Aug. 14, 1951 H. C. GRANT, JR 2,563,837

FLUID MEDIUM DISPENSING SYSTEM

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Fig. 1

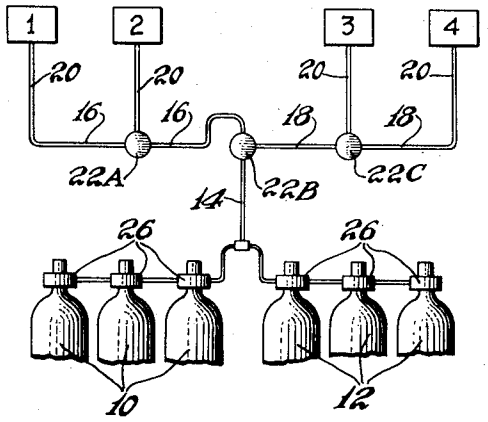


Fig. 2

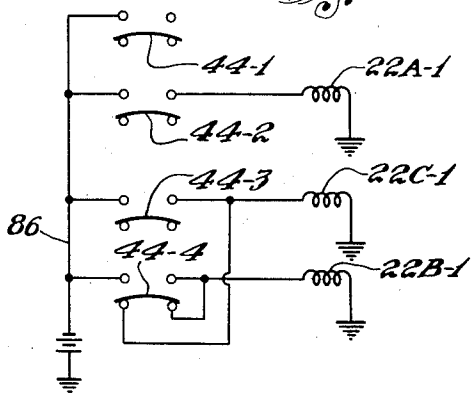


Fig. 3

SPACE SWITCH	DIR. VALVE
1	NONE
2	A
3	BC
4	B

Fig. 4

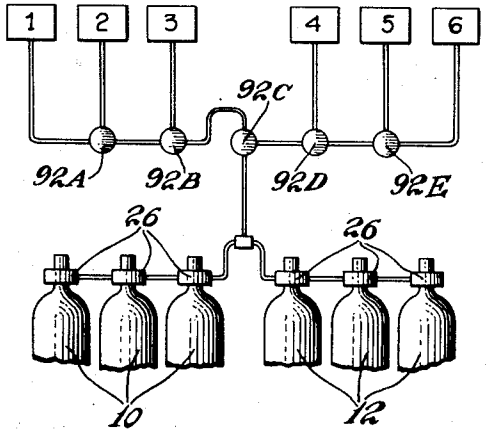


Fig. 5

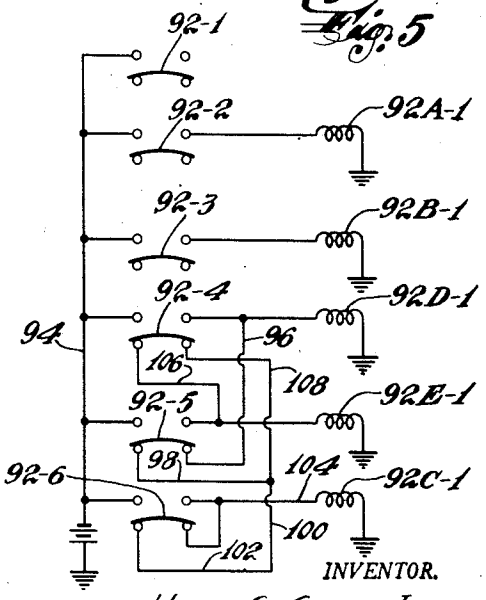


Fig. 6

SPACE SWITCH	DIR. VALVE
1	NONE
2	A
3	B
4	CD
5	CE
6	C

INVENTOR.
HARRY C. GRANT, JR.
BY
Jack Montgomery
ATTORNEY

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Fig. 7

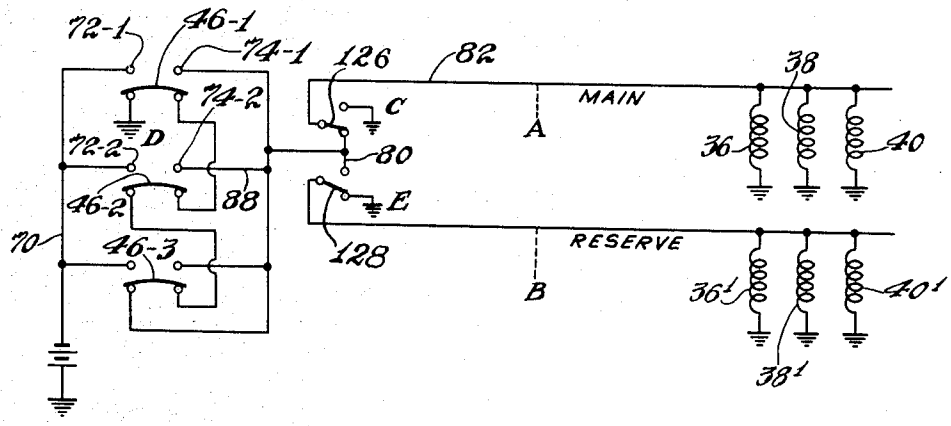
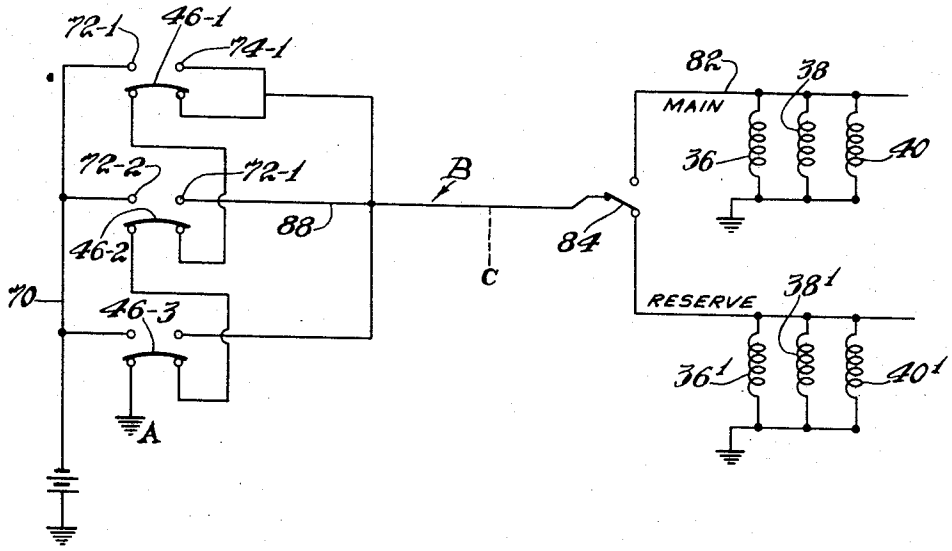


Fig. 8



INVENTOR.
HARRY C. GRANT, JR.
BY
Jack Montgomery
ATTORNEY

Aug. 14, 1951 H. C. GRANT, JR 2,563,837

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Fig. 9

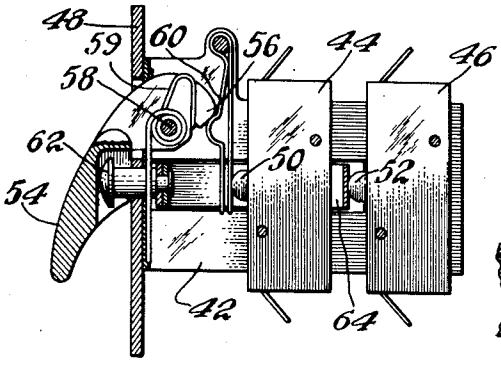


Fig. 12

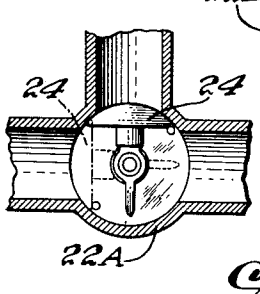


Fig. 13

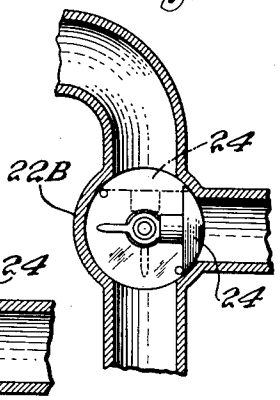


Fig. 14

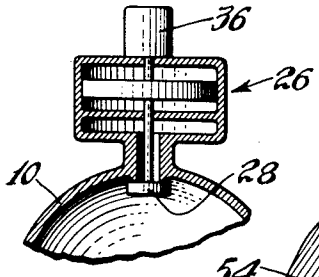


Fig. 10

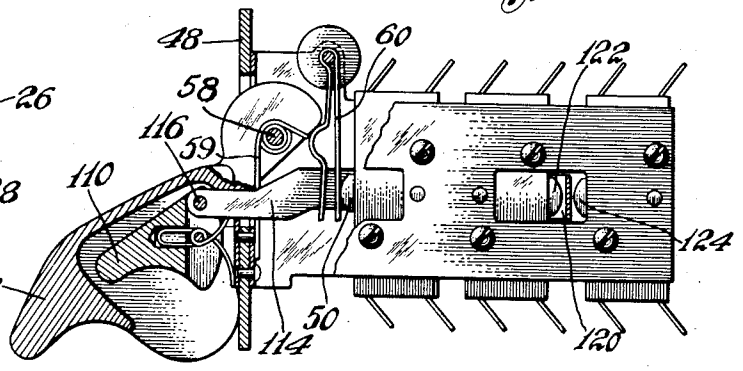
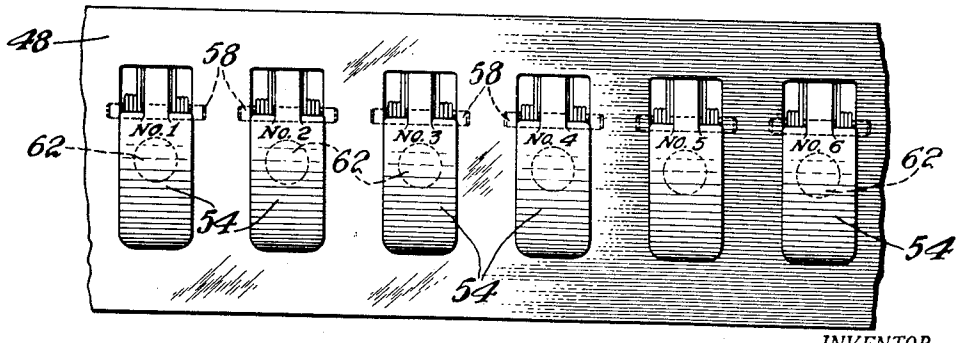


Fig. 11



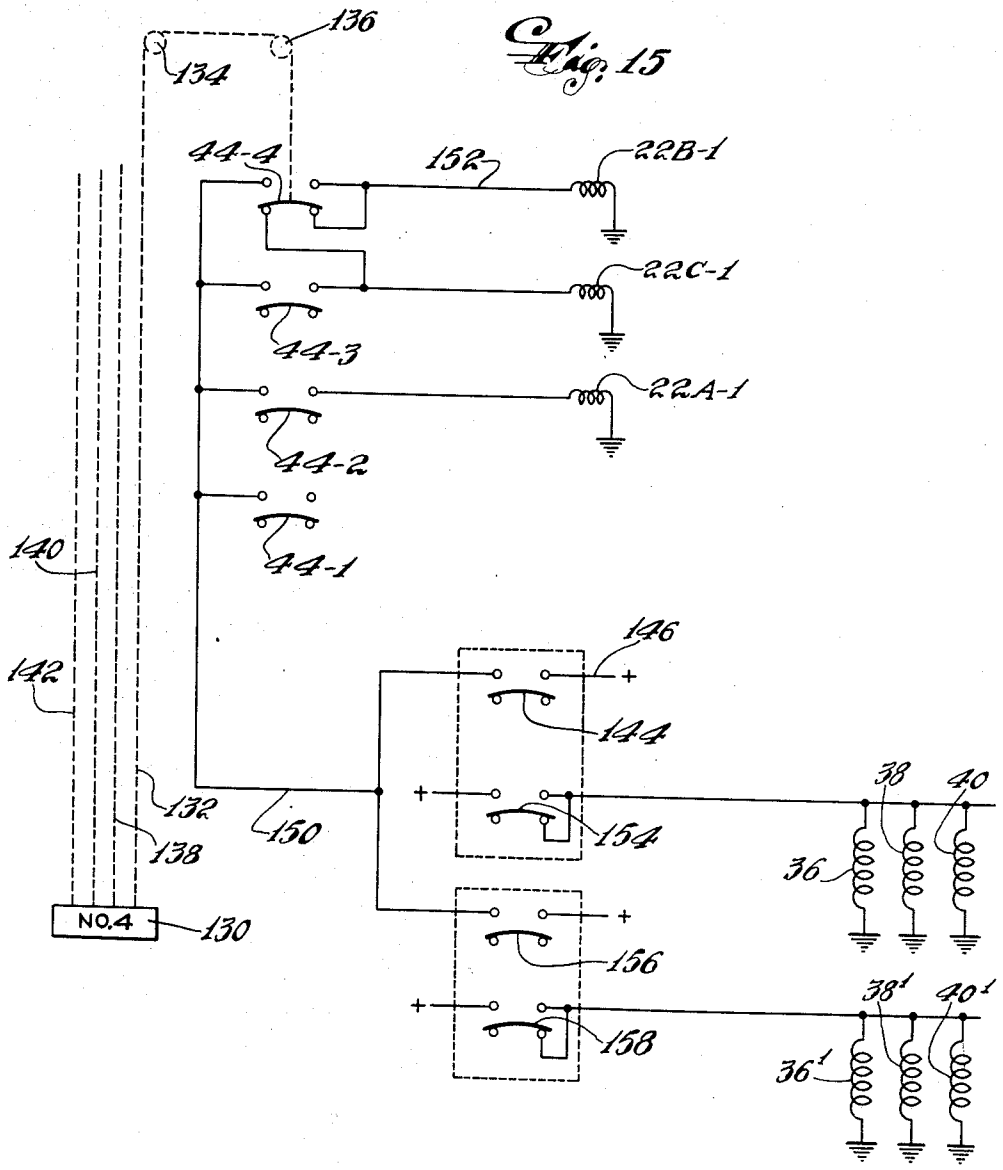
INVENTOR.
HARRY C. GRANT, JR.
BY
Joseph Montgomery
ATTORNEY

Aug. 14, 1951 H. C. GRANT, JR 2,563,837

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Fig. 15



INVENTOR.
HARRY C. GRANT, JR.
BY
Joseph Montgomery
ATTORNEY

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UNITED STATES PATENT OFFICE

2,563,837

FLUID MEDIUM DISPENSING SYSTEM

Harry C. Grant, Jr., Ridgewood, N. J., assignor to Specialties Development Corporation, Belleville, N. J., a corporation of New Jersey

Application May 5, 1947, Serial No. 745,931

19 Claims. (Cl. 169—5)

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This invention relates to improvements in fluid medium dispensing systems, such as fire extinguishing systems, and is particularly directed to such systems suitable for use in aircraft and the like, wherein the fire extinguishing medium may be directed for distribution to one or more selected points of use.

In such systems, there is a source of supply of the fire extinguishing medium, such as one or more containers for the medium, which containers are each provided with a release valve, which when opened permits the discharge of the medium into a discharge conduit. Branch conduits extend from the discharge conduit to points of use, which may be the several engine nacelles of the aircraft, for example. Each of the branch conduits is provided with a secondary or direction valve, which valves are opened selectively by the operator to direct the medium to the selected point of use.

In such systems, it is sometimes necessary that the direction valve be opened before the release valve. Under fire conditions and the resulting excitement, it is possible, with systems as heretofore installed, to inadvertently open the release valve first, which, with certain types of direction valves, results in the inability to open the direction valve, whereby the system would be rendered ineffective.

Such systems, as at present constructed, include a separate direction valve for each branch line and the necessary means for operating each valve by remote control, which include electric wiring extending from the operator's station to a solenoid associated with the valve for opening the same. Separate electric wiring and solenoids are also provided for opening the release valves. This wiring generally passes through junction boxes, and accidental application of the hot side voltage during testing or repairing of the system, results in accidental opening of the release valves.

Accordingly, an object of the present invention resides in the provision of a system of the character indicated having means whereby the proper sequential operation of the direction and release valves is assured.

Another object resides in the provision of a system wherein the number of direction valves employed is less than the number of branch lines, thereby reducing the expense and weight of the system, desiderata in aircraft.

Another object resides in the provision of means for preventing the accidental discharge of

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the medium during testing or repairing of the system.

A further object resides in the provision of a system wherein the direction valve may be selected manually and simultaneously with feathering the propeller and shutting off the oil and fuel supply to the selected engine, and wherein the necessary sequential operation of the direction and release valves is assured.

A still further object is the provision of a system of the character indicated which is efficient for the intended purpose and which can readily be operated, even by a novice, without any complicated or involved operating instructions.

Other and further objects not specifically mentioned will be manifest from the following description and accompanying drawings, in which drawings:

Fig. 1 is a schematic view of the system of the present invention as applied to the protection of four spaces, e. g. the nacelles of a four engine aircraft.

Fig. 2 is a schematic wiring diagram for operation of the valve actuators of the system of Fig. 1.

Fig. 3 is a chart showing the direction valves to be operated by the respective switches of Fig. 2 in order to direct the medium to the respective spaces of Fig. 4.

Fig. 4 is a view similar to Fig. 1, but as applied to the protection of six spaces, e. g. the nacelles of a six engine aircraft.

Fig. 5 is a schematic wiring diagram for the system of Fig. 3.

Fig. 6 is a chart showing the direction valves to be operated by the respective switches of Fig. 5.

Fig. 7 is a schematic wiring diagram for the release valves.

Fig. 8 is a similar view of a modified wiring diagram for the release valves.

Fig. 9 is a sectional view of one form of switch mechanism for the system.

Fig. 10 is a sectional view of another form of switch mechanism for the system.

Fig. 11 is a front elevational view of a switch plate for supporting the switch mechanism and adapted for mounting on the instrument panel of the aircraft.

Fig. 12 is a schematic sectional view of one of the direction valves.

Fig. 13 is a schematic sectional view of another direction valve.

Fig. 14 is a schematic sectional view of one of the release valves; and

Fig. 15 is a wiring diagram for a modified system.

Referring to the drawings in detail, the system shown in Fig. 1 includes a main bank of containers 10 for fire extinguishing medium, and a reserve bank of containers 12. The fire extinguishing medium may be liquid carbon dioxide, liquid methyl bromide, or any other fire extinguishing medium stored in a container under the pressure of a fluid medium or otherwise adapted to be discharged under the pressure of a fluid medium. Three containers are shown in each bank, but it is to be understood that any desired number may be employed. The containers of each bank may be connected directly, or, as illustrated, through their discharge heads, to a discharge conduit 14. Discharge line extensions 16 and 18 provide communication between the discharge conduit 14 and branch conduits 20 which extend from the discharge conduit extensions to several points of use, which may be the engine nacelles of the craft.

In Fig. 1, four protected spaces or points of use are shown, designated by the numerals 1, 2, 3 and 4, which in this case, represent the nacelles of the four engines of the craft. The flow of fire extinguishing medium from the discharge conduit 14, through the discharge line extensions 16 and 18, to the branch conduits 20 leading to these spaces, is controlled by secondary, selector or direction valves designated 22A, 22B and 22C. The valves 22A and 22C may be of the type illustrated in Fig. 12, and the valve 22B may be of the type illustrated in Fig. 13, the latter valve being common to all of the branch lines 20, in that the fluid medium must pass through this valve before reaching any of the branch lines, as will be understood from the description to follow.

Each of these valves is controlled or actuated by a solenoid, diagrammatically shown in Fig. 2, and designated 22A—1, 22B—1 and 22C—1, respectively.

These solenoids, when energized, rotate a blocking segment 24 (Figs. 12 and 13) in the respective valves to block off one of the branch lines, in the manner hereinafter described. The blocking segments are held in their respective rotated positions by the pressure of the fluid medium until there is a predetermined drop in the pressure due to the discharge of the medium, after which the segments return to their respective normal positions.

Each container of the main bank 10 and the reserve bank 12 has a discharge head designated 26 provided with a release valve 28 (Fig. 14). These release valves are each controlled or actuated by a solenoid, diagrammatically shown in Fig. 7 and designated 36, 38 and 40 and 36', 38' and 40', respectively. Each of these solenoids, when energized, unseats its respective valve 28, whereby to release the medium from its container to the discharge conduit, in the manner as more fully described hereinafter.

The electric circuits shown in Figs. 2 and 5, for energizing the solenoids of the direction valves, and the circuits shown in Figs. 7 and 8, for energizing the solenoids of the release valves, are each controlled by the sequence switch mechanism shown in Fig. 9 or 10. The number of switch mechanisms provided, corresponds to the number of spaces to be protected, and each being identical in structure, one only will be described in detail.

The sequence switch mechanism of Fig. 9 comprises a frame 42 supporting a pair of small switches or switchettes 44 and 46, arranged in tandem, so as to occupy a minimum of space on the back of a switch plate 48, shown in Fig. 11, on which the switch mechanism is mounted. One switch 44 is provided in each circuit of each solenoid direction valve, and one switch 46 is provided in each circuit for the solenoid release valves. The switch 44 includes a push button 50, and the switch 46 includes a push button 52. The push button 50 of the switch 44 is adapted to be depressed to close the circuit to its solenoid by means of a pivoted cover plate 54. A nose 56 of the cover plate 54, when the cover plate is raised about its pivot 58, engages a spring member 60 and moves it against the button 50, whereby the button is depressed to close the circuit to the direction valve solenoid.

The cover plate 54 completely covers a push button 62 mounted on a slidable stirrup or arm 64, the inner end of which is in alignment with the button 52, so that when the button 62 is depressed it in turn will depress the button 52, whereby to close the circuit to the release valve solenoids.

By having each cover plate 54 completely cover its respective button 62, the push buttons 62 can not be depressed to operate the release valve solenoids until the cover plate is raised, as hereinbefore mentioned, the circuit of the direction valve solenoid is closed and the button 62 is exposed, so that it can be depressed by the operator to close the circuit to the release valve solenoids.

In operation of the system illustrated in Figs. 1, 2 and 7, employing the switch of Fig. 9, assuming that a fire has broken out in or adjacent engine No. 1, the operator raises the cover plate marked "No. 1" (Fig. 11). This will not close any solenoid circuit (Fig. 2) because, in the system of the present invention, there is no solenoid valve for the branch line to engine No. 1, as will be understood from the description to follow. This lack of a solenoid valve for that line need not be known to the operator. All that he needs to know is that he must lift the cover plate, whereby to expose the button 62, which he then presses. The pressing of the button 62 closes the circuit (Fig. 7), through the switch 46—1, to the solenoid release valves of the containers 10 of the main bank, whereby current will flow from its source through line 70, contact 72—1, switch 46—1, contact 74—1, line 76, line 78, switch 80 (the latter being a double throw switch which is normally closed, to the circuit of the solenoids 36, 38 and 40), and through line 82 to the solenoids 36, 38 and 40, whereby the solenoids will be energized to effect opening of the release valves 28. Upon opening of the release valves, the fire extinguishing medium will be released to the discharge conduit 14 (Fig. 1), and thence through valves 22B and 22A and branch conduit 20 to engine No. 1, the valves 22B and 22A being normally open to permit the flow of medium to the said branch conduit.

Assuming that a fire breaks out in or adjacent engine No. 2, the operator lifts the cover plate marked "No. 2" (Fig. 9), whereby the push button 50 will be depressed to close switch 44—2 (Fig. 2), thereby closing the circuit from its source of current through line 86 (Fig. 2), and through switch 44—2 to the solenoid 22A—1, to energize the same. Energization of the solenoid 22A—1 causes the direction valve 22A to operate, thereby rotating the blocking segment 24 (Fig. 12) in a counterclockwise direction to the dotted line position shown in Fig. 12, to block off the branch

line to engine No. 1, and open the branch line to engine No. 2. When the cover plate "No. 2" is raised, in the manner described, the operator presses the push button 62 (Fig. 9), which in turn depresses the button 52 closing switch 46—2 to complete the circuit to the release valve solenoids 36, 38 and 40, the current passing from its source through line 70 (Fig. 7) through contact 72—2, switch 46—2, contact 74—2, line 88, line 78, switch 80, and line 82 to the release valve solenoids. Energization of the solenoids effects opening of the release valves, whereby the fire extinguishing medium will be discharged through the discharge conduit 14 (Fig. 1), valve 22—B and valve 22A to engine No. 2, or the nacelle of that engine.

When it is desired to discharge the medium to engine No. 4 (Fig. 1), the raising of the cover plate marked "No. 4" will close the circuit to the solenoid 22B—1 of direction valve 22B only, whereby the blocking segment 24 of that valve (Fig. 13) will be rotated in a counterclockwise direction to the dotted line position, to block off the branch line to valve 22A and engines Nos. 1 and 2. The valve 22C at this time being open, the medium will flow directly to engine No. 4. As will be seen from the diagram of Fig. 2, the closing of the switch 44—4 will complete the circuit directly from line 86 to solenoid 22B—1.

When it is desired to direct the medium to engine No. 3, the valves 22B and 22C are operated, the operation of the valve 22C blocking off the line to engine No. 4 and opening the line to engine No. 3 in the same manner as previously described in connection with the operation of valve 22A. The circuit for the solenoid valves 22B and 22C may be traced (Fig. 2) from the source of current, through line 86 and switch 44—3, to solenoid 22C—1 of valve 22C, and through branch line 90 and switch 44—4 to solenoid 22B—1 of valve 22B.

The direction valves 22A and 22C are similar in construction, and their respective blocking segment 24, as well as the blocking segment of direction valve 22B, are normally in the positions shown in full lines in Figs. 12 and 13, respectively. These segments, when rotated to their dotted line positions, as shown in Figs. 12 and 13, are retained in their rotated positions under the influence of the pressure medium, and return to their full line, or normal, positions when the medium has been discharged and pressure of the fluid media on the segments thereby relieved.

It will be seen from the foregoing, and from the chart of Fig. 3, that when the cover plate marked "No. 1" is raised, no circuit is closed and no direction valve is operated; but when the associated button 62 is depressed the circuit to the release valves is closed and those valves opened, whereby medium is directed through the normally open valves 22B and 22A to engine No. 1. When the cover plate marked "No. 2" is raised, the circuit to solenoid 22A—1 of direction valve 22A is closed, whereby to rotate the segment 24 of that valve to close the branch conduit to engine No. 1 and to open the branch conduit to engine No. 2. When cover plate marked "No. 3" is raised, solenoids 22B—1 and 22C—1 of direction valves 22B and 22C, respectively, are operated, whereby to rotate segment 24 of valve 22B to close off the branch lines to engines Nos. 1 and 2, and to rotate the segment 24 of valve 22C to open the branch line to engine No. 3 and close off the branch line to engine No. 4. When cover plate marked "No. 4" is raised, only solenoid 22B—1 of direction valve 22B is operated, whereby the medium is directed away from discharge line extension 16 to engine No. 4, the valve 22C at this time being closed to the branch conduit leading to engine No. 3 and being open to the branch line leading to engine No. 4.

The operation of the system for a six engine aircraft, as shown in Figs. 4 and 5, is similar to that of the system of Figs. 1 and 2, except for the additional electrical circuits for the additional direction valves.

In the operation of the system of Figs. 4 and 5, when it is desired to direct the medium to engine No. 1, the operator raises the cover plate marked "No. 1" (Fig. 11). This will not close any solenoid circuit because, in this system, as in the system of Figs. 1 and 2, there is no solenoid valve for the branch line to engine No. 1. When the cover plate No. 1 is raised, however, the push button 62 is exposed, which the operator then presses. The pressing of any of the buttons 62 closes the circuit to the release valves in the same manner as previously described in connection with the circuit of Fig. 7, hence it is unnecessary to describe such operation in connection with the release valves of the system of Figs. 4 and 5.

In operating the direction valves of the system of Figs. 4 and 5, upon raising the cover plates, circuits are completed to the respective solenoids of those valves.

When the cover plate marked "No. 2" is raised, the push botton 50 (Fig. 9) will thereby be depressed, whereby to close switch 92—2 (Fig. 5), which results in the closing of a circuit from the source of current through line 94, and through switch 92—2 to solenoid 92A—1 to energize the same and cause the blocking segment 24 of direction valve 92A to rotate and block off the branch line to engine No. 1, and open the branch line to engine No. 2. When the cover marked "No. 3" is raised, the push button 50 (Fig. 9) will be depressed, whereby to close switch 92—3 (Fig. 5), and complete a circuit from the source of current through line 94, and through switch 92—3 to solenoid 92B—1 to energize the same and cause the blocking segment 24 of direction valve 92B to rotate and block off the branch lines to engines Nos. 1 and 2 and open the branch line to engine No. 3. When the cover plate marked "No. 4" is raised and switch 92—4 closed thereby, a circuit is completed to solenoid 92D—1 of the direction valve 92D through line 94 and switch 92—4. The closing of the switch 92—4 also completes a circuit to solenoid 92C—1. This circuit may be traced from the source of current supply, through line 94, switch 92—4, line 96, switch 92—5, lines 98, 100, 102, switch 92—6, and line 104 to the solenoid 92C—1. The energization of the latter solenoid causes the blocking segment 24 of the valve 92C to rotate and block off the lines leading to valves 92A and 92B and engines Nos. 1, 2 and 3, and to open the line leading to valve 92D, the blocking segment of which was rotated upon energization of the solenoid 92D—1, as previously described, whereby to block off the line leading to valve 92E and engines Nos. 5 and 6, and to open the line to engine No. 4. When the cover plate marked "No. 5" is raised, and switch 92—5 is closely thereby, a circuit is completed to solenoid 92E—1 of the direction valve 92E, through line 94 and switch 92—5. The closing of the switch 92—5 also completes a circuit to solenoid 92C—1. The latter circuit may be traced from the source of current supply, through line 94, switch 92—5, line 106, switch 92—4, lines 108,

100 and 102, switch 92—6 and line 104 to the solenoid 92C—1. The energization of the latter solenoid operates the direction valve 92C in the same manner as previously described. The energization of solenoid 92E—1 will block off the line to engine No. 6 and open the line to engine No. 5, as will be understood from the previous description. When the cover plate marked "No. 6" is raised and the switch 92—6 is closed thereby, a circuit is completed from line 94, through switch 92—6, and line 104 to the solenoid 92C—1, whereby to energize that solenoid and operate the direction valve 92C to direct the fluid medium to engine No. 6, the valves 92D and 92E at that time being in their respective normal positions blocking off the lines to engines 4 and 5, respectively.

It will be noted that in the systems of Figs. 1 and 4, the number of direction valves required for operation of the systems is less than the number of spaces or engines protected. In the system of Fig. 1, four spaces or engines are protected by the use of three direction valves, and in the system of Fig. 4, six spaces or engines are protected by five direction valves. The reduction in the number of direction valves reduces the weight of the aircraft as well as the expense of the system.

The switch mechanism, shown in Fig. 10, is similar to that of Fig. 9, except that a lever or toggle arm 110 is provided under the cover plate 54, instead of the push button 62. This switch mechanism provides convenient means for switching from the main to the reserve bank of containers and vice versa. When the lever 110 is in one position it closes the circuit to the main bank of containers 10, and when in another position closes the circuit to the reserve bank of containers 12.

The lever 110 is pivotally mounted in the switch frame at 112 and has an arm 114 pivotally connected thereto at 116. This arm 114 operates a sliding stirrup 118, similar to the stirrup 64 of Fig. 9. The stirrup has an end piece 120 which extends laterally between opposed push buttons 122 and 124, which buttons are adapted to be depressed by the end piece 120 of the stirrup 118, upon manipulation of the lever 110. When the lever is raised about its pivot, the stirrup is moved to the right, as viewed in Fig. 10, to depress the button 124 and close switch 128; and when the lever is depressed, the stirrup is moved to the left, as viewed in Fig. 10, to depress the button 122 and close switch 126. Switch 126, as shown in Fig. 7, when closed, completes the circuit to the release valves 36, 38 and 40 of the main bank of containers 10, through the contacts of switch 80 and line 82. Switch 128, as shown in Fig. 7, when closed, completes the circuit to the release valves 36', 38' and 40' of the reserve bank of containers 12. It is to be understood that the wiring of the switches 126 and 128 may be reversed so that the lever 110, when raised, will effect closing of the circuit to the release valves of the reserve bank of containers, and when depressed will close the circuit to the release valves of the main bank of containers.

As will be seen from Fig. 7, the double throw switch 80 is normally closed to the circuit of the solenoid release valves of the main bank of cylinders, when the switch mechanism of Fig. 9 is employed. When the main bank supply has been exhaused, this switch is thrown to bring the solenoid valves of the reserve bank of cylinders in to the circuit. When the switch mechanism of Fig. 10 is employed the switch 80 is in neutral position, whereby closing of the switch 126 will complete the circuit to the solenoid release valves 36, 38 and 40 of the main bank, and closing of the switch 128 will complete the circuit to the solenoid release valves 36', 38' and 40' of the reserve bank of containers.

A single throw switch 84 is provided for switching from the main to reserve banks, and vice versa, in the system of Fig. 8. In this figure, the same reference characters are employed as in Fig. 7.

The systems of Figs. 7 and 8 are employed where the wiring to the solenoids passes through junction boxes, wherein accidental application of the hot side voltage might occur, resulting in accidental opening of the release and direction valves and the discharge of the medium as, for example, in testing or working on other circuits in the junction box.

When the system is undergoing repair, or at any other desired time, it is desirable to prevent such accidental operation of the valves, and accordingly, in the diagram of Fig. 7, provision is made for grounding the circuits during testing and repairing. In this diagram, the double-throw switch 80, when thrown to one position will ground the main line at C, while the reserve line is grounded at D, and when thrown to its other position will ground the reserve line at E, while the main line is grounded at D.

In the system of Fig. 8, the line B is normally grounded at A through switches 46—1, 46—2 and 46—3, as shown in the drawing, so that in the event of accidental connection of the line B to the hot side voltage of another circuit in the junction box, as at C for example, a dead short circuit is set up from A to C whereby to blow a fuse or open a circuit breaker in the line C of the other circuit.

The modification illustrated in Fig. 15 shows the sequence system of the present invention as applied to an airplane fire extinguishing system wherein the switches in the circuits for the solenoids of the direction valves are operated manually before the circuit to the source of electric energy is completed. In this system, two sequence switch mechanisms are employed, one of which is operated when the main bank of containers is to be discharged, and the other when the reserve bank of containers is to be discharged.

In some installations of airplane fire extinguishing systems, a gang bar or similar device is employed for manually selecting the direction valve to be operated, or for operating the selected direction valve. The gang bar, in addition to selecting or operating the direction valve for a selected engine, also operates means to feather the propeller of that engine, close a valve to shut off the oil supply and close a valve to shut off the fuel supply to that engine.

In the modification shown in Fig. 15, a gang bar 130 is schematically illustrated, which is mechanically connected by a cable 132 which passes over pulleys 134 and 136, to switch 44—4 of the solenoid 22B—1 of the direction valve 22B. Cables 138, 140 and 142 are also connected to the gang bar whereby to operate, respectively, means (not shown) for feathering the propeller of engine No. 4, a valve (not shown) to shut off the oil supply to engine No. 4, and a valve (not shown) to shut off the fuel supply to that engine.

When the gang bar 130 is pulled by the operator, because of the outbreak of fire at engine No. 4, for example, the switch 44—4 is closed, the propeller of that engine is feathered and the oil

and fuel supply shut off. While the operation of the gang bar closes the switch 44—4, it will be noted that no current will flow to the solenoid 22B—1, by reason of the circuit to the source of current being open. However, after the switch 44—4 is closed, in the manner described, the operator raises the cover plate 54 of the sequence switch mechanism to close switch 144 whereby the circuit is completed from the source of current to the solenoid 22B—1, the circuit being traced from its source through line 146, switch 144, lines 148 and 150, switch 44—4, and line 152 to the solenoid 22B—1. The energization of this solenoid will operate the direction valve 22B in the manner previously described.

After the cover plate 54 is raised, in the manner just described to effect operation of the solenoid direction valve, the operator presses the button 62 to close switch 154, whereby to effect energization of the solenoid release valves 36, 38 and 40 and the opening of the release valves 28 of the main bank of containers, in the manner previously described.

The second sequence switch mechanism of Fig. 15 is operated when the reserve bank of containers is to be discharged, the operation being the same as for the mechanism for the main bank of containers as just described. In the second sequence switch mechanism, the switches 156 and 158 function similarly to the switches 144 and 154, respectively.

It will be understood that while only four cables are shown connected to the gang bar 130 for performing their respective functions, additional cables may be employed to perform other functions, if desired. It will also be understood that while one gang bar 130 has been illustrated, there is a similar gang bar provided for each engine, whereby to close the respective switches 44—3, 44—2 and 44—1, in the same manner as the switch 44—4 is closed, and to feather the propeller and shut off the oil and fuel supply to the respective engines.

From the foregoing, it will be seen that the present invention provides a fire extinguishing system which can readily and simply be operated by the lifting of a designated switch button cover plate, and pressing the button normally concealed under the plate, the lifting of the plate closing a circuit to a similarly designated solenoid to effect operation of a direction valve, and the pressing of the switch button, closing a circuit to effect the release of fire extinguishing medium to the point of use selected by the designated switch button cover plate. By this arrangement, the proper sequential operation of the system is assured, it being impossible to close the circuit to effect operation of a release valve before closing the circuit to effect opening of a direction valve. By this arrangment, also, the solenoids of the direction valves may be designed for momentary operation, whereby to reduce the weight and also to prevent overheating or the burning out of the windings which might occur if the solenoids are left energized for too long a period. As will be understood from the description of the operation of the system, the solenoids are energized only for the period during which the cover plate 54 is in raised position. After this plate is raised to close the circuit to energize its respective direction valve solenoid and as soon as the button 62 is depressed to energize the release valve solenoids, the cover plate may be released, whereby to return to its normal position under the action of its spring 59, thereby opening the circuit to the solenoid release valve. By energizing the release valve solenoids, upon pressing the button 62, the fluid medium is released and the pressure of the medium on the blocking segment of the direction valve will retain the same open, as previously described, so that it is not necessary to maintain the direction valve solenoid energized during the discharge of the medium. When no medium is flowing, and the circuits to the solenoids of the direction valves are open, the valve segment will return to its normal position.

While seat type release valves are illustrated and described, it is to be understood that any other type of electrically operated release valve may be employed, such as, for example, that shown in U. S. Patent No. 2,417,082.

It will also be seen that provision is made whereby the selection of a direction valve to be operated will simultaneously result in feathering of the propeller, and shutting off the oil and fuel supply to the engine to which the first extinguishing medium is to be directed, and wherein the proper sequential operation of the direction and release valves is assured.

From the foregoing, it will also be seen that the system of the present invention is protected against accidental operation in the event of short circuiting during testing or repairing of the system.

It will be seen also that the present invention provides a system wherein a separate direction valve is not required for each branch line, thereby reducing the weight of the system as well as its cost.

It is to be understood that while the present invention has been described in connection with airplane fire extinguishing systems, it has other applications, such as, for example, in the lowering of landing gear of aircraft, wherein it is necessary to unlock the gear before admitting pressure; and any other installation wherein sequential operation of valves is necessary or desirable.

While the invention has been described with specific reference to the use of a fire extinguishing medium stored in containers under the pressure of a fluid medium, such, for example, as liquid carbon dioxide or liquid methyl bromide, the invention is in no way limited by the character of the fire extinguishing medium employed, so long as it can be discharged under pressure, whether the fire extinguishing medium is normally under fluid pressure or whether the fluid pressure is developed and/or applied to the fire extinguishing medium at the time of operation of the system; nor is the invention limited to fire extinguishing systems, it being applicable to use with any fluid medium dispensing system, as pointed out hereinbefore. The medium to be discharged under pressure may accordingly be in liquid, gaseous or solid form, and may include by way of example, water, dry powder or any other medium suitable for the use intended. Similarly, the pressure medium may be of any type, for example, compressed air, carbon dioxide or nitrogen, or the gaseous phase of a liquid fire extinguishing medium, as when liquid carbon dioxide or liquid methyl bromide are employed, or the pressure medium may be the combustion product of a burning liquid or powder. Accordingly, the expressions "fluid medium" and "fire extinguishing medium under pressure" are employed in the claims in a broad sense.

While preferred embodiments of the present

invention have been illustrated and described herein, it is to be understood that the present invention is not limited to such precise constructions, wiring or arrangements of parts, as obviously various changes and modifications may be made therein without departing from the spirit and scope of the invention.

I claim:

1. A fluid medium dispensing system comprising in combination a receptacle for containing a fluid medium adapted to be discharged under pressure, an electrically operated release valve for releasing the medium, first switch means for closing a circuit to effect operation of said valve, delivery means into which said medium is delivered when released, an electrically operated secondary valve in said delivery means for controlling the flow of medium to a point of use, second switch means for closing an electric circuit to effect operation of said secondary valve, and means associated with said second switch means for preventing the operation of the first switch means until the second switch means has been operated.

2. A fluid medium dispensing system in accordance with claim 1, wherein the second switch means includes means for normally urging the same into open circuit position and thus upon operation thereof momentarily closes the circuit controlled thereby and then opens said circuit, and wherein the secondary valve has means operable by the released fluid medium to retain the same open after the second switch means has returned to its normal open circuit position.

3. A fluid medium dispensing system in accordance with claim 1, wherein a switch plate is provided for mounting the first and second switch means, and wherein the second switch means comprises a switch arm pivotally mounted in juxtaposition to said first switch means whereby normally to cover the first switch means.

4. A fluid medium dispensing system in accordance with claim 1, having means for grounding said circuits whereby to prevent accidental closing of the circuits and opening of the said valves.

5. A fire extinguishing system comprising in combination a source of fire extinguishing medium adapted to be discharged under pressure, an electrically operated release valve for releasing the medium from its source, an electric circuit for said valve, a switch for closing said circuit to effect operation of said valve, a discharge conduit into which the medium is delivered when released, a plurality of branch conduits each leading from said discharge conduit to a point of use, an electrically operated direction valve for controlling the flow of medium to said branch conduits, an electric circuit for said direction valve, a second switch for closing the last named circuit to effect operation of the direction valve, and means for operating said second switch comprising a movable member normally preventing the operation of the first switch until after movement of said member.

6. A fire extinguishing system in accordance with claim 5, having a plurality of direction valves for controlling the flow of medium to the branch conduits, and separate switch means for closing the circuits to the direction valves to effect operation thereof.

7. A fire extinguishing system in accordance with claim 6, wherein one of the direction valves is common to a plurality of branch conduits.

8. A fire extinguishing system in accordance with claim 7, wherein the common direction valve is operable to permit the flow of fluid medium to a predetermined valve.

9. A fire extinguishing system in accordance with claim 8, wherein the common direction valve and another of the direction valves are operable upon closing said second switch to permit the flow of medium to different predetermined valves.

10. A fire extinguishing system in accordance with claim 6, wherein the total number of direction valves is one less than the total number of branch conduits.

11. A fire extinguishing system for multi-engine aircraft comprising in combination a receptacle for containing fire extinguishing medium adapted to be discharged under pressure; an electrically operated release valve for releasing the medium; an electric circuit for said valve; delivery means into which the medium is delivered when released; branch conduits leading from the delivery means to adjacent each of the engines of the craft; a plurality of electrically operated direction valves for controlling the flow of the medium to said branch lines; an electric circuit for each of the direction valves; manually operable means for selecting the direction valve to be operated and for closing a selection switch in the circuit of the selected valve; sequence switch means including a first switch for connecting the circuit of the release valve to a source of electric energy whereby to operate that valve, and a second switch for connecting the circuit of the selected direction valve to a source of electric energy, whereby to operate the selected direction valve, the second switch being adapted to render the first switch inoperative until the second switch is operated.

12. A fire extinguishing system in accordance with claim 11, wherein the second switch includes a lever pivotally mounted adjacent the first switch whereby to normally conceal the first switch.

13. A fire extinguishing system in accordance with claim 11, wherein the manually operable means for selecting the direction valve comprises means mechanically connected to the selection switch.

14. A fire extinguishing system in accordance with claim 11, wherein the manually operable means for selecting the direction valve comprises a gang bar having separate mechanical connections respectively to the selection switch, means for feathering the propeller and to valves for controlling the flow of fuel and oil supply to the selected engine of the aircraft.

15. A fire extinguishing system in accordance with claim 11, wherein main and reserve receptacles are provided for containing fire extinguishing medium, the electrically operated release valves thereof being in separate electric circuits, and separate sequence switch means for each circuit.

16. A sequence switch unit comprising a frame, a pair of electric switches mounted on said frame, and a manually engageable actuator for operating each switch movably mounted on said frame, the actuator for one switch normally prevent access to the actuator for the other switch, whereby the said other switch can not be operated until exposed upon operation of the actuator for the said one switch.

17. A sequence switch unit in accordance with claim 16, wherein the actuators are at the front of the frame and the switches are mounted in

tandem on the back of the actuators in operative connection therewith.

18. A sequence switch unit in accordance with claim 16, wherein the actuator for one switch comprises a pivoted lever and the actuator for the other switch comprises a push button, the pivoted lever normally covering the push button whereby to prevent operation of the button until the lever is moved about its pivot to expose said button.

19. A sequence switch unit according to claim 16, wherein the actuator for one switch comprises a pivoted lever, and wherein an actuator is provided for a pair of second switches, the latter actuator comprising a toggle arm normally completely concealed by the said lever.

HARRY C. GRANT, JR.

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