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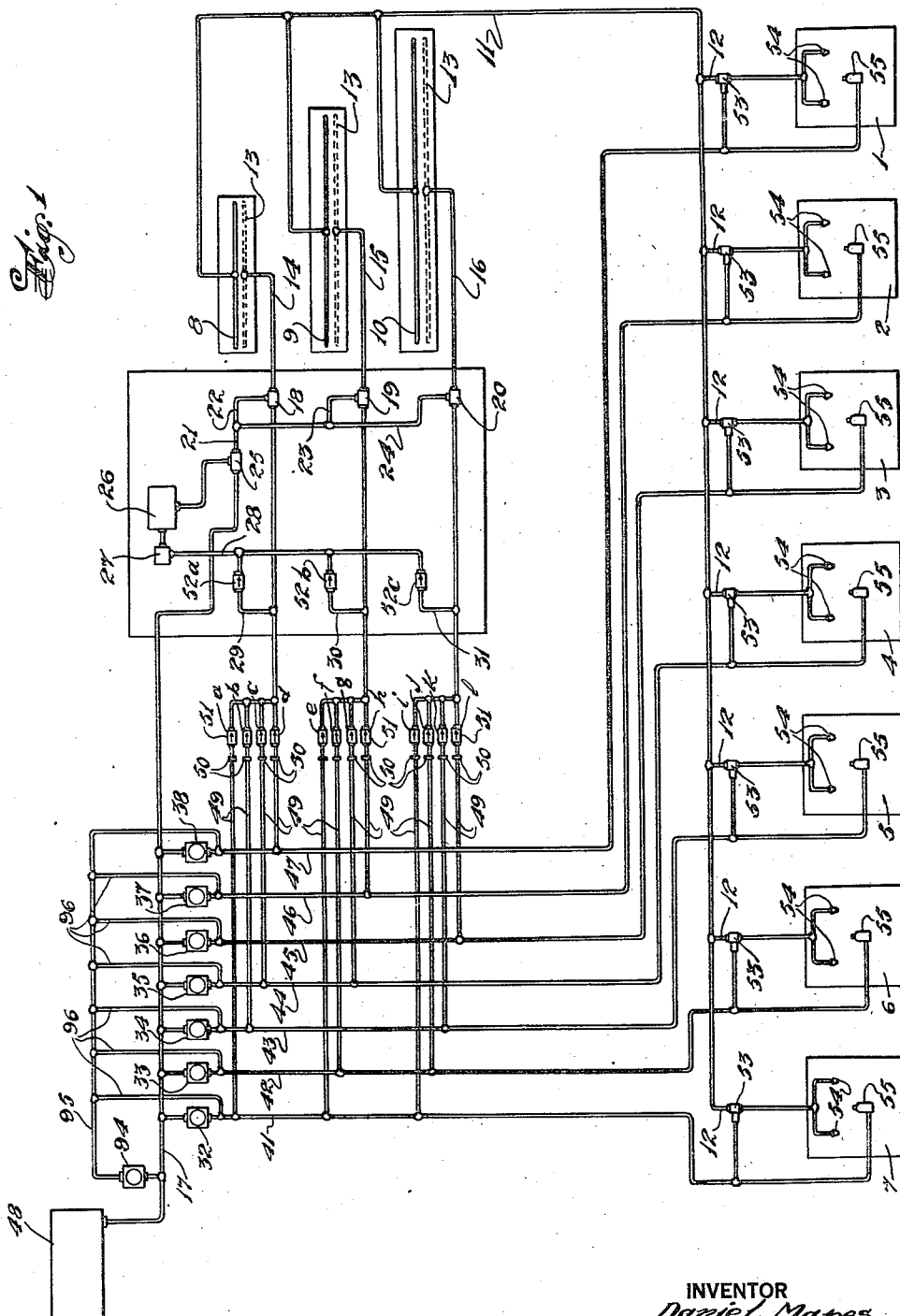
D. MAPES

2,307,784

MULTIPLE RESERVOIR FLUID MEDIUM DISTRIBUTION SYSTEM

Filed Aug. 27, 1941

2 Sheets-Sheet 1



INVENTOR
Daniel Mapes
BY *Harry J. Mower*
ATTORNEY

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D. MAPES

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Fig. 2

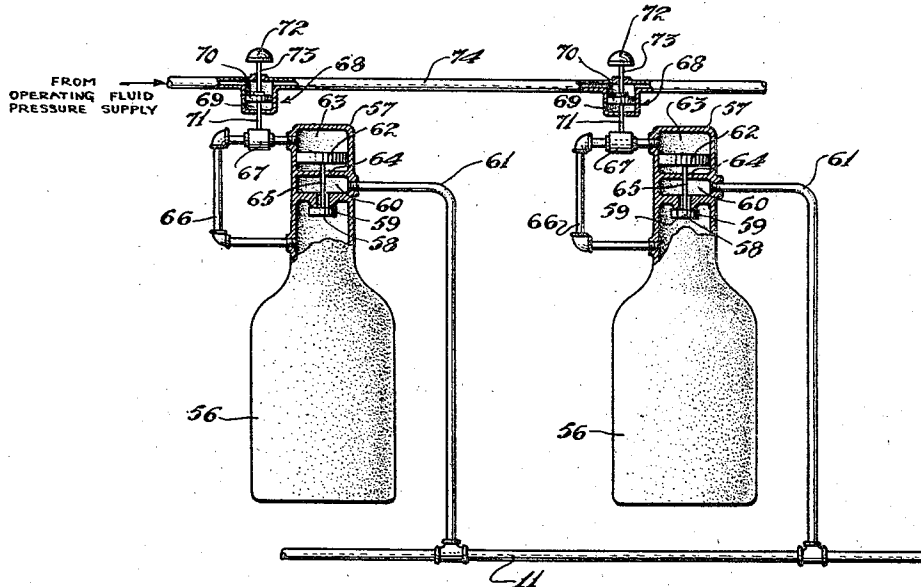
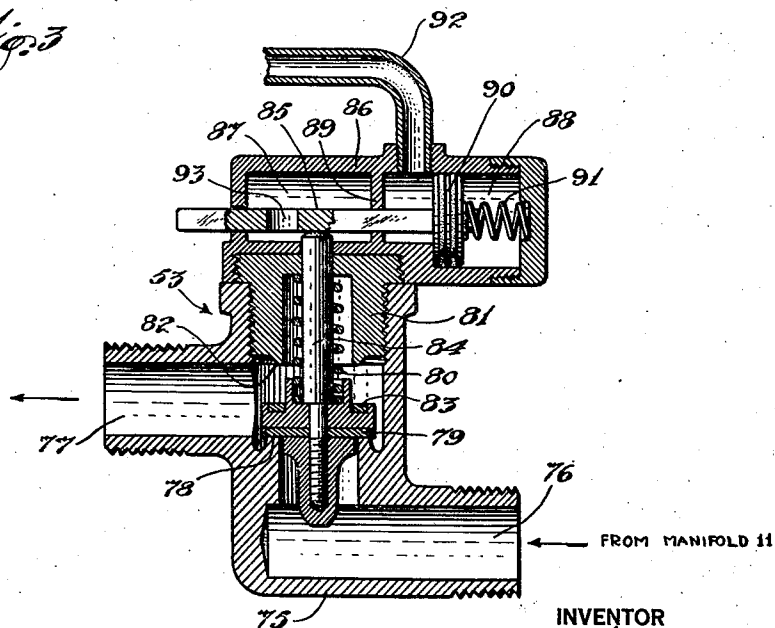


Fig. 3



INVENTOR
Daniel Mapes
BY *Harry J. Muzer*
ATTORNEY

UNITED STATES PATENT OFFICE

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MULTIPLE RESERVOIR FLUID MEDIUM
DISTRIBUTION SYSTEM

Daniel Mapes, Rutherford, N. J., assignor to Specialties Development Corporation, Bloomfield, N. J., a corporation of New Jersey

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6 Claims. (Cl. 169-11)

The present invention relates to high pressure gaseous fluid medium distribution systems, and more particularly to fire extinguishing systems employing carbon dioxide under pressure as the extinguishing medium. The carbon dioxide in such systems is stored in containers under high pressure and when required, is released into and distributed through appropriate distributing conduits which conduct it to the space or spaces afire.

More especially this invention relates to fire extinguishing systems of the type in which the fire extinguishing fluid medium is released by a fluid medium under pressure; where a plurality of spaces are protected; and in which the release of the extinguishing medium is somewhat delayed so as to permit of a warning to be given to occupants of the space to be flooded by the extinguishing medium.

While the present invention has certain features in common with the apparatus disclosed in the copending application for Letters Patent of the United States Serial No. 302,202, filed Oct. 31, 1939, it differs therefrom in that provision is made for the utilization in various combinations of a plurality of separate banks of containers and for an adaptable fluid pressure release control therefor.

In apparatus of this character, it is frequently necessary to protect a great variety of spaces with an accompanying variation in each case in the requirements for the extinguishing medium.

It is, therefore, an object of this invention to provide a high pressure fluid medium distribution system, as embodied in a fire extinguishing apparatus of the type referred to, which is capable of protecting a plurality of spaces having varying fire extinguishing fluid medium requirements.

Another object of the invention is to provide in a system of the type referred to, fluid pressure operable control apparatus which permits of the release of variable quantities of extinguishing medium.

A further object is to make provision in such a system for the operator to be able to preselect a desired outlet from among a plurality of possible outlets, and to release, automatically, extinguishing medium in accordance with predetermined requirements.

Further objects, not specifically enumerated above, will be apparent as the invention is described in greater detail in connection with the accompanying drawings, wherein:

Figure 1 represents a multi-space, multiple container bank fire extinguishing system in accord-

ance with the invention and shown in diagrammatic form.

Figure 2 illustrates schematically the fluid release apparatus for a pair of extinguishing fluid medium containers, while Figure 3 shows in section the general characteristics of one of the direction valves used in the system of Figure 1.

Referring now particularly to Figure 1, a plurality of spaces, which are to be protected, are indicated at 1 through 7; at 8, 9 and 10 are shown reservoirs or banks of storage cylinders or sources for liquid carbon dioxide adapted to discharge into a main conduit 11 to which are manifolded branch conduits 12 leading into the spaces 1 through 7. The individual containers grouped together in the three banks, as shown, may be controlled as a group or individually for the release of their fluid by means of a fluid pressure operable apparatus 13, indicated by broken lines and more particularly described in connection with Figure 2.

The release apparatus 13 is actuated by fluid supplied through conduits 14, 15 and 16, and coming through a main carbon dioxide or compressed air supply line 17. The admission of operating fluid pressure medium to the conduits 14, 15 and 16 and to the apparatus 13 is controlled by normally closed valves 18, 19 and 20 which are of the fluid pressure opened, piston operated type. The fluid to operate these valves is fed through a conduit 21, which is in communication with all three of the valve operating mechanisms through branch conduits 22, 23 and 24. The admission of the operating fluid from the supply line 17 to the conduit 21 is, in turn, controlled by a normally closed valve 25. This valve 25 is operatively combined with a time-delay device 26 in the manner as disclosed in Figure 1 of the copending application for Letters Patent of the United States, No. 302,202, that is, its operation by direct action of pressure is possible only after the time delay device has operated. However, the time-delay, instead of being released by means of a pull cable, is, in this case, released through the actuation of a fluid pressure operated mechanism 27, the details of which form no part of the present invention, and which may take any one of a number of well known forms of fluid motors.

The fluid motor 27 is supplied with operating pressure fluid through conduit 28, which communicates with the conduits 14, 15 and 16 through the branch conduits 29, 30 and 31. Conduits 14, 15 and 16 are associated with an operating fluid supply or source 48 by way of the conduit 17 through the medium of operating control valves 32 through 38, which control supply branch con-

duits 41 through 47. These branch conduits serve to conduct operating fluid under pressure from the source 48 to the release apparatus 13 of the banks 14, 15 and 16, each branch serving to convey operating fluid to a permutational combination of these banks or sources. Thus, for instance, the branch conduit 44 serves banks 8 and 9, while the branch conduit 43 combines banks 8 and 10 for a simultaneous operative release. This is accomplished by means of connector conduits 49, which connect the conduits 14, 15 and 16 with the supply branch conduits 41 through 47 in the proper combinations to achieve the permutations of banks 8, 9 and 10, as above referred to. A vent 50 and a check valve 51 are provided in each of the connector conduits 49, while a check valve 52, designated as *a*, *b* and *c*, is also seen to be placed in each of the conduits 29, 30 and 31, the significance of which will appear later. The check valves 51 are individually referred to by references *a* to *l*.

Upon being discharged into the manifolded branch conduits 12, the fire extinguishing medium by its pressure opens direction or branch valves 53, which are normally kept latched in a closed position. The unlatching of these branch valves 53 by means of an operating fluid pressure medium, acting through the conduits 41 to 47, will become evident in connection with the detailed description of Figure 3. The branch conduits 12 are shown to terminate within the protected spaces 1 to 7, and are there provided with extinguishing medium discharge nozzles 54, while the operating supply fluid branch conduits 41 to 47, also leading into spaces 1 to 7, are provided with pressure fluid operated warning bells or whistles 55, the particular design of which is not relevant to this disclosure.

For the situation where a simultaneous release of all banks to all the protected spaces is desired, usually a very rare occurrence, provision is made to operate all the banks and to open all direction valves 53 at once. In Figure 1, this is shown to comprise a special operating control valve 94, which controls the access of compressed air or other fluid medium under pressure from the source 48 into the conduit 95. The conduit 95 is provided with branches 96 which connect into the supply fluid branch conduits 41 to 47 in such a manner as to by-pass the operating controls 32 to 38.

Having now reference to Figure 2, the releasing mechanisms for two containers are here shown, since they are representative of the mechanisms of all of the containers in the three banks shown in Figure 1. In the diagrammatic form employed here, there is indicated at 56 a fluid storage reservoir or container which is provided with a fluid pressure operable releasing means 57, comprising a main valve 58 adapted to control the discharge of the fluid medium in the container 56 past a valve seat 59, into a chamber 60 and out into discharge tubing 61. The discharge tubing 61 conducts the released fluid medium to the main discharge manifold 11 shown in Figure 1. The valve 58 is adapted to be operated by a piston 62 reciprocally movable in a cylinder 63, separated from the chamber 60 by a partitioning wall 64. The piston 62 and the valve 58 are operatively joined by a connecting rod 65 which passes through an appropriate aperture in the wall 64. Each of the containers 56 is equipped with a fluid flow connection 66 connecting the container with the operative portion of the cylinder 63. A control or pilot valve 67 is located in

the connection 66. This pilot valve is adapted to be actuated by means of fluid pressure operable means 68 comprising a cylinder 69 and a piston 70 movable therein, a connecting rod 71 joining the piston 70 and the valve 67. The pilot valve 67 is also operable manually by means of a knob 72 and an actuating member 73, which extends into the cylinder 69, and which is capable, when actuated, of depressing piston 70 and capable of opening the pilot valve 67. The cylinders 69 of the pilot valve operating means 68 for the containers of a single bank are all connected to a pressure fluid supply line 74, which is referred to as 14, 15 and 16 in Figure 1.

The construction of the direction valves 53 of Figure 1, is shown in a detailed embodiment in Figure 3, and comprises a valve body 75 formed with an inlet 76 and an outlet 77, and having a valve seat 78 intermediate the inlet and the outlet. A valve member 79 is adapted to seat on the valve seat, being held there by the action of its top surface by a spring 80, which with its upper end bears against the nether surface of an appropriately recessed plug 81 disposed in an opening of the valve body 75. The plug 81 is formed with a secondary valve seat 82 facing the upper surface of the valve 79, so that, in case of discharge, when the valve member is lifted from its seat 78 by the pressure of the incoming fluid, its upper surface, where a corresponding secondary valve 83 is located, makes a sealing contact with the secondary valve seat 82 to prevent leakage of the fluid past a valve stem 84. The valve stem 84 extends through and beyond the plug 81. A piston-actuated latch 85 is shown reciprocally movable in a cylindrical member 86 threadedly secured to the top of the plug 81. The cylindrical member 86 is divided into two chambers 87 and 88 by means of a partition 89. The chamber 88 serves as a cylinder for a piston 90, which is movable against the force of a spring 91 by fluid under pressure supplied through tubing 92. Movement of the piston 90 causes the latch member 85, which is secured thereto, to move with it to one side, thus permitting the valve stem 84 and the valve 79 free to move upwardly through an aperture 93 in the latch member 85 due to pressure acting on the valve 79 through the inlet 76, and to permit fluid to pass from the inlet toward the outlet of the valve device. Tubing 92, in Figure 1, is represented by the supply branch conduits 41 to 47.

The operation of the system is as follows:

To facilitate the understanding of the operation of the complete system, it will be assumed that the space 5 is to be flooded with fire extinguishing medium. This space requires all the containers of the banks 8 and 10 to be released simultaneously. It is also assumed that compressed air is the operating medium. Upon opening of the operating control valve 34, associated with space 5, compressed air from the source or supply 48 is permitted to pass through this valve into the branch conduit 43 down to the piston 90 of the direction valve 53, controlling the admission of extinguishing fluid into the space 5. The valve 53 is thus unlatched and put in a position to be opened at the first onrush of carbon dioxide from the carbon dioxide supply banks. The compressed air, in addition to unlatching the direction valve also sounds the fluid pressure operated warning device 55 in the space 5. At the same time, air passes through the check valves 51, *b* and *k* in the connector conduits 49 connected to the branch conduit 43, which permit the air to

advance in the direction of the arrow into the operating fluid conduits 14 and 16 and up to the valves 18 and 20 which are normally closed. It is evident that the check valves 51 prevent the operating fluid released by the control valve 34 from reaching any of the other supply branch conduits through the connector conduits 49, and thereby prevent the operation of any of the direction valves other than that associated with the space 5. Air also passes through the check valves 52a and b and through the conduit 28 to the time delay release mechanism 27, causing the operation of the time delay 26 to be started.

The valve 18 and 20 remain closed until the time delay has completed its stroke, when air coming from the conduit 17 is able to force open the valve 25. This permits the air, after the desired time delay, to be fed into branches 22, 23 and 24 to open the valves 18, 19 and 20. Since air under pressure has previously passed through the check valves 51, b and k toward the valves 18 and 20, the opening of the valve 19 has no significance, while the air now coming through the valves 18 and 20 causes the operation of the control or release apparatus 13 of all the cylinders in the banks 8 and 10, thus releasing the extinguishing medium of all of these cylinders. As will be seen from inspection of Figure 2, air under pressure passing through the fluid supply line 74, which corresponds to the conduits 14 or 16 in Figure 1, causes all of the auxiliary or pilot valve pistons 70 to be depressed, and thereby causes the opening of the pilot valves 67. Carbon dioxide within the containers 56 is now able to pass through the fluid flow connections 66 and onto the back of the main valve operating pistons 62, thus opening the main valves 58 and allowing carbon dioxide to discharge into the manifold 11.

All the containers of the banks 8 and 10 are thus released simultaneously to discharge carbon dioxide into the direction valve manifold 11 and through the preselected valve 53, which had been previously unlatched through action of air through the branch conduit 43. The required gas thus automatically reaches the space 5. After the discharge has ceased and the operating control valve 34 has been closed, the valve 53, leading into the space 5, reseats, and the system is ready for another operation.

It can readily be seen, how, by following this same procedure, in respect to any other space, a similar train of operation may be set in motion. For example, by operating the control valve 32, all the gas of the banks 8, 9 and 10 would be released into the space 7 in a manner similar to that described for the space 5.

In view of the above, the operation of the system as a whole by the control 94 will be self-evident, as such operation of the control 94 will cause the opening of all direction valves 53 as well as the release of all the banks 8, 9 and 10, by the admission of operating fluid into all the supply branches 41 to 47 resulting in the simultaneous flooding of the spaces 1 through 7.

In some cases, when it is desired to obtain a slower or partial discharge of a bank, the operator is enabled to operate individually the necessary cylinders by pushing or turning down the manual local pilot valve control knobs 72 on the top of each piston operated control head. This will cause the release of gas only from the cylinders directly operated without affecting the others. Later on, additional cylinders may be

discharged in a similar manner and in the desired quantity.

It may be seen from the above description and operation that any combination between any number of spaces and any number of cylinders is possible, merely, by increasing the number of the operating control valves 32 to 38, the number of check valves 51, and that of the distributing valves 53.

Since each of the three groups of connector conduits 49, as illustrated, comprises four conduits manifolded together to the conduits 14, 15 and 16, respectively, there exists the possibility that the operating fluid pressure medium released by any of the control valves 32 to 38 may leak past the check valves 51 and undesirably operate some of the direction valves 53 through the corresponding supply conduits 41 to 47. In order to prevent such a possible undesirable operation of any except the selected direction valve 53, provision is made to vent the connector conduits 49 through the vents 50.

Having described a preferred form of the invention, I do not wish to limit myself to the specific details set forth but wish to reserve to myself any changes or variations that may appear to those skilled in the art as mechanical equivalents or fall within the scope of the following claims.

I claim:

1. A fire extinguishing system for protecting a plurality of enclosures comprising in combination a plurality of sources for a fluid medium under pressure, a common main delivery conduit for said sources, a plurality of branch conduits connecting said main conduit with said enclosures, a fluid pressure operated flow control valve in each of said branch conduits, locking means for each of said control valves adapted to be rendered inoperative by fluid pressure, fluid pressure operable means for releasing the fluid medium from each of said sources, a separate operating fluid pressure supply for the operation of said last named means, a supply conduit for connecting the releasing means of each source with said fluid pressure supply, a control means associated with each operative permutational combination of said supply conduits with respect to said operating fluid supply corresponding to the number of enclosures, a normally closed valve in each of said last named supply conduits to control the admission of fluid pressure to each of the reservoir releasing means, pressure operable valve opening means associated with each of the last named valves, common fluid flow connecting means from said operating fluid supply to all of said pressure operable valve opening means, a normally closed pressure operable valve in said common fluid flow connection, fluid pressure releasable time delay means associated with said last named valve to control its operation, a second fluid flow connection disposed between said time delay means and said last named control means, and a third fluid flow connection from the supply through said control means to each of said pressure operable valve locking means.

2. In a fire extinguishing system for protecting a plurality of enclosures and having extinguishing fluid stored in a plurality of sources, each source being adapted to be released by a fluid pressure operable device; the combination of conduits, one leading to each of said fluid pressure actuable releasing devices, a valve in each of said conduits normally held closed and adapted to be opened by fluid pressure, operating fluid con-

ducting means leading to said last named valves, a pressure operable controlling valve in said conducting means, and a fluid pressure operable time delay device operatively controlling said controlling valve, whereby the simultaneous operation of all of said first named valves is controlled by said time delay device and said controlling valve.

3. In a fire extinguishing system protecting a plurality of enclosures and including fire extinguishing fluid stored in a plurality of sources, each source being adapted to be released by a fluid pressure operable device, and an operating fluid conduit for each of said devices; the combination of a main operating fluid supply conduit, a branch conduit in said main conduit for each possible operative permutational combination of said operating fluid conduits, an operating control valve for each of said branch conduits, and connector conduits between said operating fluid conduits and said branch conduits.

4. In a fire extinguishing system for protecting a plurality of enclosures and including fire extinguishing fluid stored in a plurality of sources, each source being adapted to be released by a fluid pressure operable device, and an operating fluid conduit for each of said devices; the combination of a main operating fluid supply conduit, a branch conduit in said main conduit for each possible operative permutational combination of said operating fluid conduits, an operating control valve for each of said branch conduits, connector conduits between said operating fluid conduits and said branch conduits, and a check valve and a vent in each of said connector conduits permitting the flow of operating fluid there-through in a direction toward said operating fluid conduits.

5. In a fire extinguishing system for protecting a plurality of enclosures and including fire extinguishing fluid stored in a plurality of sources,

each source being adapted to be released by a fluid pressure operable device, and an operating fluid conduit for each of said devices; the combination of a discharge manifold for said sources having branches leading to said enclosures, a pressure operable direction valve for each of said branches; a main operating fluid supply conduit, a branch conduit in said main conduit for each possible operative permutational combination of said operating fluid conduits forming a fluid flow connection to each of said direction valves, an operating control valve for each of said branch conduits, and connector conduits between said operating fluid conduits and said branch conduits, whereby upon operation of a selected operating control valve a predetermined amount of extinguishing fluid is discharged into the selected space.

6. In a fire extinguishing system for protecting a plurality of enclosures and including fire extinguishing fluid stored in a plurality of sources, each source being adapted to be released by a fluid pressure operable device, and an operating fluid conduit for each of said devices; the combination of a discharge manifold for said sources having branches leading to said enclosures, a pressure operable direction valve for each of said branches; a main operating fluid supply conduit, a branch conduit in said main conduit for each possible operative permutational combination of said operating fluid conduits forming a fluid flow connection to each of said direction valves, a main operating control valve for said branch conduits, and connector conduits between said operating fluid conduits and said branch conduits, whereby upon operation of said main operating control valve the fire extinguishing fluid of all of said sources is discharged into all of said enclosures.

DANIEL MAPES.