve rod connected with slide valve, and operating means connected with said rod.

14. Control device for fluid pressure door
20 operating systems comprising a balanced slide valve capable of producing short circuit conditions in addition to working conditions in either direction in door-operating

motive power means, manual control means operatively connected with said valve, and
25 spring control means normally maintaining said valve in short-circuiting position.

15. Control device for fluid pressure door-operating systems comprising a balanced
30 slide valve capable of producing short circuit conditions in addition to working conditions in either direction in door-operating motive power means, manual control means operatively connected with said valve,
35 spring control means normally maintaining said valve in short-circuiting position, and automatic hydrostatic means adapted to be operative upon said valve when certain conditions arise to shift said valve to a distributing position substantially as set forth.
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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."