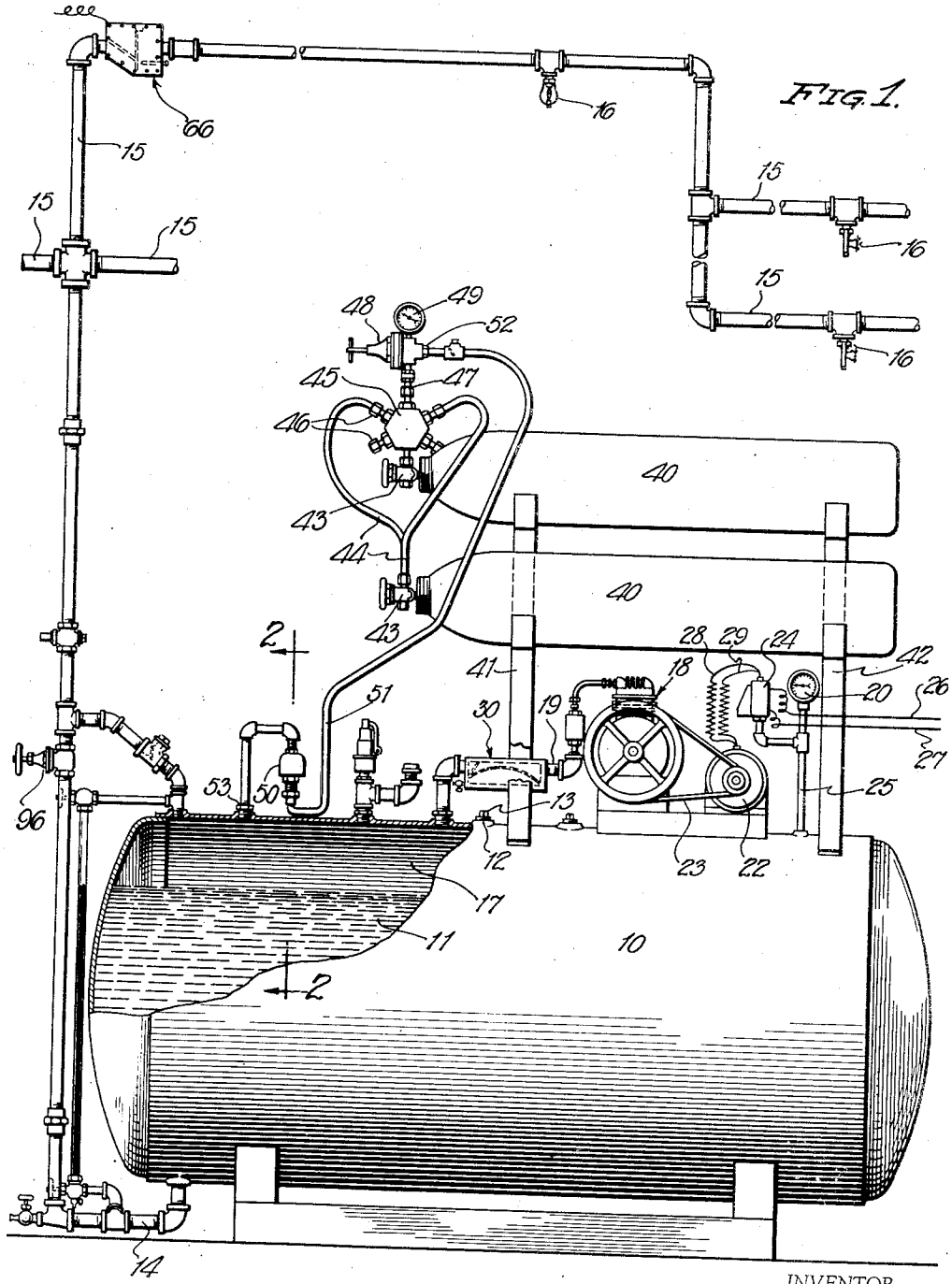
Oct. 4, 1938. J. L. SEAT 2,132,132

FIRE EXTINGUISHER SYSTEM

Filed May 14, 1937 3 Sheets-Sheet 1

FIG. 1.



INVENTOR.
JAY LAWRENCE SEAT.

WITNESS:
G. Dewton Lusby.

BY
Eby & Pattison
ATTORNEYS.

Oct. 4, 1938. J. L. SEAT 2,132,132

FIRE EXTINGUISHER SYSTEM

Filed May 14, 1937 3 Sheets-Sheet 2

FIG. 2.

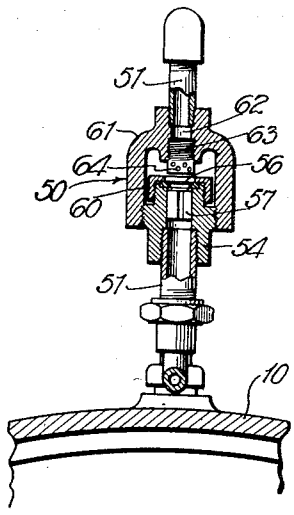


FIG. 3.

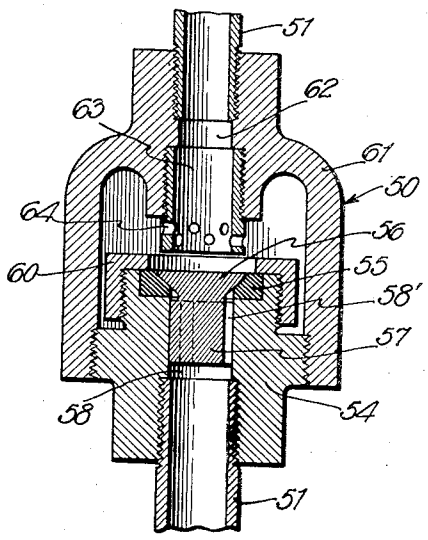


FIG. 4.

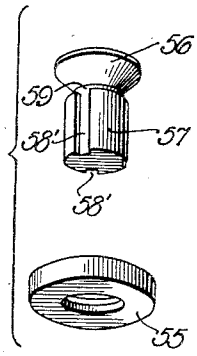


FIG. 5.

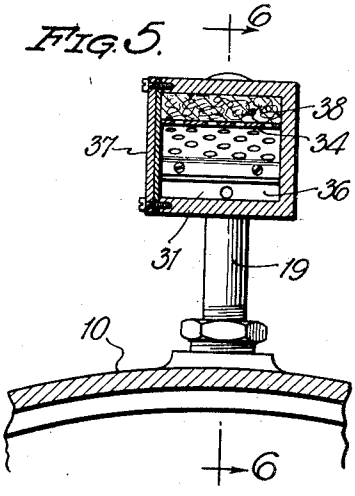


FIG. 6.

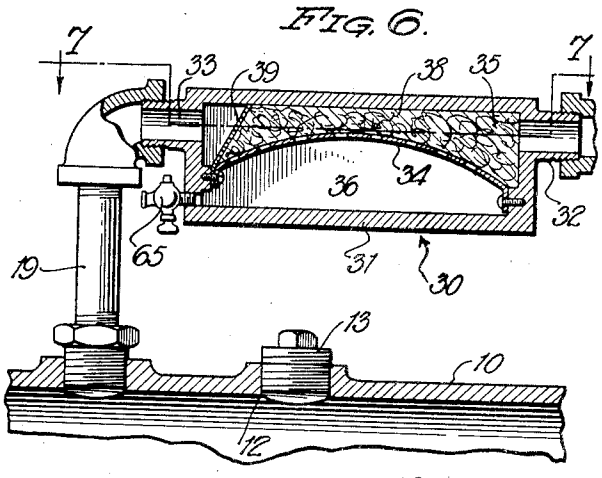


FIG. 13.

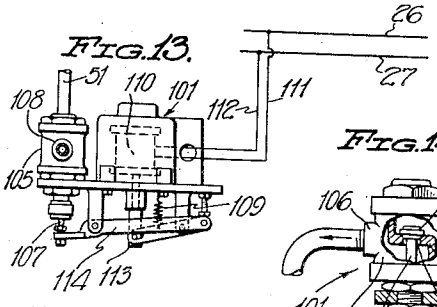


FIG. 14.

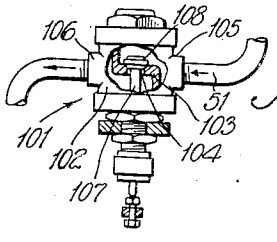
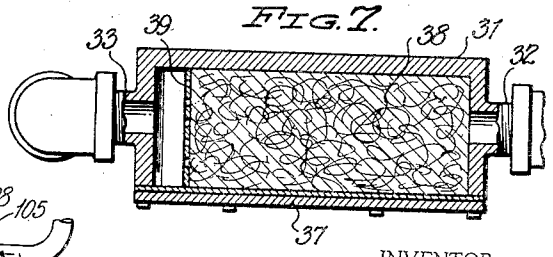


FIG. 7.



INVENTOR.
JAY LAWRENCE SEAT.
BY Ely & Pattison.
ATTORNEYS.

WITNESS:
G. Clifton Lusby.

Oct. 4, 1938. J. L. SEAT 2,132,132

FIRE EXTINGUISHER SYSTEM

Filed May 14, 1937 3 Sheets-Sheet 3

FIG. 8.

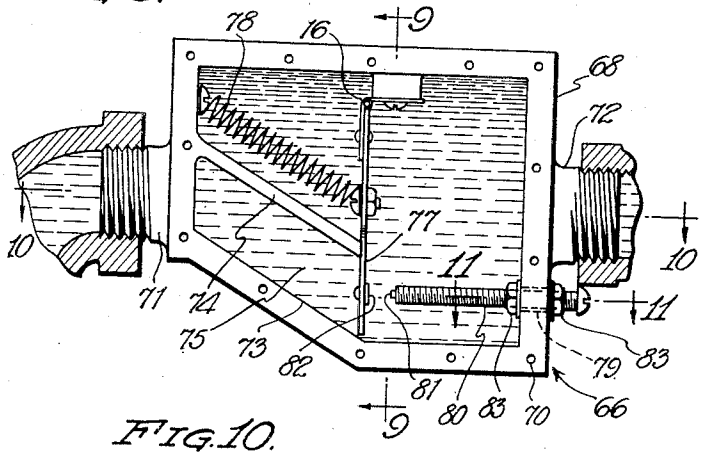


FIG. 9.

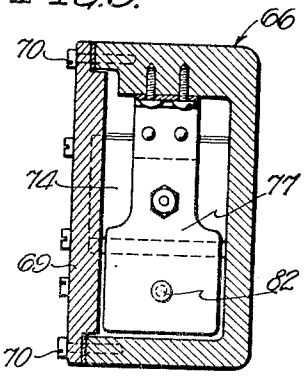


FIG. 10.

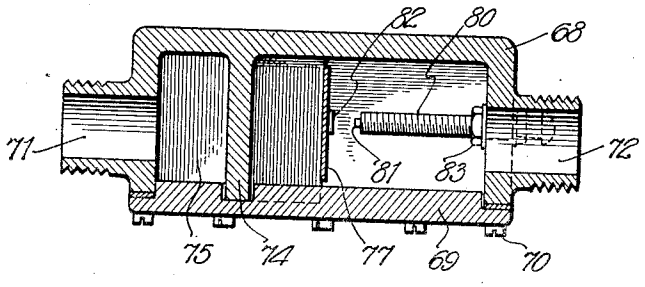


FIG. 11.

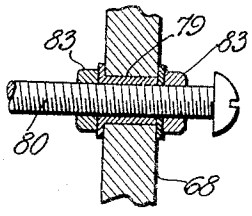
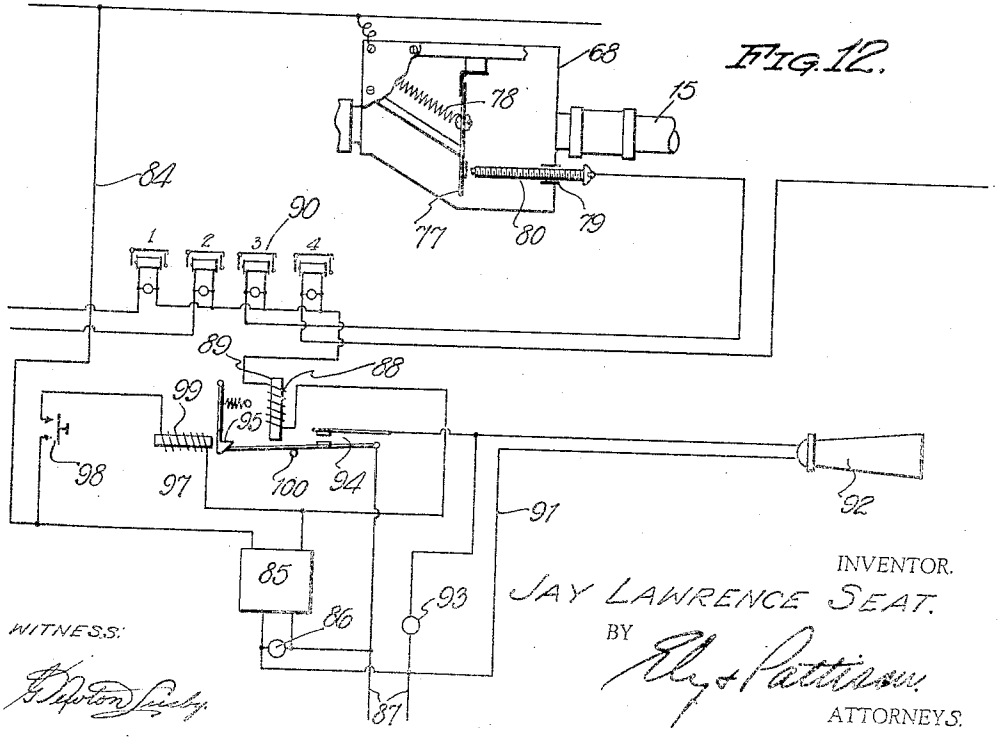


FIG. 12.



INVENTOR.
JAY LAWRENCE SEAT.
BY
Ely & Patterson
ATTORNEYS.

WITNESS:

Patented Oct. 4, 1938 2,132,132

UNITED STATES PATENT OFFICE

2,132,132

FIRE EXTINGUISHER SYSTEM

Jay Lawrence Seat, Fairfield, Conn.

Application May 14, 1937, Serial No. 142,548
In Great Britain August 9, 1935

5 Claims. (Cl. 137—68)

This invention relates to fire extinguishing systems of the storage tank, pipe line and thermal valve type and more particularly to means for automatically maintaining the pressure in such systems within predetermined limits.

The operation of systems of this type depend on the automatic release of the thermal valves when the temperature in the vicinity thereof increases to a predetermined degree. When a valve opens the fire extinguishing fluid, which is normally maintained in the tank and pipe lines under pressure, is released. As the fire extinguishing fluid is released, the pressure in the system decreases rapidly and unless some means are provided for maintaining the pressure within predetermined limits, the efficiency of the system is seriously impaired. At present it is customary to maintain the pressure in the system by means of an air compressor which is adapted and arranged to automatically start and stop as the pressure in the system varies between predetermined limits. This arrangement is unsatisfactory, however, since it is limited to localities wherein suitable power is available for driving the compressor. Also it frequently happens that during a fire the power is interrupted, thereby rendering the compressor useless. Furthermore, due to the cost of the compressor, it is common practice when designing such systems to take advantage of the fact that only a comparatively few valves are released during a fire, consequently in the event that a comparatively large number of valves are released the compressor is unable to maintain the pressure in the system at desired values.

An object, therefore, of the present invention is to provide means for automatically maintaining the pressure in such fire extinguishing systems within predetermined limits.

Another object of the invention is to provide power operated means for maintaining the pressure in such systems within predetermined values and means independent of the power operated means which operates automatically to supply pressure to the system in the event of failure of the power operated means or in the event the output capacity of the power operated means is insufficient to maintain the pressure within predetermined values.

Still another object of the invention is to provide means for automatically establishing and disestablishing communication between the storage tank of such systems and an auxiliary source of pressure as the pressure in the storage tank varies between predetermined values.

In accordance with the invention, the pressure in the system is maintained between predetermined values by power operated means such as an air compressor and an auxiliary source of pressure such as an auxiliary pressure tank wherein air or gas is stored under high pressure. The air compressor is automatically operated by a pressure controlled switch and is designed to maintain the pressure in the storage tank within predetermined values in the event that only a comparatively few thermal valves are released at any one time. The auxiliary tank is connected to the storage tank of the system by means of a pressure operated valve and supplied pressure to the storage tank in the event of failure of the compressor or in the event that a comparatively large number of thermal valves are released and the compressor is unable to maintain the pressure in the system within predetermined values. When the pressure in the system decreases to a predetermined value, the pressure controlled switch closes thereby automatically starting the compressor. In the event or failure of the compressor or in the event the pressure in the storage tank decreases faster than pressure is being supplied by the compressor and the pressure in the system decreases to a further predetermined value, the pressure operated valve automatically opens to establish communication between the auxiliary pressure tank and the storage tank of the system. This embodiment of the invention is particularly adaptable for localities where power is available to drive the compressor.

Another feature of the invention resides in a gravity flow valve arranged in the supply line of the system for operating an alarm and setting a fire station indicator means for selective operation when any one of the thermal valves operate in order to audibly sound an alarm and indicate the location of the operating thermal valve.

A still further feature is the provision of a novel strainer arranged in the compressor line to the storage tank to trap moisture of condensation and prevent such moisture from reaching the storage tank.

With these and other objects in view, the invention resides in the certain novel construction, combination and arrangement of parts, the essential features of which will be hereinafter fully described, are particularly pointed out in the appended claims and are illustrated in the accompanying drawings, in which:

Figure 1 is an elevational view, partly in section of my improved fire extinguisher system.

Figure 2 is a vertical transverse sectional view on the line 2—2 of Figure 1.

Figure 3 is an enlarged vertical sectional view of the valve structure shown in Figure 2.

Figure 4 is a collective perspective view of the valve member and its seal shown in Figure 3.

Figure 5 is a vertical transverse sectional view through the compressed air filter.

Figure 6 is a vertical sectional view on the line 6—6 of Figure 5.

Figure 7 is a horizontal sectional view on the line 7—7 of Figure 6.

Figure 8 is an enlarged sectional elevational view of the gravity flow valve with the side cover plate removed.

Figure 9 is a vertical transverse sectional view on the line 9—9 of Figure 8.

Figure 10 is a horizontal sectional view on the line 10—10 of Figure 8.

Figure 11 is a detail horizontal sectional view on the line 11—11 of Figure 8.

Figure 12 is a diagrammatic view of the electric signalling circuits.

Figure 13 is a side elevational view of a modified form of emergency valve.

Figure 14 is a sectional elevational view looking at right angle to Figure 13.

As shown, a storage tank 10 is partially filled with a suitable fire extinguishing chemical fluid 11 such as carbon tetrachloride. A charging port 12 is provided in the top of the tank 10 for introducing the fire extinguishing fluid therein. Normally the charging port 12 is closed and rendered air-tight by a plug 13 which is in threaded engagement therewith. A discharge pipe 14 opens from the bottom of tank 10 and extends upwardly through the structure to be protected and in which a manual control valve 96 is conveniently arranged. The control valve 96 is normally open to supply fluid through the supply line during operation of the system. A plurality of branch pipes 15 open from the discharge pipe 14 and lead to various sections or compartments of the structure. A plurality of normally closed thermal valves 16 open from the branch pipes 15. The thermal valves 16 may be of any of the well known types, the essential feature being that they automatically release when the temperature in the vicinity thereof increases to a predetermined value. The upper section 17 of the tank 10 is filled with air or gas under a predetermined pressure. Under such conditions fire extinguishing fluid is maintained under pressure in the discharge pipe 14, the branch pipes 15 and the thermal valves 16.

A compressor 18 for supplying air under pressure to the storage tank 10 of the system is mounted on the top of the tank 10. Communication between the compressor 18 and the upper section 17 of the tank 10 is established by a pipe 19. A pressure gage 20 is connected to the top of the tank 10 to give a visible indication of the pressure supplied by the compressor 18. The compressor 18 is driven by an electric motor 22 which is connected thereto by an endless belt or chain 23. A pressure operated switch 24 is mounted on the top of the tank 10 for automatically starting and stopping the motor 22 which drives the compressor 18 as the pressure in the tank 10 varies between predetermined limits. Communication between the tank 10 and the pressure operated switch 24 is established by a pipe 25. Insulated conductors 26 and 27 lead from any suitable source of current to opposite sides of the switch 24 and similar insulated conductors 28 and 29 establish a circuit from the switch 24 through the motor 22. When the pressure in the tank 10 decreases to a predetermined limit, the switch 24 automatically closes, thereby starting the motor 22 which drives the compressor 18 and as a result air under pressure is forced through pipe 19 into the upper section 17 of the storage tank 10. When the pressure in the tank 10 increases to a predetermined value, the switch 24 automatically opens, thereby stopping the motor 22.

Arranged in the pipe 19 is a filter or separator 30 which includes a casing 31 having an inlet 32 at one end and an outlet 33 at the opposite end. The inlet and outlet ends of the casing terminate in threaded nipples to which pipe sections of the pipe line 19 connect. A concavo-convex perforated partition 34 is supported by opposite ends of the casing 31 and divides the interior of the casing into an upper filter chamber 35 and a lower moisture accumulator chamber 36. One side of the casing is closed by a removable plate 37 to facilitate access to the inside of the casing. Brass wool 38 is packed in the upper chamber 35 and is prevented from being forced by pressure through the outlet 33 by a perforated guard plate 39 which extends transversely of the upper portion of the casing adjacent the outlet 33. A pet cock 65 is provided in one of the end walls of the casing at the bottom thereof to facilitate the draining off of any moisture which may accumulate therein. The compressed air produced by the compressor 18 must pass from the inlet 32 of the filter casing through the brass wool 38 to the outlet 33 and any moisture present in the air will drop through the perforated partition 34 to the accumulating chamber 36 when it becomes trapped. This prevents the mixing of moisture with the chemical fluid 11 with which the tank 10 is charged.

Auxiliary pressure tanks 40 are mounted on cradle supports 41 and 42 which are supported by the storage tank 10. The auxiliary tanks 40 are filled with air or gas under relatively high pressure. The mouth end of each tank 40 is provided with a manual control valve 43 from which coupling pipes 44 extend to a common coupling member 45 having radially extending unions 46 for effecting connection of the pipes 44. Rising from the body of the coupling member 45 is an outlet supply pipe 47 in which a manual cut-off valve 48 is arranged. A pressure controlled indicator 49 is arranged adjacent but beyond the cut-off valve 48 to give visible indication of the pressure in the auxiliary pressure line when the valves 43 and 48 are open. Communication is automatically established and disestablished between the auxiliary tanks 40 and storage tank 10 by means of a pressure controlled emergency valve 50 as the pressure in the tank 10 varies between predetermined lower limits. As shown more clearly in Figures 2, and 3, the pressure controlled valve 50 is arranged in a pipe line or conduit 51, a portion of which is U-shape. The upper end of the conduit 51 opens into the cut off valve 48 and is connected thereto by means of a union 52. The lower end of the conduit 51 opens into the upper section 17 of the storage tank 10 and is in threaded engagement with the inner surface of a bushing 53, the outer surface of which is in threaded engagement with the shell of the tank 10. A valve supporting bushing 54 is in threaded engagement with the outer surface of the conduit 51, in one of the legs of the U-shaped section. The upper face of the bush-

ing 54 is recessed to receive a beveled washer 55 which provides a seat for a beveled valve member 56. The valve member 56 is connected to the upper end of a valve stem 57. The valve stem 57 is slidably mounted in the bore 58 provided in the bushing 54 and is provided with longitudinal grooves 58' which extend from the lower end of the stem to the reduced neck 59 adjacent the head of the valve member 56. The removable valve seat member 55 is held in the recess by a ring-like screw cap 60 threaded to the upper portion of the bushing 54.

Threaded to the bushing 54 and enclosing the cap 60 is a bonnet or housing 61 having a central bore 62, the top end of which threadedly connects with a section of the pipe line 51. The bore 62 is in axial alinement with the valve member 56 and threaded therein and terminating directly above and in spaced relation to the normal position of the valve member is a sleeve 63. The lower end of the sleeve is exposed and its sides have spaced openings 64 therein for the passage of gas through the control valve when the valve member 56 is in a raised open position. The pressure from the tanks 40 opens the valve member 56 when the pressure in the supply tank drops below a predetermined degree, causing the valve member to rise upwardly and abut the lower end of the sleeve 63, the gas passing through the grooves 58', into the bonnet 61, through the openings 64 and out through the sleeve 63 to the tank 10 through a section of the pipe line 51. The valve member 56 closes by gravity when the pressure through the pipe line 51 is shut off by the valve 48, or when the pressure in the tank 10 rises to the desired operating pressure and which backs up through the pipe line 51 against the top of the valve member 56.

Arranged in each branch supply pipe 15 leading from the main supply pipe 14 is a flow alarm device 66 and which is operable to an open position when any one of the sprinkler heads 16 served by a branch line 15 opens by reason of the rupturing of the thermal fuse element of such sprinkler head.

The flow alarm device 66 includes a casting 68 open at one side and which open side is closed and sealed by a removable cover plate 69 secured to the casing by bolts 70. One end of the casing 68 is provided with an inlet nipple 71 and the opposite end wall with an outlet nipple 72. The nipples 71 and 72 are joined by sections of the branch pipe lines 15. The bottom wall of the casing adjacent the inlet extends downwardly at an angle as at 73 while extending from the adjacent end wall above the inlet end disposed parallel to the inclined wall 73 is a partition wall 74. The walls 73 and 74 and the side walls of the casing define a downwardly extending passage 75 through which fluid entering the casing must pass. Pivoted adjacent the top of the casing 68 as at 76 and insulated therefrom is a contact barrier 77, normally held against the inner end of the partition 74 by a spring 78. One end of the spring 78 is connected to the barrier 77 and the other end to the inlet end of the casing thus holding the barrier in a closing position at the inner end of the passage 75.

Fitted into the end wall of the casing having the outlet, is a bushing of insulating material 79 and slidably supported by the bushing is a contact screw 80, the inner end of which is disposed in the path of the open movement of the barrier 77. The extreme inner end of the screw is provided with a German silver point 81 which is engaged by a similar point 82 carried by the barrier 77. The screw 80 is adjustable relative to the barrier and held in adjusted position by lock nuts 83 which abut opposite ends of the bushing. The screw is adjusted to enable the barrier to move to an open position thereagainst to make contact and yet permit of the free flow of extinguishing fluid through the casing. The flow alarm constitutes a switch for operating an audible signal and fire station indicating device which will now be described and as shown in Figure 12 of the drawings.

In Figure 12 the casing 68 is connected to a wire arranged in a relay operating circuit 84, the other end of the circuit extending to the contact screw 80, and interposed in the circuit between the normal break therein caused by the position of the barrier 77 with respect to contact 80, is a transformer 85, pilot light 86, wires 87, leading from a source of electric supply to the transformer, coil 88 of a relay 89, and a station annunciator 90.

Receiving its source of energy direct from the current supply wires 87 is an audible signal circuit 91 which includes a siren 92, pilot light 93 and relay operated switch 94 normally held open by a spring actuated catch 95.

From the above description, it follows that if the flow alarm device 68 operates by the blowing off of a sprinkler head in the branch line controlled thereby, that the relay circuit 84 will be closed by reason of the contact of the barrier 77 with the screw 80, causing the coil 88 to be energized, and operation of the annunciator 90 associated with the particular alarm device. The energizing of the coil 88 closes the switch 94 against the action of the spring catch 95, which in turn closes the audible signal circuit 91 sounding the siren 92.

By reason of the sounding of the siren 92, an audible alarm is sounded, and by reference to the annunciator board on which all the annunciators 90 are mounted, the exact location of the fire may be learned.

In order to shut off the siren 92, the siren circuit 91 must be broken and this may be done by shutting off the flow from the source of supply by the turning off of the control valve 96.

To release the catch 95 to effect a resetting of the alarm circuit, I provide a reset circuit 97 which receives its current through the transformer 85 and which also includes a normally open push button switch 98 and an electromagnet 97, the armature of which is disposed adjacent the catch 95 to actuate the same to releasing position against its spring tension. Thus by pushing the reset push button 98, the electromagnet 99 will be energized which draws the catch 95 toward the core of the magnet and away from the lower spring contact of the switch 94 allowing the same to drop to a position against a stop pin 100 and thus causing another break in the siren circuit. The various switches are set for further operation upon the resetting of the other parts of the system.

In the operation of the system herein shown and described, the pressure operated switch 24 is adjusted to close when the pressure in the system decreases to a predetermined value. The force of this pressure backing up into the emergency valve 50 holds the gravity valve member 56 upon the seat 55 against the pressure in the auxiliary pipe line 51 leading to the auxiliary supply tanks 40. The valve member 56 automatically opens under the pressure in the pipe

line 51 when the pressure in the storage tank 10 decreases to a lower predetermined limit to establish communication between the auxiliary tanks 40 and storage tank 10, and closes upon the building up of pressure in the tank 10 to a value slightly above the pressure at which the pressure operated switch 24 is adjusted to close. Under such conditions when the temperature in the vicinity of a thermal valve 16 increases, to a predetermined degree, the thermal valve automatically opens and fire extinguishing fluid is discharged therefrom under pressure. As the fire extinguishing fluid is discharged the pressure in the storage tank 10 decreases. When the pressure in the tank 10 has decreased to a predetermined value the pressure operated switch 24 automatically closes, thereby starting the compressor 18, and as a result air under pressure is forced into the tank 10. When the pressure in the tank 10 has increased to a predetermined value the pressure operated switch automatically opens, thereby stopping the compressor 18. In the event of failure of the compressor or in the event the pressure in tank 10 decreases more rapidly than it is being supplied by the compressor 18 and the pressure decreases to a further predetermined value, the pressure operated valve 50 automatically opens, thereby establishing communication between the auxiliary pressure tanks 40 and the storage tank 10. In the event the pressure then increases above the value at which the pressure operated switch 24 is adjusted to close, the pressure operated valve 50 automatically closes, thereby disestablishing communication between the two tanks. Under such conditions the pressure in the storage tank 10 is being maintained by the compressor alone. In the event the pressure continues to increase, the compressor is automatically stopped when the pressure reaches the value at which the pressure operated switch is adjusted to open.

A detail description of the alarm signalling system has already been given and a repetition thereof at this point is not deemed necessary, other than to say that upon each operation of a thermal valve 16, the alarm circuit is closed by reason of the flow of fire extinguishing liquid through the flow alarm switch 66.

In Figures 13 and 14 of the drawings, I have illustrated a modified form of emergency valve designated in its entirety by the reference character 101 and which may be substituted for the emergency pressure valve 50 hereinbefore described. The emergency valve 101 is in reality an electrically controlled valve and includes a valve casing 102 having a partition 103 therein provided with a passage 104 and with inlet and outlet nipples 105 and 106 respectively to which sections of the pipe 51 are connected. Slidable in the casing 102 is a valve stem 107 carrying a valve head 108 which is urged to closing position by gravity but which valve head is held normally open by an electric solenoid 110. The solenoid 110 is arranged in the current supply circuit of which the wires 26 and 27 form a part and the solenoid is connected to said wires by conductor wires 111 and 112 respectively. The sliding core 113 of the solenoid is operatively connected with lever means 114 which means is also operatively associated with the lower extending end of the valve stem 107. When the solenoid 110 is energized by reason of the flow of current through the wires 26 and 27 to the motor 22 of the compressor, the valve stem 107 is in lowered position with the valve head 108 seated and closing the passage 104. Should the flow of current through the wires 26 and 27 cease for some unexpected reason, the solenoid becomes deenergized and the spring 109 acting upon the lever means 114 moves the core inwardly which actuates the valve stem 107 to move the valve head 108 to unseated open position, thus establishing communication between the auxiliary pressure tanks 40 and the top of the tank 10. By the use of this modified form of emergency valve 101, it will be appreciated that should the compressor 18 fail to function for the reason that the supply of current thereto is shut off, the auxiliary tanks 40 will supply the tank 10 with the necessary pressure.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In a fire extinguishing system, the combination with a main storage tank containing fire extinguishing liquid under compressed air pressure, means for maintaining the air pressure in said tank within predetermined limits, an auxiliary fluid pressure pre-charged storage tank connected to said main storage tank, and automatic valve means acting normally to shut off the fluid pressure from said auxiliary fluid pressure storage tank to said main storage tank and operable to admit fluid pressure from said auxiliary storage tank to said main storage tank when the air pressure in said main storage tank drops below predetermined lower limits.

2. In a fire extinguishing system, the combination of a main storage tank containing fire extinguishing liquid under compressed air pressure, an air compressor for supplying air under pressure to said main storage tank, means for automatically starting and stopping said air compressor as the air pressure in said storage tank varies between predetermined limits, an independent auxiliary pre-charged fluid pressure storage tank, and means for automatically establishing and disestablishing communication between said auxiliary fluid pressure storage tank and said main storage tank only when the air pressure in said latter tank varies between predetermined lower limits.

3. In a fire extinguishing system, the combination with a main storage tank containing fire extinguishing liquid under compressed air pressure, means for maintaining the air pressure in said main storage tank within predetermined limits, an auxiliary pre-charged gas pressure tank, pipe connecting said auxiliary pressure tank and said main storage tank, and automatic valve means in said pipe for automatically establishing and disestablishing communication between said main storage tank and said auxiliary tank as the air pressure in said main storage tank varies between predetermined lower limits.

4. In a fire extinguishing system, the combination with a main storage tank containing fire extinguishing liquid under compressed air pressure, means for maintaining the air pressure in said main storage tank within predetermined limits, an auxiliary pre-charged gas pressure tank, pipe connecting said auxiliary gas pressure tank and said main storage tank, and automatic valve means in said pipe for automatically establishing and disestablishing communication between said storage tank and said auxiliary gas pressure tank as the air pressure in said main storage tank varies between predetermined lower limits, said automatic valve means including a valve seat, and

a valve member held seated against said valve seat by the air pressure from within said main storage tank backing up into said pipe whereby a reduction of air pressure within said storage tank below that of the gas pressure in said auxiliary tank will unseat said valve to admit gas pressure from said auxiliary tank to said main storage tank.

5. In a fire extinguishing system, the combination of a main storage tank containing fire extinguishing liquid under compressed air pressure, an electrically operated air compressor for supplying air under pressure to said tank, an electric current supply for said electrically operated air compressor, a pressure operated switch for automatically starting and stopping said electrically operated air compressor as the pressure in said storage tank varies between predetermined limits, an independent auxiliary precharged gas pressure tank connected to said main storage tank, valve means for establishing and disestablishing communication between said auxiliary gas pressure tank and said main storage tank, an electro-magnetic device energized by said electric current supply to normally hold said valve means closed, and means for opening said valve means upon disengagement of said electro-magnetic device caused by failure of said electric current supply to function.

JAY LAWRENCE SEAT.