United States Patent

Lease

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[54] **FIRE SUPPRESSION SYSTEM FOR HEAVY MOBILE MACHINES**

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[52] **U.S. Cl.**.....**169/2 A,** 169/9, 169/16

[51] **Int. Cl.**.....**A62c 3/00**

[58] **Field of Search**.....169/2 R, 2 A, 9, 16, 26

[56] **References Cited**

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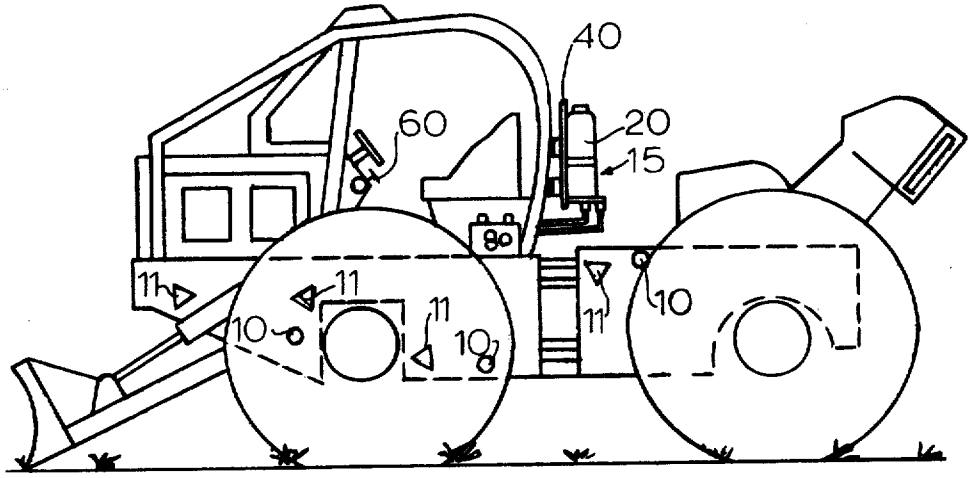
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Assistant Examiner—Thomas C. Culp, Jr.
Attorney—B. B. Olive

[57] **ABSTRACT**

An automatic and essentially shock proof fire suppression system for a heavy mobile machine such as a log skidder, tractor, street sweeper or the like incorporates a set of spray nozzles piped to a tank of extinguishing fluid. A self contained battery circuit includes a plurality of thermostatic switch heat sensors and in the presence of fire a sensor closes, actuates a solenoid valve and allows CO_2 gas from a CO_2 capsule to flow and operate a piston device which in turn punctures a CO_2 cartridge, gas from the cartridge flows and pressurizes the extinguishing tank thereby causing the extinguishing fluid to be discharged from the nozzles.

9 Claims, 7 Drawing Figures



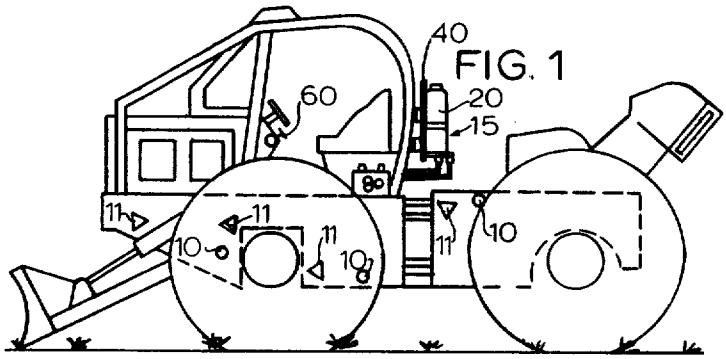


FIG. 1

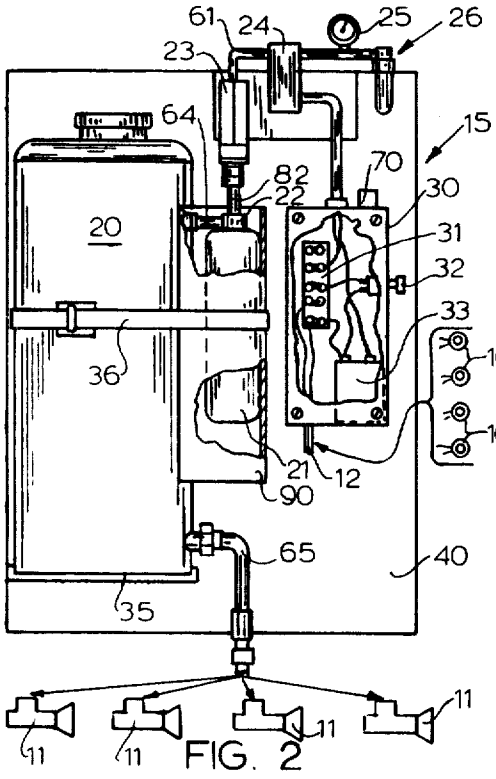


FIG. 2

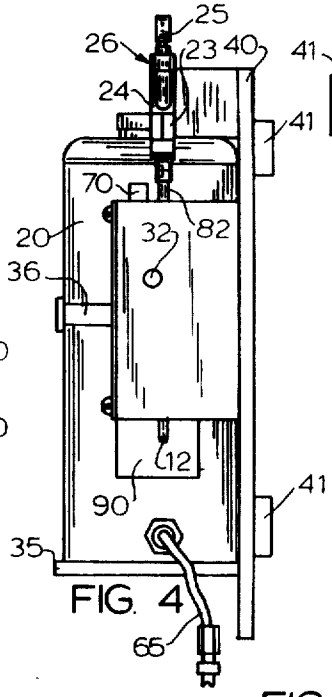


FIG. 4

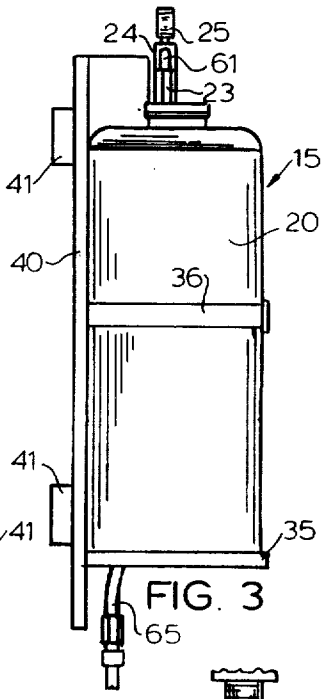


FIG. 3

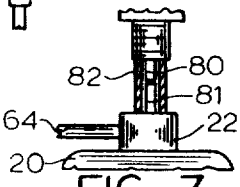


FIG. 7

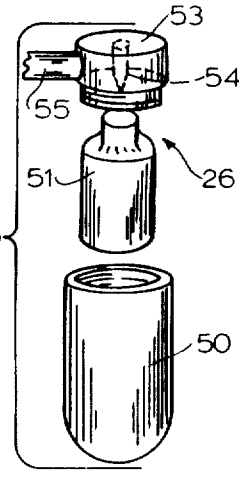


FIG. 6

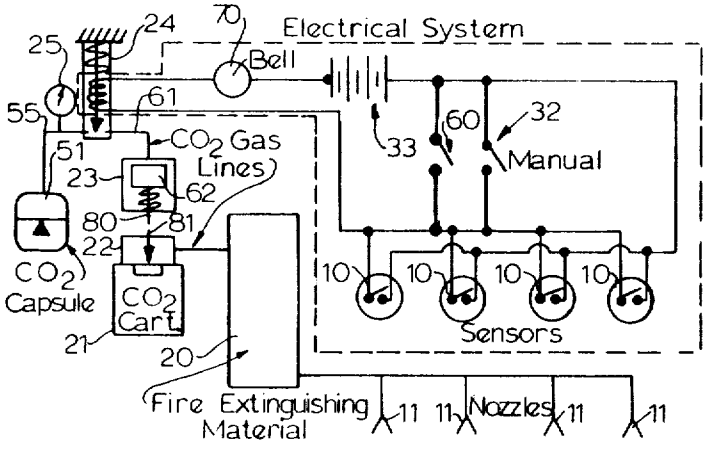


FIG. 5

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FIRE SUPPRESSION SYSTEM FOR HEAVY MOBILE MACHINES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to automatic fire suppression and extinguishing systems and particularly to electrically operated systems designed for use on heavy machinery exposed to vibration and shock.

2. Description of the Prior Art

For many years automatic fire suppression and extinguishing systems have protected aircraft and railcars where a fire could result in a dramatic loss of lives and property. However, until recently very little was done to protect heavy machinery such as logging and construction equipment, which is plagued by fires started by trash, leaking fuel and electrical shorts. As a result, insurance companies have become hesitant to insure some of this expensive machinery against fire damage. Manually triggered fire extinguishing systems have been offered as optional equipment on log skidders. The Ansul 101 system made by The Ansul Company, Marinette, Wisconsin 54143 is an example. This system pipes a dry chemical to four predetermined critical areas on a skidder when manually actuated by the operator. However, many fires go unseen until a great deal of damage has occurred or ignite during off duty hours when the machine is unattended. In addition, the excessive vibration and shock to which heavy equipment is subjected can adversely effect the reliability of a system which was not designed for such an application. Some attempts have been made to provide electrical systems operated off the machine battery but the battery itself is often a source of fire and involves shorts, grounds and the like.

In summary, none of the prior art devices provide an automatic electrically self-powered fire extinguishing system which can be universally adapted to heavy machinery and provide around the clock protection with substantially complete reliability.

SUMMARY OF THE INVENTION

The invention provides a fire suppression and extinguishing system for heavy mobile machines such as tractors, log skidders, street sweepers and the like and which includes means for sensing and causing a fire extinguishing fluid to be directed to the fire. A plurality of heat sensors in the nature of shock resistant, precision temperature sensitive, thermostatic switches are distributed over the machine at strategic locations. The switches are normally open and when any one is closed by heat the system is immediately triggered and extinguishing fluid is directed to a plurality of nozzles which are located so as to allow the fluid to effectively blanket the machine. Wires from the sensors and piping from the nozzles is brought to a shock mounted component panel which mounts a tank of extinguishing fluid and associated control equipment. The system has its own battery mounted on the panel so as not to depend on the machine power supply. On the panel there is provided a removable threaded cup device which receives a small CO_2 capsule. The capsule is placed in the cup device and the cup device is then screwed into a holder which mounts a puncturing rod so that the capsule is punctured and its gas contents released. The gas flows into a pipe connected to one side of a sensor controlled solenoid operated valve. This valve can be opened either by a sensor closing in the presence of heat or by a manual control switch which like the sensor completes a circuit to the battery. When the valve opens the small amount of pressurized gas from the CO_2 capsule passes through the valve and acts on a piston mounted in a housing connected to receive the gas from the valve. The piston mounts a puncturing rod which passes through a cap sealing member secured to the top of a CO_2 cartridge having a relatively larger pressurized gas supply than in the capsule. The puncturing rod breaks the sealing member and allows the cartridge gas to pass through connected piping to the tank which holds fire extinguishing fluid, e.g., a flowable dry chemical type mixture. The extinguishing fluid now under pressure from the cartridge gas is forced out of the tank and into piping connected to the nozzles which spray the fluid onto the machine in some predetermined pattern and until the content of the tank is exhausted. Only 5 to 10 seconds is required.

All components and the system itself is designed in such a way as to adapt to the rugged demands of shock, vibration, dust and the like normally encountered in the use of heavy machinery. Furthermore, so long as a periodic maintenance check is made the system is essentially 100 percent reliable and whether or not attended. As shown in the more detailed description special construction arrangements allow the system to be quickly and economically restored to normal condition after a fire, allow for ease of installation, allow for maximum protection against use vibration and allow for ease of periodic service checks.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a log skidder equipped with an automatic fire extinguishing system according to the invention.

FIG. 2 is a front view of the component panel.

FIG. 3 is a left side view of the component panel.

FIG. 4 is a right side view of the component panel.

FIG. 5 is a schematic diagram of the electrical triggering circuit and extinguishing fluid piping system.

FIG. 6 is an exploded view of a CO_2 capsule arrangement employed in the invention.

FIG. 7 is a partial elevation view of a connector assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the embodiment of the invention shown in the drawings a fire suppression or extinguishing system is shown applied to a log skidder. As previously mentioned, the system incorporates a plurality of strategically placed heat sensors **10**, represented in FIG. 1 by small circles, and spray nozzles **11**, shown in FIG. 1 as small triangles. Critical locations on a log skidder would include the brake assemblies, the engine compartment and the hydraulic and fuel tanks and the sensors **10** and nozzles **11** are shown accordingly in FIG. 1. The sensors are of critical importance. They should be rugged, precision temperature sensitive and vibration resistant. An ideal sensor has been discovered to be the Klixon M-1 precision, single pole, single throw, thermostatic switch made and sold by the Texas Instruments Corporation, Attleboro, Massachusetts. These

switches have a 60 G acceleration rating and have previously proven practical for operating aircraft warning signal lights. Their utility for automatic fire control in heavy mobile equipment has however not been heretofore recognized. The sensors are available with different calibrations but for the present invention a rating of 300° F at which the sensor closes has been found desirable.

While a wide choice of nozzle structure is available a nozzle deemed specially suited to the invention is the self-closing cap type nozzle as made and sold by The Ansul Company, Marinette, Wisconsin. This nozzle has a spring loaded cap which opens under a few ounces of pressure and can also be obtained in a design adapted to provide a wide spray pattern which is desirable for blanketing a heavy mobile machine as intended by the system of the invention.

The sensors are preferably encased with a heavy duty rubber or the like and the sensor leads are led through protective fire and explosion proof cables generally indicated at **12**, to a main component board **15**. Component board **15** effectively assemles all parts of the system in one location except for the sensors, the nozzles, and the related wiring and piping between the sensors, nozzles and component board. That is, the sensors can be installed and the sensor wiring brought to the component board location. Similarly, the nozzles can be installed and the nozzle heading brought to the component board. All that is then required to complete the installation is to install the component board and make appropriate connections of the sensor wiring and nozzle piping to the corresponding wiring and piping junctions on the component board. The component board also serves another very practical purpose in providing a convenient means for manufacturing and shipping since the entire component board assembly can be prefabricated and shipped as a unit from the factory along with the required number of sensors, nozzles and wiring and piping which can be cut to length, installed and terminated at pipe **65** as shown.

The component board **15** supports a dry chemical container **20**, e.g., a 30 pound dry chemical, a main CO_2 gas cartridge **21**, a cartridge receiver-pneumatic actuator **22**, a pneumatic piston-cylinder device **23**, a solenoid valve **24**, a pressure gage **25** and CO_2 capsule holder-puncturing unit **26**. There is also mounted on the component board **15** a housing **30** inside of which is mounted a terminal board **31**, a manual control switch **32**, and a battery **33**. Container **20** sits on a shelf support **35** and is held by a releasable strap member **36** to the main backing plate **40** which is provided with vibration mounts **41**.

The capsule holder-puncturing unit **26** includes a threaded cup **50** adapted to receive a small CO_2 capsule **51** and to be threaded into a cap **53** having a fixed puncturing rod **54** designed to puncture capsule **51** and release its gas contents into pipe **55** so as to provide a gas under pressure indicated by gauge **25**. This gas appears on one side of solenoid valve **24**. As indicated in FIG. **5** the operation of any sensor **10** or the manual control switch **32**, which may be located on the component board as in FIG. **2** or a switch on the dashboard as at **60** in FIG. **1** will act to energize solenoid **24**. The capsule gas then enters pipe **61** and moves the piston **62** (FIG. **5**) in actuator **22** so as to puncture and release the gas from cartridge **21** and allow this gas to enter pipe **64** and expel the contents of container **20** through the pipe **65** and associated nozzles **11**. Simultaneously a bell **70** is energized so that if the machine is unattended a suitable audible warning is given. While not shown in the drawings it may be mentioned that an easily pressure punctured seal is normally provided in the line leading from the container **30** to the nozzle **11** and this seal is broken during an operation of the system. Pipe **65** normally includes this seal.

Because log skidders and the like are subjected to extremely heavy shocks and the like the invention system makes special provision for a relatively loose and flexible connection between the piston-cylinder device **23** and the actuator **22**. This is shown in FIG. **7** where the piston rod **80** of device **23** is shown loosely mounted in a loose pipe **82** and making contact with puncturing rod **81** of actuator **22**. In use this allows container **20**, and actuator **22** to vibrate and slightly move without disturbing device **23**.

In regard to actuator **22**, it should be understood that systems presently sold by The Ansul Company incorporate actuators such as actuator **22** and cartridges such as cartridge **21** but which are conventionally used with a manual firing device. That is, the combination of actuator **22**, cartridge **21** and container **20** is, per se, old however the conventional practice is to operate actuator **22** manually by pressing down on the actuator puncturing rod **81**. So far as is known the system of the invention is particularly novel in providing a means for automatically and non-manually puncturing cartridge **21** utilizing the piston device, valve and capsule arrangement just described.

While not shown in detail, it should be noted that vibration, fire and explosion proof pipes, pipe fittings, pipe connections and wiring harness should be employed throughout the system. It may also be noted that two or more independent systems may be used and set for different sensing temperatures. With a system built according to the present invention and using four nozzles a 30 pound tank of dry chemical can be emptied in approximately 6 seconds time.

In summary, it can be seen that the invention makes available to lumbering companies, construction companies, municipalities and the like a completely reliable system for automatically releasing a fire extinguishing fluid in the event of a fire on heavy mobile equipment. While circumstances will determine whether the system is capable of completely extinguishing a particular kind of fire at the very least the fire will be suppressed, and a warning given. The presence of an independent battery insures independence from the equipment power supply which itself is often the cause of fires and cannot be depended upon for control or operating power in the event of fire. With relatively simple instructions concerning locating the sensors and nozzles and arranging the piping and wiring the system lends itself to quick and economical installation and maintenance. A quick test involves removing the cover **90** from cartridge **21**, removing cartridge **21** and then actuating the system by closing manual switch **32** which should cause actuator **22** to function. This tests electrical and mechanical operability and involves only the cost of an inexpensive and easily replaced capsule **51**. Cartridge **21**, battery **33** and container **20** should of

course be serviced and replaced as required and in accord with well known practices. The sensors are generally regarded as good for the life of the equipment.

The loose connection previously described in reference to FIG. 7 allows container **20**, cartridge **21** and actuator **22** to vibrate as a unit. This arrangement also allows this unit to be removed and replaced simply by releasing strap member **36** and lifting container off shelf support **35** since pipe **82** (FIG. 7) is loose, the connection between piston rod **80** and puncturing rod **81** is easily separated. Container **20** and cartridge **21** can, of course, be replaced in a reverse order of steps. The other components, that is cylinder-piston operator **23**, valve **24**, battery **33** and auxiliary gas source **36** are separately and preferably rigidly mounted to panel board **40**. Thus, the panel board and these latter mentioned components can vibrate independent of the vibration of container **20** and cartridge **21**.

What is claimed is:

1. An automatic fire suppression system for heavy mobile equipment and the like comprising, in combination:

a. a plurality of precision, vibration and shock resistant thermostatic type heat sensors each providing a pair of normally open electrical contacts and being fixed at fire susceptible locations on an equipment to be protected;

b. a plurality of fire fluid dispensing nozzles fixed on said equipment proximate said locations;

c. an unpressurized container of fire extinguishing fluid material having piping connected to said nozzles and adapted when pressurized to exhaust said fluid material through said nozzles;

d. a main gas cartridge having a puncturable sealed opening and opposite said opening an actuator device having a puncturing rod adapted to engage and puncture said opening and having piping connecting said opening to said container to allow gas escaping from said cartridge to pressurize said container and exhaust said fluid material;

e. a cylinder-piston operator having a movable piston mounted in a cylinder housing connected to receive pressurized gas and adapted under the influence of such gas to engage and operate said puncturing rod;

f. an auxiliary source of pressurized gas having a pipe connected to said cylinder;

g. a normally closed electrically operated solenoid valve mounted in said pipe and adapted when closed to block said auxiliary source gas from said cylinder and when open to pass said auxiliary source gas to said cylinder to operate said piston, said auxiliary source gas being connected to pressurize said pipe on one side of said valve and while in a closed position;

h. an electrical power source; and

i. wiring means connecting each said sensor to said electrical source and being arranged whereby upon closing of the contacts in any of said sensors, said electrical source is connected to electrically energize and open said valve, said auxiliary gas source is allowed to flow and operate said piston to actuate said puncturing rod, said cartridge gas is released to said container and said fluid material is exhausted through said nozzles.

2. A system as claimed in claim **1** wherein said electrical source comprises a battery independent of the electrical system of said equipment.

3. A system as claimed in claim **1** wherein said auxiliary gas source comprises a punctured pressurized gas capsule.

4. A system as claimed in claim **2** including a panel board mounted on said equipment and mounting said container, main gas cartridge, cylinder-piston operator, solenoid valve, battery and auxiliary gas source.

5. A system as claimed in claim **1** having at least one normally open manual electrical switch connected to said electrical source and valve and adapted to energize and open said valve when said switch is closed.

6. A system as claimed in claim **4** including an electrical terminal board and pipe connector means on said panel board enabling both said sensor wiring and container-nozzle piping to be connected and disconnected at said panel board.

7. A system as claimed in claim **3** including a removable holder for said capsule and means adapted to puncture said capsule and release the gas therefrom into said pipe and being operable by installing said holder.

8. An automatic fire suppression system for heavy mobile equipment and the like comprising, in combination:

a. a plurality of precision, vibration and shock resistant thermostatic type heat sensors each providing a pair of normally open electrical contacts and being fixed at fire susceptible locations on an equipment to be protected;

b. a plurality of fire fluid dispensing nozzles fixed on said equipment proximate said locations;

c. an unpressurized container of fire extinguishing fluid material having piping connected to said nozzles and adapted when pressurized to exhaust said fluid material through said nozzles;

d. a main gas cartridge having a puncturable sealed opening and opposite said opening an actuator device having a puncturing rod adapted to engage and puncture said opening and having piping connecting said opening to said container to allow gas escaping from said cartridge to pressurize said container and exhaust said fluid material;

e. a cylinder-piston operator having a movable piston and rod mounted in a cylinder housing connected to receive pressurized gas and adapted under the influence of such gas to engage and operate said puncturing rod;

f. an auxiliary source of pressurized gas including a pressurized gas capsule, a removable threaded cup holder for said capsule, a threaded mating cap member having a pipe connected to said cylinder and including means adapted to puncture said capsule upon said holder being threaded into said cap member and thereby release gas into said pipe;

g. a normally closed electrically operated solenoid valve mounted in said pipe and adapted when closed to block said auxiliary source gas from said cylinder and when open to pass said auxiliary source gas to said cylinder to operate said piston, said auxiliary source gas being connected to pressurize said pipe on one side of said valve and while in a closed position;

h. an electrical power source comprising a battery independent of the electrical system of said equipment;

i. a panel board mounted on said equipment and mounting said container, main gas cartridge, cylinder-piston operator, solenoid valve, battery and auxiliary gas source and including an electrical terminal board and pipe connector means enabling both said sensor wiring and container nozzle piping to be connected and disconnected at said panel board;

j. at least one normally open manual electric switch connected to said battery source and valve and adapted to energize and open said valve when said switch is closed; and

k. wiring means connecting each said sensor to said battery source and being arranged whereby upon closing of the contacts in any of said sensors, said battery source is connected to electrically energize and open said valve, said auxiliary gas source gas is allowed to flow and operate said piston to actuate said puncturing rod, said cartridge gas is released to said container and said fluid material is exhausted through said nozzles.

9. An automatic fire suppression system as claimed in claim 8 and including connector means providing a relatively loose and removable connection between said piston rod and puncturing rod, strap means releasably securing said container and main gas cartridge as a unit to said panel board and separate securing means mounting and securing said cylinder-piston operator, valve, battery and auxiliary gas source to said panel board thereby enabling said container-cartridge unit to vibrate and be readily removed as a unit separate from other components on said panel board.

* * * * *