Sept. 20, 1971 G. J. GRABOWSKI ET AL 3,605,901

FIRE PROTECTION APPARATUS

Filed Oct. 28, 1968 4 Sheets-Sheet 1

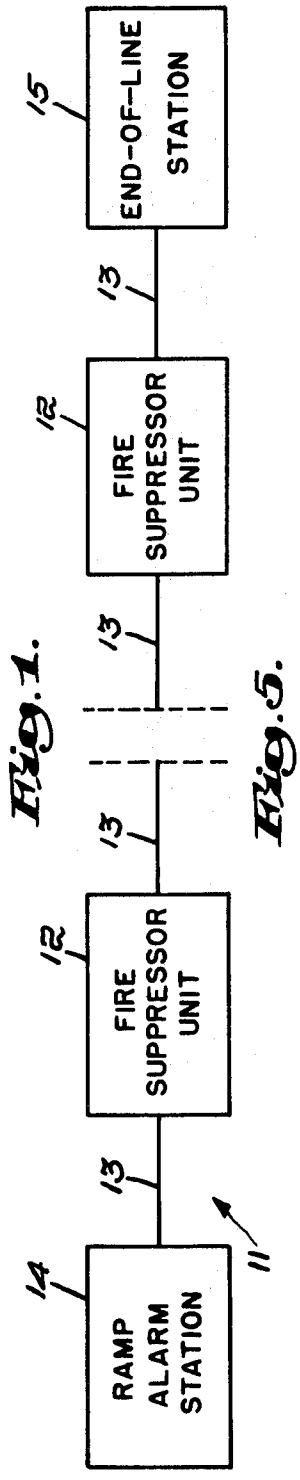


Fig. 1.

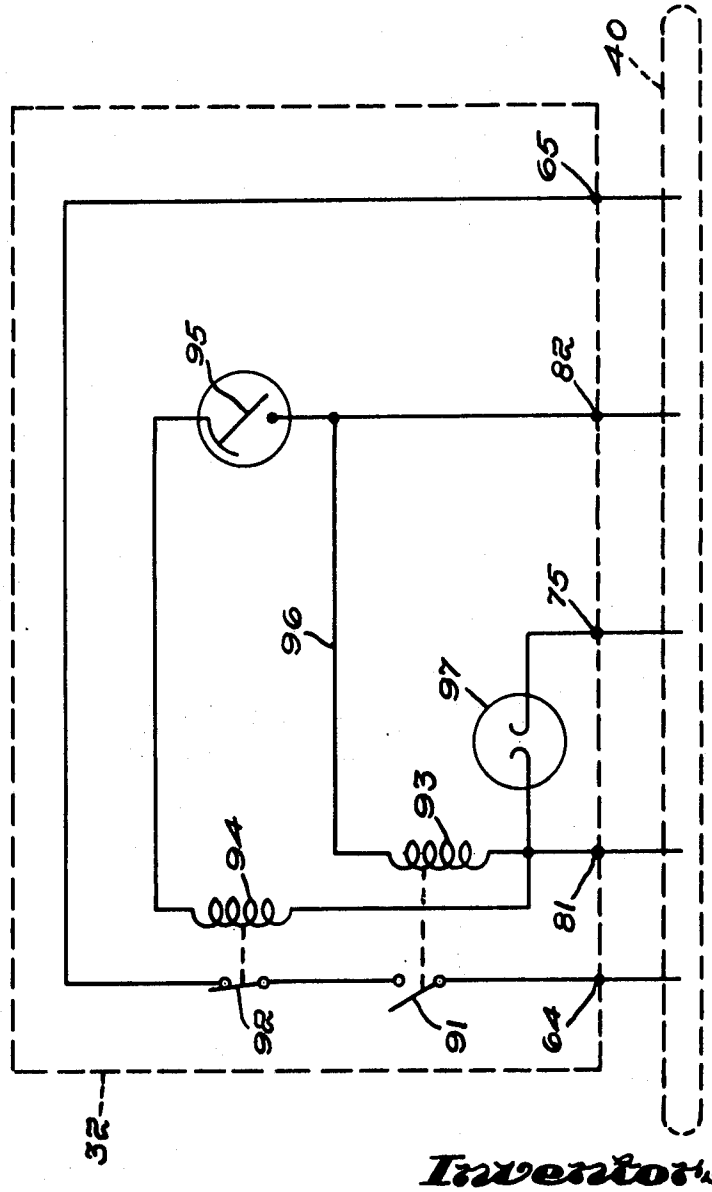


Fig. 5.

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FIRE PROTECTION APPARATUS

Filed Oct. 28, 1968 4 Sheets-Sheet 2

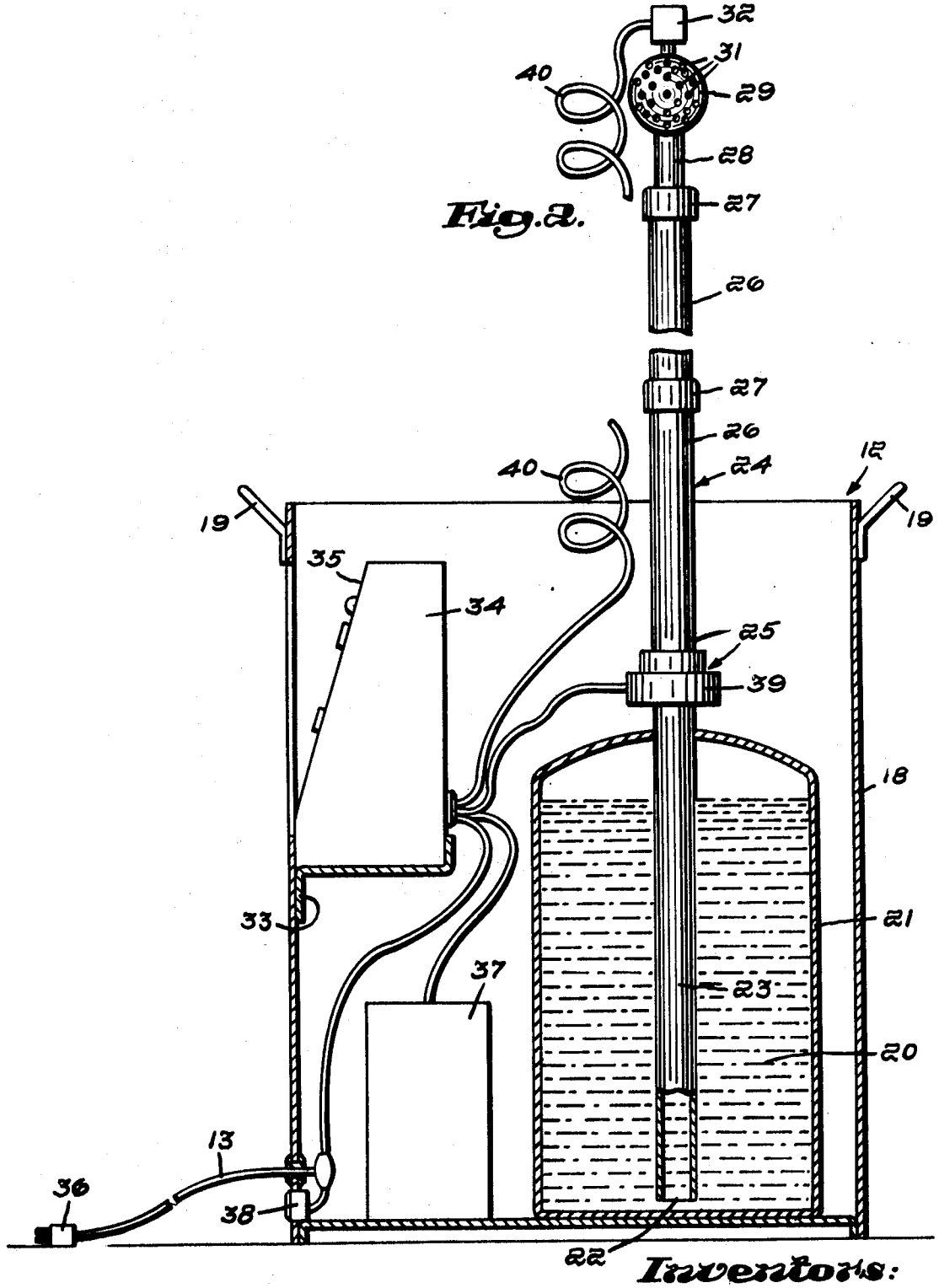


Fig. 2.

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FIRE PROTECTION APPARATUS

Filed Oct. 28, 1968 4 Sheets-Sheet 3

Fig. 6.

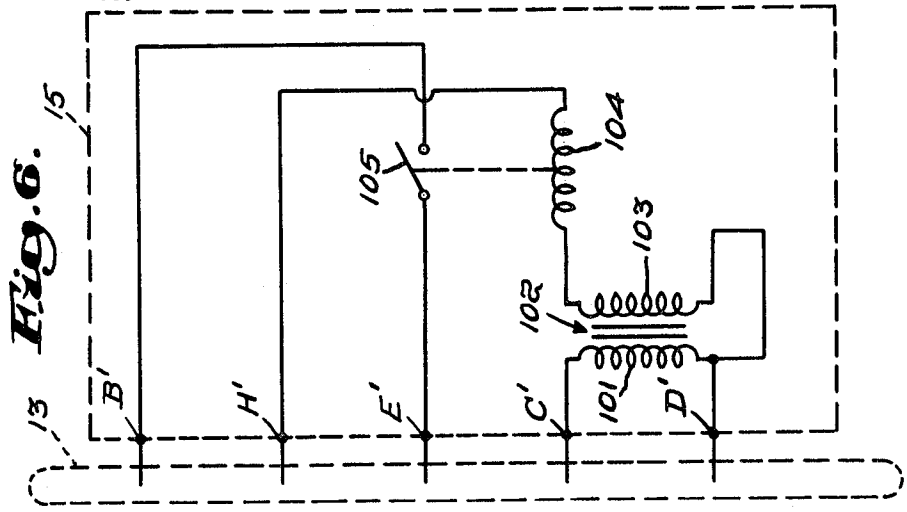
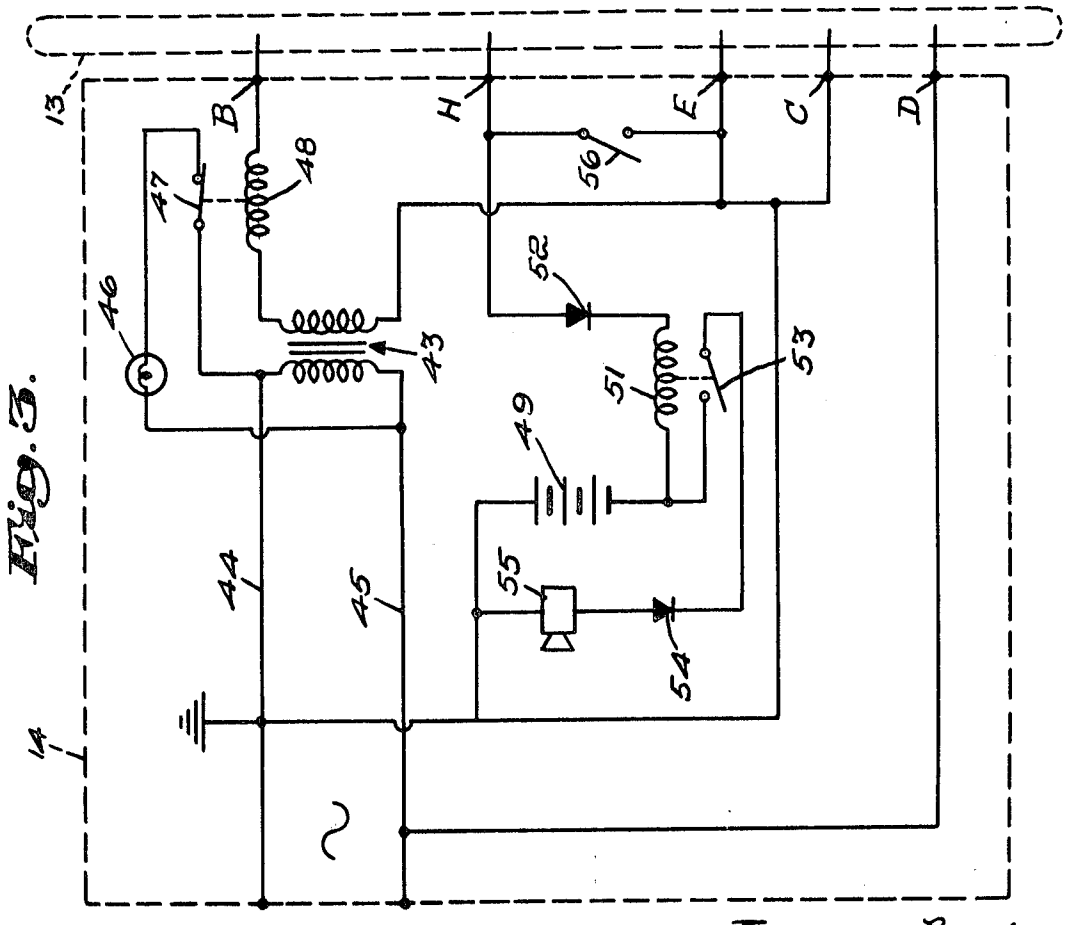


Fig. 5.



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FIRE PROTECTION APPARATUS

Filed Oct. 28, 1968 4 Sheets-Sheet 4

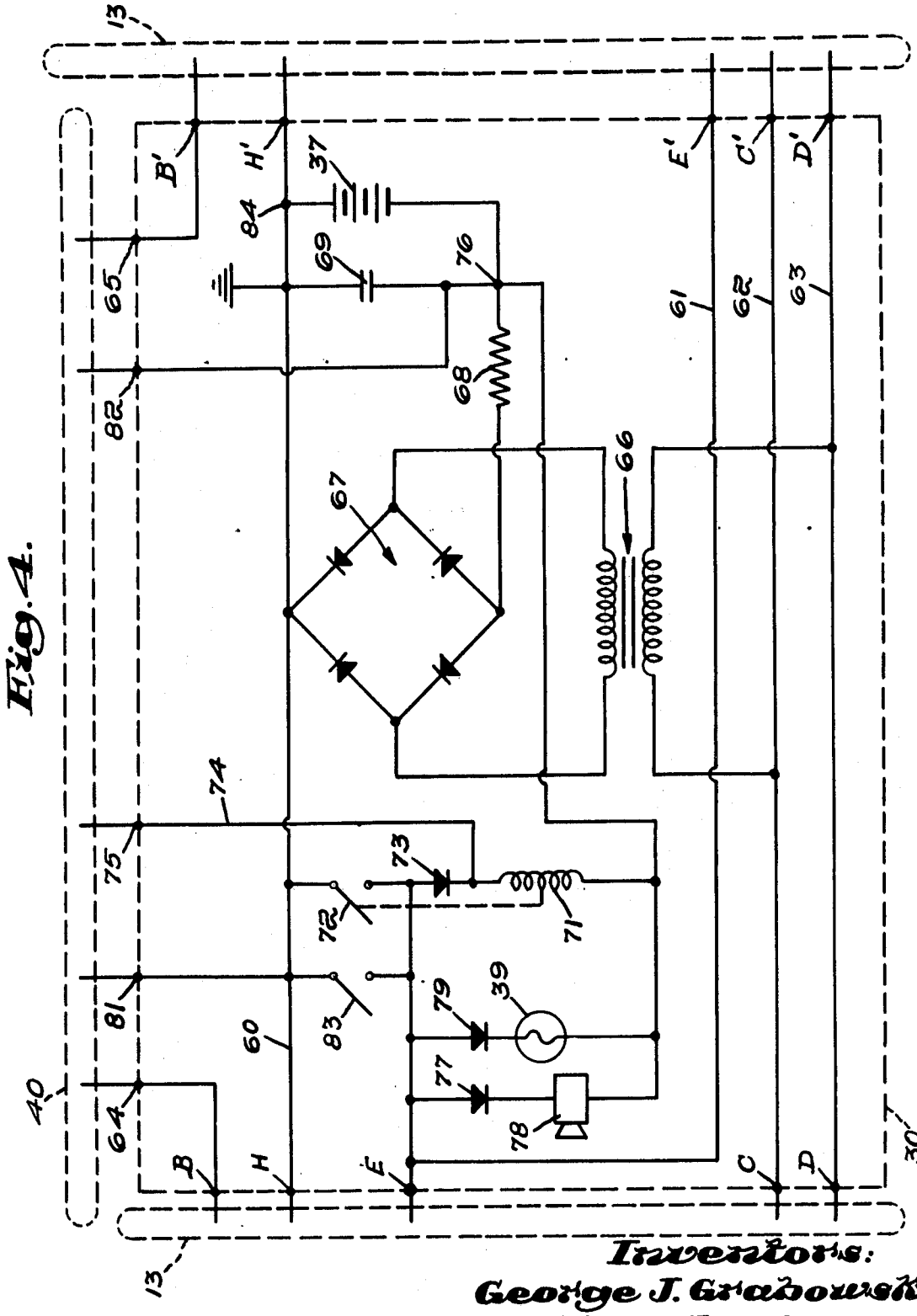


Fig. 4.

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United States Patent Office 3,605,901 Patented Sept. 20, 1971

3,605,901

FIRE PROTECTION APPARATUS

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Filed Oct. 28, 1968, Ser. No. 770,926
Int. Cl. A62c 35/00
U.S. Cl. 169—2R 11 Claims

ABSTRACT OF THE DISCLOSURE

A completely automatic fire protection system is disclosed comprising battery powered, portable suppressor units each including a supply of fire extinguishing fluid and a fire detector. Connection of the individual unit's control circuits provides a control circuit network that automatically initiates extinguishing fluid discharge from all units in response to fire detection by any single unit.

BACKGROUND OF THE INVENTION

This invention relates generally to fire protection apparatus and, more particularly, relates to a portable, fully automatic fire extinguishing device that can be used either independently or in groups to provide a complete fire protection system.

There exist various circumstances wherein temporary fire protection is desired for particularly valuable objects. Examples of such objects include grounded and unoccupied aircraft, partially constructed buildings, temporarily stored high value equipment such as electronic gear, etc. In addition to these applications, a completely portable, automatic fire protection system could be used to protect valuable cargo being transported, for example, on aircraft, trailers, railroad cars, ships, etc. or in some instances to protect an existing installation in circumstances wherein the incorporation of a permanent fire extinguishing system would prove economically unwarranted.

Previous portable fire protection devices have included either automatic detectors that produce an alarm in response to fire conditions or manually operated fire extinguishers. No portable system exists, however, which is capable of both automatically detecting and quickly extinguishing an existing fire. Because of this deficiency flame, heat and smoke damage in the above noted applications is relatively common. Furthermore, the relatively slow response associated with present fire protection methods results frequently in both water and fire fighting damage to the protected equipment or structures.

The object of this invention, therefore, is to provide a fully automatic, self-contained and portable fire extinguishing apparatus which can be easily transported to and installed in an area wherein temporary fire protection is desired.

CHARACTERIZATION OF THE INVENTION

The invenion is characterized by the provision of a portable fire suppressor including a fire extinguishing medium filled container, a valve for controlling discharge of the fire extinguishing medium, a condition responsive detector, and an actuator adapted to open the valve and produce discharge of the fire extinguishing medium in response to activation by the condition responsive detector. By merely transporting the portable suppressor to a selected location, the immediately enclosing volume is provided with fully automatic and quickly responsive fire protection.

One feature of the invention is the provision of a portable fire suppressor of the above type including an extendible hollow mast connected for fluid communication between the extinguishing medium filled container and a discharge orifice. Upon contraction of the mast, the suppressor is extremely compact and can be easily stored or moved to an area of intended use after which extension of the mast provides a fluid extinguishing medium discharge orifice at a particularly desired height.

Another feature of this invention is the provision of a portable suppressor of the above featured type wherein the condition responsive detector is a fire detector mounted on the discharge orifice end of the extendible mast. According to this arrangement, the detector is automatically positioned at a suitable position near the top of the protected zone.

Another feature of this invention is the provision of a portable fire suppressor of the above featured types including a discharge head having a plurality of openings that form the discharge orifice and establish a uniform discharge of the extinguishing medium. According to an additional feature, the discharge head openings form the primary restriction to fluid flow in the discharge path including the valve and extendible mast. Thus, upon use of a liquified gas extinguishing medium, heat absorbing evaporation occurs externally and problems of internal freeze-up are obviated.

Another feature of this invention is the provision of a portable fire suppressor of the above featured types including an electrical control circuit responsive to the fire detector and operable to activate the fluid medium discharge actuator. Also included in the control circuit is a self-contained source of electrical power. Incorporation of a battery powered control circuit permits efficient automatic operation of the suppressor in even remote locations where electrical power is not available.

Another feature of this invention is the provision of a fire protection system formed by a plurality of portable fire suppressors of the above featured types. According to this embodiment of the invention, electrical leads are utilized to connect corresponding control circuit terminals of a plurality of suppressor units and the resultant control circuit network is adapted to produce sympathetic actuation and resultant extinguishing medium discharge from all units in response to fire detection by any of the associated fire detectors. By strategically locating the individual suppressor units, a completely automatic fire extinguishing system can be established for a protection zone of any size and configuration.

Another feature of this invention is the provision of a fire protection system of the above featured type and including an alarm station and an end-of-line station connected to opposite ends of the suppressor array. The combined circuitry of the alarm station, the end-of-line station and the suppressor unit are adapted to produce a signal at the ramp alarm station in response to a variety of trouble conditions existing anywhere in the zone protected by the complete system.

Another feature of the invention is the provision of a fire protection system of the above featured type wherein the ramp alarm system is adapted for connection to a source of alternating current power that under normal conditions provides charging current to the batteries in all of the detector units. With this system, fully charged batteries are insured at all times. In addition, the control circuit of each suppressor includes a capacitor that stores energy received from the A.C. source and is effective to activate the valve actuator in the absence of battery power.

Another feature of the invention is the provision of a fire protection system of the above featured types wherein the suppressor control circuits are adapted to isolate the individual batteries from each other thereby preventing the drain of power from one unit to another in which a faulty battery circuit exists.

DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will become more apparent upon a perusal of the following specification taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a schematic block diagram illustrating a preferred embodiment of the invention;

FIG. 2 is a schematic view of one of the suppressor units shown in block form in FIG. 1;

FIG. 3 is a schematic circuit diagram of the ramp alarm station shown in FIG. 1;

FIG. 4 is a schematic circuit diagram of a suppressor unit control circuit shown in FIG. 1;

FIG. 5 is a schematic circuit diagram of the detector circuit shown in FIG. 2; and

FIG. 6 is a schematic circuit diagram of the end-of-line station shown in FIG. 1.

DESCRIPTION OF THE INVENTION

Referring now to FIG. 1 there is shown a block diagram of a preferred embodiment of the invention. The fire protection system **11** includes the plurality of suppressor units **12** connected by the electrical cables **13**. As more fully described below, each of the suppressors **12** is a self-contained, automatic unit including a source of extinguishing medium and a fire detection control system capable of inducing discharge of the extinguishing medium in response to detection of a fire. In addition, the individual units **12** are completely portable and can be selectively distributed in any manner desired. Thus, the number and arrangement of the individual units **12** can be selected such that the entire system **11** provides fire protection for a zone of any configuration or size. Terminating opposite ends of the system **11** and also connected by electrical cables **13** are the ramp alarm station **14** and the end-of-line station **15** which also are described in detail below.

FIG. 2 schematically illustrates one of the suppressor units **12**, all of which are identical. As shown, the unit **12** includes a portable base housing **18** with carrying handles **19**. Retained within the housing **18** is the container tank **21** filled with a suitable fire extinguishing medium **20**. Although other agents such as water or dry chemicals can be used, preferred extinguishing mediums are halogenated, liquified gases such as "Freon" FE 1301 ($CBrF_3$) which is marketed by the DuPont Co.

Extending into the tank **21** and having a discharge port **22** disposed adjacent the bottom thereof is the hollow discharge tube **23**. The hollow extendible mast assembly **24** is connected to the discharge tube **23** by the valve unit **25**. Preferably, the valve unit **25** is activated by an electrically energized explosive squib. Valves of this type are conventional and shown, for example, in U.S. Pat. No. 2,712,881. As shown, the mast assembly **24** includes a plurality of hollow mast sections **26** joined by fluid tight couplings **27**. The upper mast section **28** supports the discharge head **29** having a plurality of openings **31** that define a discharge orifice. Supported by the discharge head **29** is the fire detector **32** described more fully below.

Also mounted within the housing **18** on the support bracket **33** is the circuit housing **34** having a control and indicator panel **35**. Extending into the housing **18** and connected to the circuitry in the circuit box **34** is the electrical cable **13** that terminates with the multi-pronged plug **36**. Also connected with the circuitry in the circuit box **34** are the battery **37** and the plug receptacle **38** that is adapted to receive an electrical plug identical to plug **36**. Also connected to the circuitry in circuit box **34** are both the detector unit **32** by the elongated cord **40** that permits extension of the mast assembly **24** and the explosive squib **39** of the valve unit **25**. All the circuitry retained by the housing **18** is shown in the schematic circuit diagram of FIG. 4 and is described in detail below.

The suppressor unit **12** can be used either as an individual self-contained, automatic fire extinguishing device or can be combined with other units in a system as shown in FIG. 1. When used individually, the suppressor **12** is manually transported by the carrying handles **19** to an area where fire protection is desired. During storage or movement of the suppressor unit **12**, the mast assembly **24** is maintained in a compact condition with the individual mast sections **26** dismantled. However, after placement for intended use, the mast assembly **26** is extended by connecting together the desired number of mast sections **26**. Final positioning of the discharge head **29** and detector unit **32** near the ceiling of the protected zone is accomplished by adjustment of mast section **28** which is slideably received by the adjacent mast section **26**. The detector **32** may be, for example, 5 to 10 feet above the surface supporting the housing **18**. Obviously, the desired extendibility also can be obtained with a mast assembly composed entirely of telescopic sections.

This is an important feature of the invention in that actuation of a valve unit **25** will induce discharge of the fire extinguishing medium **20** through the discharge head **29** that is positioned above the protected area. Since most desirable extinguishing agents are heavier than air, discharge above the protected zone is the most efficient method of extinguishment. Furthermore, the detection efficency is improved by placement of the detector **32** above the protected zone since the products of combustion such as smoke and heat are lighter than air and will accordingly be most easily detected near the top of the protected zone.

After detection of fire by the detector unit **32**, the control circuit in the circuit box **34** responds, as described below, to energize the explosive squib **39** and open the valve **25**. This permits the vapor pressure within the tank **21** to force extinguishing liquid up through the discharge port **22**, the discharge tube **23**, the hollow mast assembly **24** and out of the openings **31** in the discharge head **29**. Thus, the protected zone is permeated with the agent **20** and the detected fire is extinguished. As another feature of the invention, the discharge openings **31** comprise the greatest restriction to fluid flow in the discharge path including the mast assembly **24**, the valve **25** and the discharge tube **23**. Consequently, heat absorbing vaporization of the extinguishing agent **20** occurs externally and the possibility of fluid flow restricting freeze-up in internal portions of the device is obviated.

When the suppressor **12** is used in a system application as illustrated in FIG. 1, the individual units **12** are merely connected in series by inserting the plug **36** of one unit into the receptacle **38** of another and end units are similarly connected respectively, to a ramp alarm station **14** and an end-of-line station **15**. The attached units **12** are selectively distributed so as to provide coverage of the entire area to be protected. Because of the flexibility provided by the connecting cords **13**, a number and arrangement of units **12** can be selected to protect a zone of any size and shape.

Upon detection of a fire by any of the detectors **32**, the connected control systems are effective, as described below, to actuate the valves **25** of all suppressors **12** and flood the entire area with extinguishing agent **20**. The separation between units **12** is selected such that the volumes filled with extinguishing agent **20** by the individual suppressor units **12** will overlap and thereby provide complete coverage of the protected zone. When using the above noted liquified extinguishing gases, it is preferred that after complete discharge of all units **12** the protected zone will contain a substantially uniform concentration of the extinguishing vapor in an amount of between 2 and 5% by volume.

Referring now to FIG. 3 there is shown a schematic circuit diagram of the ramp alarm station **14** shown in FIG. 1. The primary of transformer **43** is connected between grounded line **44** and line **45** which in turn are connected to a suitable source of A.C. power. Also con-

nected in series across A.C. input lines **44** and **45** are the signal light **46** and the normally closed switch contacts **47**. The A.C. input lines **44** and **45** are connected also, respectively, to output terminals C and D. Connected between output terminals B and E is the series combination of the secondary winding of the transformer **43** and the relay winding **48** associated with contacts **47**. Between A.C. input line **44** and output terminal H are connected in series the battery **49**, the relay winding **51** and the diode **52**. Normally open switch contacts **53** operated by the relay winding **51** are connected in series with the diode **54** and the alarm horn **55** across the battery **49**. The manually operated switch contacts **56** are coupled directly across output terminals H and E.

FIG. 4 schematically illustrates the control circuitry **30** included within the suppressor housing **18** shown in FIG. 2. Input terminals B, H, E, C and D are connected directly to the corresponding output terminals in the ramp alarm station **14** (FIG. 3) by signal lines in the electrical cord **13**. Coupled directly to the input terminals H, E, C and D of the suppressor control system **30** by lines **60–63** are its corresponding output terminals H', E', C', and D' while input termnial B an doutput terminal B' are linked, respectively, to the detector terminals **64** and **65**. The A.C. supply lines **62** and **63** are connected to the primary winding of the transformer **66** having a secondary winding coupled across the input terminals of the diode rectifier bridge **67**. Connected across the output terminals of the rectifier bridge **67** through the limiting resistor **68** is the parallel combination of the capacitor **69** and the battery **37** (shown in FIG. 2).

Also coupled across the output terminals of the battery **37** is the series combination of the relay winding **71** and associated normally open switch contacts **72** and the diode **73**. The junction between the diode **73** and the relay winding **71** is connected by line **74** to the detector terminal **75** while the junction between the diode **73** and the switch contacts **72** is connected to input terminal E. Connected in parallel between input terminal E and the negative output terminal **76** of the battery **37** are the series connected diode **77** and alarm horn **78** and the series connected diode **79** and valve operating explosive squib **39** (shown in FIG. 2). The other detector terminals **81** and **82** are connected, respectively, to input terminal H and the negative output terminal **76** of the battery **37**. The manually operated switch contacts **83** are connected between input terminal E and input terminal H which is also connected by line **60** to the positive output terminal **84** of the battery **37**.

FIG. 5 shows schematically the circuitry included in the detector unit **32** shown in FIG. 2. The input terminals **64**, **65**, **75**, **81** and **82** are directly connected to the corresponding detector terminals in the suppressor control system **30** (FIG. 4) by electrical lines in the electrical cable **40**. Connected in series between the terminals **64** and **65** are the normally open switch contacts **91** and the normally closed switch contacts **92**. The relay winding **93** associated with normally open switch contacts **91** and the series combination of the relay winding **94** associated with normally closed switch contacts **92** and the combustion products detector **95** are connected in parallel across terminals **81** and **82**. Directly connected between terminals **75** and **81** is the fire detector **97**. Both the combustion products detector **95** and fire detector **97** are conventional and can comprise any of the well known types of fire detectors. In a preferred embodiment, detector **95** is a smoke responsive ionization switch and detector **97** is a rate compensated thermally actuated switch.

FIG. 6 shows a schematic diagram of the circuitry included in end-of-line unit **15** shown in FIG. 1. The terminals B', H', E', C' and D' are connected directly to the corresponding output terminals of the suppressor control system **30** shown in FIG. 4. Connected across terminals C' and D' is the primary winding **101** of the transformer **102**. The secondary winding **103** is connected in series with the relay winding **104** between one end of the primary winding **101** and the terminal H'. Connecting terminals B' and E' are the normally open switch contacts **105** associated with the relay winding **104**.

In the interest of simplicity, the suppressor control system **30** shown in FIG. 4 is described as connected directly between the ramp alarm station **14** shown in FIG. 3 and the end-of-line station **15** shown in FIG. 5. It will be appreciated, however, that any desired number of suppressor units **12** which are identical in construction and performance, can be connected in series between the ramp alarm station **14** and the end-of-line station **15**. The desired number are joined by merely inserting the plug **36** (FIG. 2) of one unit into the receptacle **38** of the next unit thereby automatically connecting corresponding terminals of the adjacent units. For example, after connection of two identical units having control circuits **30** as shown in FIG. 4, the input terminals B, H, E, C and D of one unit are connected, respectively, to the output terminals B', H', E', C' and D' of the directly adjacent unit.

After strategic deployment of the individual suppressor units **12**, the A.C. input lines **44** and **45** in the ramp alarm station **14** are energized to activate the A.C. portion of the system. This creates an A.C. potential across lines **62** and **63** (FIG. 4) in each suppressor unit **12** of the system. Consequently, the transformer **66** applies a voltage to the bridge **67** which produces a D.C. output current between output terminals **76** and **84**. This current trickle charges the battery **37** insuring its effectiveness over long periods of use. The output of the bridge circuit **67** also charges the capacitor **69** with sufficient electrical energy to operate the system, as described below, in the event that battery **37** is inoperative.

In the absence of fire, the valve actuating squib **39** is isolated from battery voltage by the normally open switch contacts **72** and **83**. However, upon the occurrence of fire in the immediate vicinity of a suppressor unit **12**, the resultant heat closes the heat responsive contacts **97** in the associated detector unit **32** (FIG. 5). This creates across the battery **37** a complete circuit including line **60**, terminal **81**, closed contacts **97**, terminal **75**, and relay winding **71**. The resultant energization of the relay winding **71** locks in the latching type contacts **72** completing a circuit through both the valve actuating squib **39** and the alarm horn **78**. Consequently, an alarm is sounded and the squib **39** actuated to open the valve **25** (FIG. 2). This in turn permits discharge of the extinguishing agent **20** through the openings **31** in discharge head **29** as described above.

In addition, since terminals H and H' of each suppressor **12** within the system **11** are connected directly in series as are terminals E and E'. closing of switch contacts **72** in one unit automatically completes a circuit between terminals H and E in all suppressors **12**. Consequently, the alarm horn **78** and valve actuating squib **39** of each unit are energized so that all suppressors sound alarms and discharge their extinguishing agents **20**. Accordingly, the entire zone protected by the selective deployment of the various suppressor units **12** is flooded with extinguishing medium in response to detection of fire by any one unit of the system.

Since closing of the latching contacts **72** anywhere in the system also connects terminals H and E in the ramp alarm station **14** (FIG. 3), the alarm horn **55** is energized to provide an audible alarm signal. This occurs because of the circuit completed through the battery **49**, the diode **52**, and the relay winding **51** which is thereby energized to close the normally open contacts **53** and permit current flow to the alarm horn **55**. This same sequence of operation is accomplished manually at any suppressor unit **12** by closing its switch contacts **83** to complete a circuit between terminals H and E. Similarly, the system can be activated at the ramp alarm station **14** (FIG. 3) by closing manually operated switch contacts **56**. It will be noted

that the diodes 73, 77 and 79 in each suppressor control circuit 30 isolate and prevent current flow between batteries located in other circuits. Thus, one faulty battery will not drain power from and deactivate the batteries of other suppressors 12 of a protection system 11.

Because operating power is supplied by the batteries 37, operation is insured even in the absence of an A.C. power source. Therefore, a system capable of functioning in the manner described above can be formed by connecting together an array of suppressor units 12 without either the ramp alarm station 14 or the end-of-line station 15. Further functions provided by these components are described below. It will be obvious also that a single suppressor 12 will function as described in the absence of any additional connected units.

Referring again to FIG. 3, the energization of the signal light 46 in response to closing of contacts 47 is an indication that any one of a number of fault conditions exists. The normally closed switch contacts 47 are opened to deactivate the trouble light 46 in response to energization of the relay winding 48. This winding 48 is normally energized by secondary current from the transformer 43 flowing in a trouble circuit that includes lines connecting the B terminals of all suppressor units in the system 11, lines joining detector terminals 64 and 65 and including switch contacts 91 and 92 in each suppressor 12 (FIG. 5), switch contacts 105 in the end-of-line station 15 (FIG. 6) and lines joining the E terminals of all units. However, the existence of smoke in the vicinity of one suppressor unit 12 activates the smoke detector 95 (FIG. 5) of its associated detector 32. This closes the smoke detector contacts and completes a circuit through relay winding 94 across the D.C. output terminals 76 and 84 thereby energizing winding 94 and opening the normally closed contacts 92. Consequently, the above noted trouble circuit is interrupted deenergizing relay winding 48 (FIG. 3), closing contacts 47 and lighting trouble lamp 46. Similarly, in the absence of a D.C. operating voltage in any suppressor unit control system 30 (FIG. 4), the relay winding 95 (FIG. 5) connected across detector terminals 81 and 82 is deenergized to open normally open contacts 91 and thereby interrupt the trouble circuit including the relay winding 48 (FIG. 3). Again, an indication of the trouble is given by the resultant closing of switch contacts 47 and lighting of signal lamp 46.

It will be appreciated that a similar trouble signal is provided upon a break in any of the lines comprising the above noted trouble circuit. In addition, a trouble signal is provided upon interruption of the lines in detector cable 40 that join the detector terminals 81 and 82 since such an interruption deenergizes relay winding 93 (FIG. 5) and opens normally open contacts 91 as described above.

The trouble circuit is interrupted also and the signal lamp 46 energized in response to opening of the normally open contacts 105 in the end-of-line station 15 (FIG. 6). This occurs upon deenergization of relay winding 104 which is in a series circuit including the secondary winding 103 of the transformer 102, the lines joining all C terminals of the system and the lines connecting all H terminals of the system. Since terminals C and H are themselves connected together in the ramp alarm station 14 (FIG. 3), the winding 104 is normally energized by current flowing in the secondary winding 103 and the normally open switch contacts 105 remain closed. However, upon loss of A.C. voltage at the ramp alarm station 14 or upon interruption of any of the A.C. supply lines connecting the A.C. supply terminals C and D anywhere in the system, the transformer 102 in the end-of-line unit 15 (FIG. 6) is deenergized. Consequently, secondary current flow through winding 104 is interrupted and contacts 105 open to cause lighting of signal lamp 46 as described above.

Thus, the signal lamp 46 is energized to provide an indication at the ramp alarm station 14 in response to any of variety of trouble conditions. These conditions include loss of A.C. power, loss of D.C. power anywhere in the system, interruption of any of the lines connecting the individual suppressor units 12 or interruption of any of the lines connecting detector terminals 64, 65, 81 or 82 of the individual control systems 30 and detector units 32.

Obviously, many modifications and variations of the present invention are possible in light of the above teachings. For example, although portability is a primary feature of the invention, the protection system 11 disclosed could be installed as a permanent installation if desired. Also, condition responsive detectors other than those specifically mentioned can be used to activate the suppressor units 12. For example, a "crash" or "*g*" switch could be used to activate a suppressor system installed in aircraft. In such an arrangement, the system would automatically function in response to ground impact and thereby prevent the loss of life prompted by fire after many aircraft crashes. It is to be understood, therefore, that within the scope of the appended claims the invention can be practiced otherwise than as specifically described.

What is claimed is:

1. A fire protection system comprising a plurality of suppressor units each retaining a supply of a fire extinguishing medium, said suppressor units being distributed throughout the protected zone and including a plurality of electrically actuated actuators for automatically inducing discharge of said fire extinguishing medium from each of said suppressor units, condition responsive means for detecting an abnormal condition in the protected zone, and control circuit means connected between said condition responsive means and said actuators for actuating each of said actuators in response to detection of an abnormal condition by said condition responsive means.

2. A fire protection system according to claim 1 wherein said condition responsive means comprises a fire detection means.

3. A fire protection system according to claim 2 wherein said detection means comprises a separate detector unit associated with each of said suppressor units.

4. A fire protection system according to claim 3 wherein said actuators are electrically operated and said control system means comprises control circuit means connected between said fire detection means and said actuators.

5. A fire protection system according to claim 1 wherein said control circuit means comprises self-contained electrical power source means.

6. A fire protection system according to claim 5 wherein said power source means comprises a separate power source for providing operating power to each of said suppressor units.

7. A fire protection system according to claim 6 wherein said separate power sources are circuit isolated so as to prevent electrical current flow therebetween.

8. A fire protection system according to claim 7 wherein said control circuit comprises electrical connector means for connecting an external electrical power source to said separate power sources.

9. A fire protection system according to claim 8 wherein said control circuit means includes trouble circuit means for producing an electrical trouble signal in response to abnormalities in said control circuit means.

10. A fire protection system according to claim 9 wherein said trouble circuit means comprises electrical switch means for producing said trouble signal in response to the absence of operating electrical power at any of said suppressor units.

11. A fire protection system according to claim 1 wherein said fire extinguishing medium is a liquified gas and said suppressor units contain said liquified gas in quantities such that upon complete discharge thereof

said protected zone will contain a substantially uniform concentration of the extinguishing vapor in an amount of between 2 and 5% by volume.

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LLOYD L. KING, Primary Examiner

U.S. Cl. X.R.

169—7, 16

Disclaimer

3,605,901.—*George J. Grabowski,* Needham, *William B. Osborne,* Marlboro and *Rexford Wilson,* Framingham Centre, Mass. FIRE PROTECTION APPARATUS. Patent dated Sept. 20, 1971. Disclaimer filed Feb. 28, 1986, by the assignee, *Kidde, Inc.*

Hereby enters this disclaimer to claim 11 of said patent.

[*Official Gazette May 13, 1986.*]