

[54] SAFETY FUEL TANKS

[76] Inventor: Ben Ingro, 2437 North 73rd Avenue,
Elmwood Park, Ill. 60635

[22] Filed: Oct. 19, 1970

[21] Appl. No.: 81,691

[52] U.S. Cl. 169/2 A, 169/4, 220/88 B

[51] Int. Cl. A62c 3/08

[58] Field of Search 169/2, 2 A, 4, 6-8,
169/24, 26, 27, 31, 32; 220/88 B, 13; 280/5 A

[56] References Cited

UNITED STATES PATENTS

2,718,330	9/1955	Adamson	220/88 B
3,379,208	4/1968	Alleaume	220/88 B
2,385,825	10/1945	Mathisen	169/2 A
3,465,827	9/1969	Levy et al.	169/2 R
2,815,819	12/1957	Marshall	169/2 A
2,889,955	6/1959	Naulty et al.	220/88 B
3,120,273	2/1964	Kaufman et al.	169/4
2,558,694	6/1951	Speig	169/4
2,687,618	8/1954	Bergstrom	169/4 X

2,867,281	1/1959	Donehue	169/2 A
3,343,609	9/1967	Charters	169/2 R

FOREIGN PATENTS OR APPLICATIONS

524,826	9/1921	France	220/88 B
---------	--------	--------------	----------

Primary Examiner—M. Henson Wood, Jr.

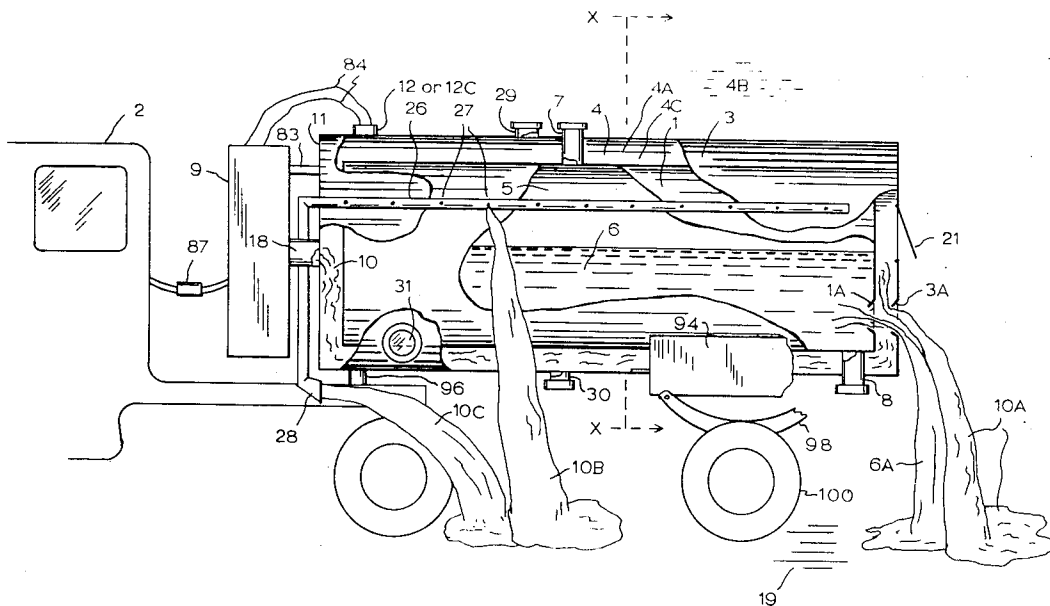
Assistant Examiner—Michael Mar

Attorney—Alberts, Brezina & Lund

[57] ABSTRACT

Safety system to prevent fire or explosion in fuel transporting tank trucks. The tank portion is surrounded by a pressurized system which when broken, as by impact, the altered pressure in the system automatically starts fire foam generating equipment to produce fire foam which is automatically dispensed in the immediate area of the tank. In a preferred form the pressurized system comprises a jacket which completely encompasses the fuel carrying tank, and the space between the tank and the jacket is charged with a pressure of air or inert gas which is slightly higher than atmospheric pressure.

7 Claims, 11 Drawing Figures



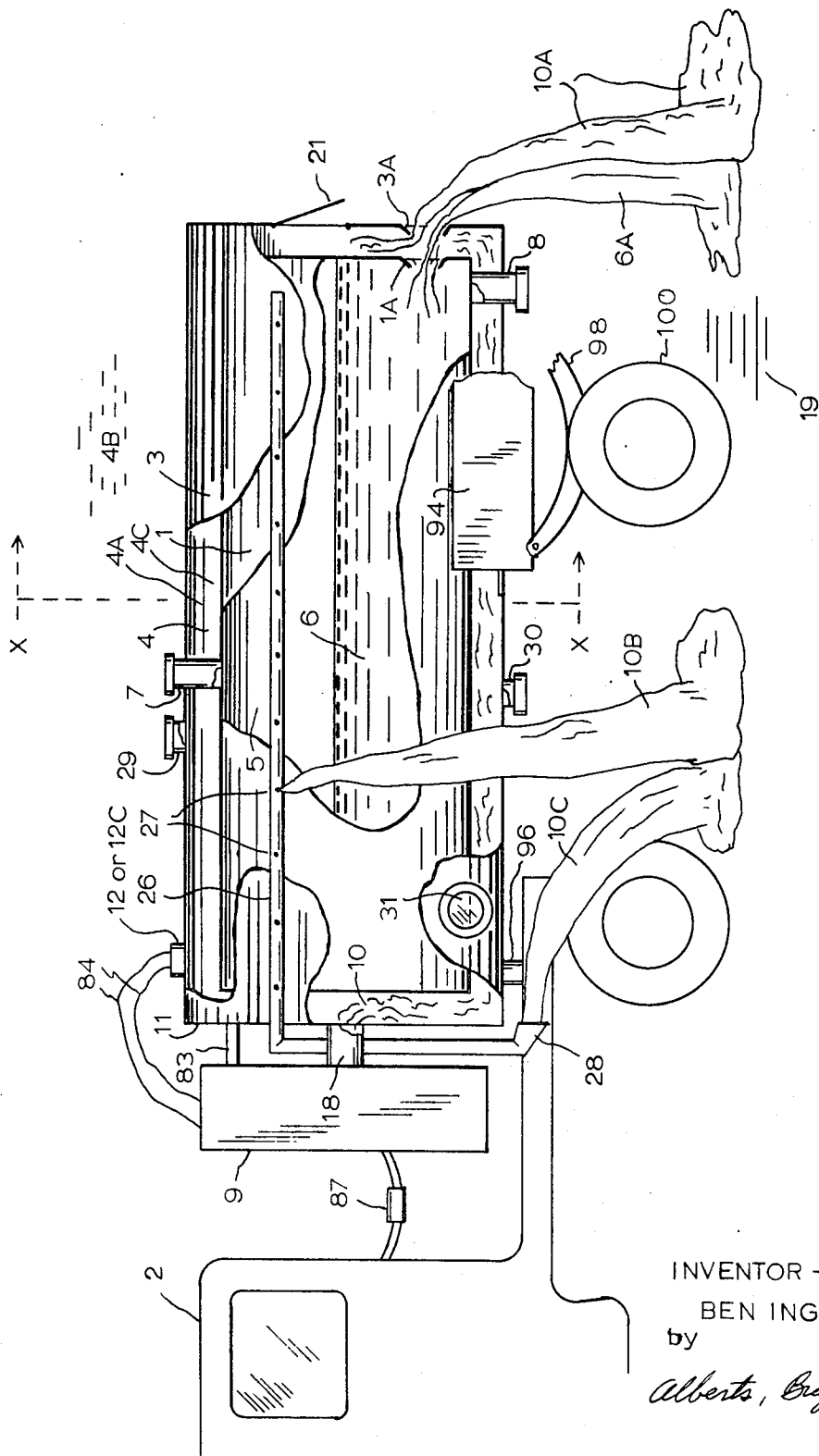


FIG. 1

INVENTOR -
BEN INGRO
by

Alberts, Bergina & Lund,
Attorneys

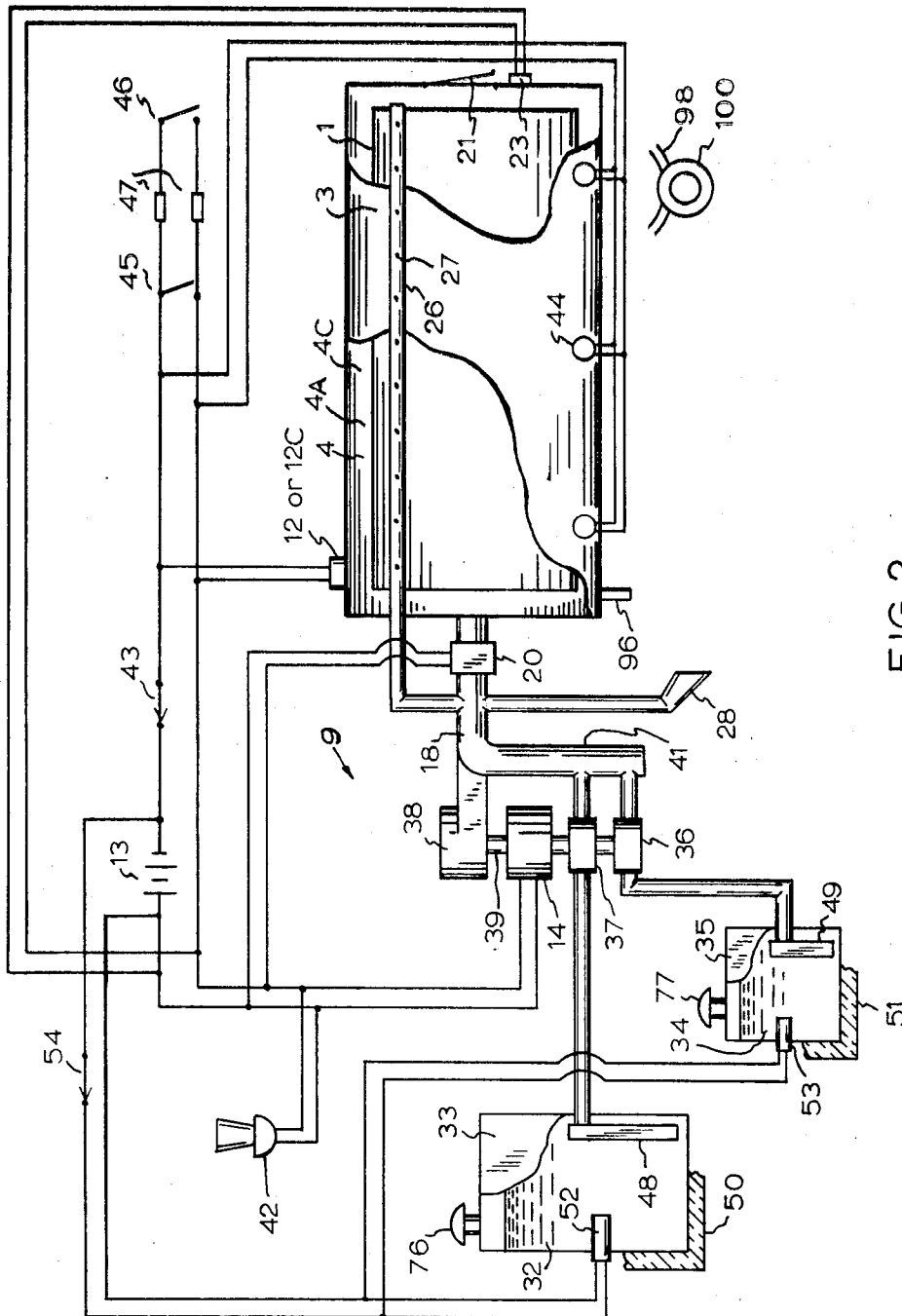


FIG. 2

INVENTOR
BEN INGRO
by *Alberts, Bregina & Lund*
Attys

FIG. 3

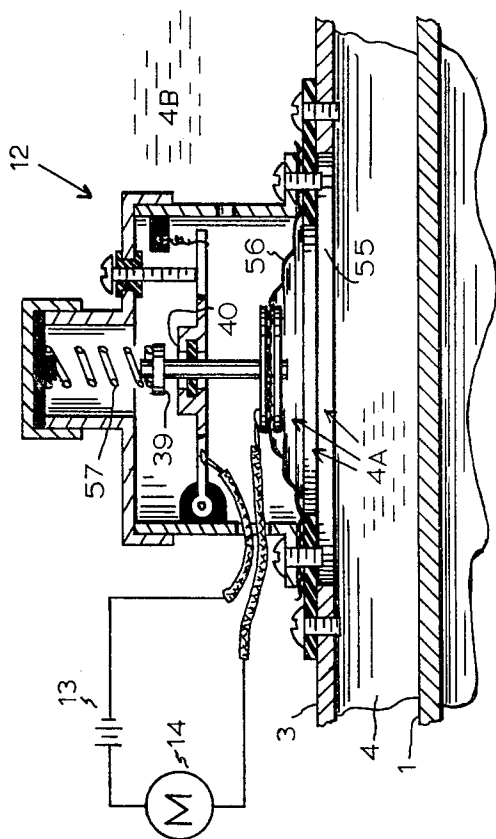


FIG. 5

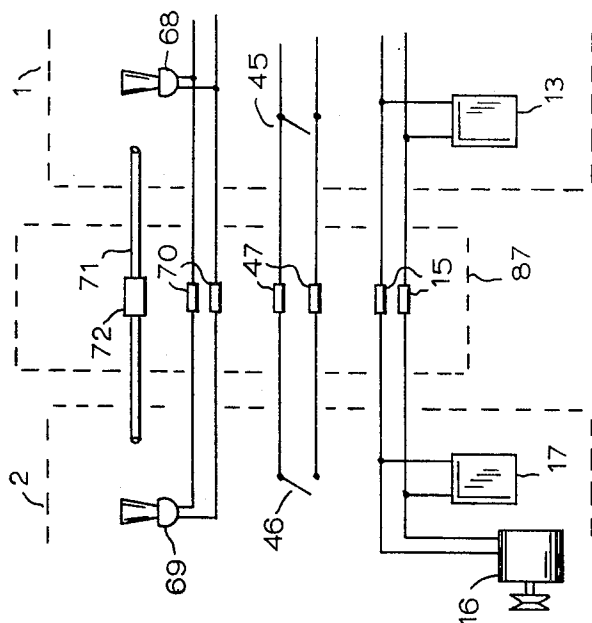
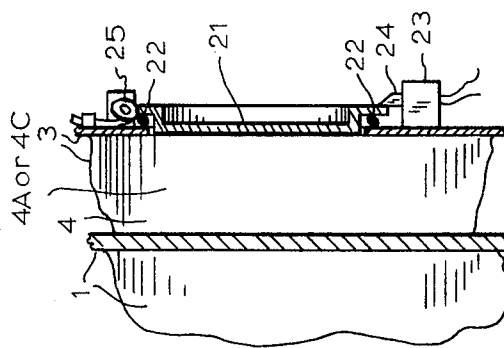
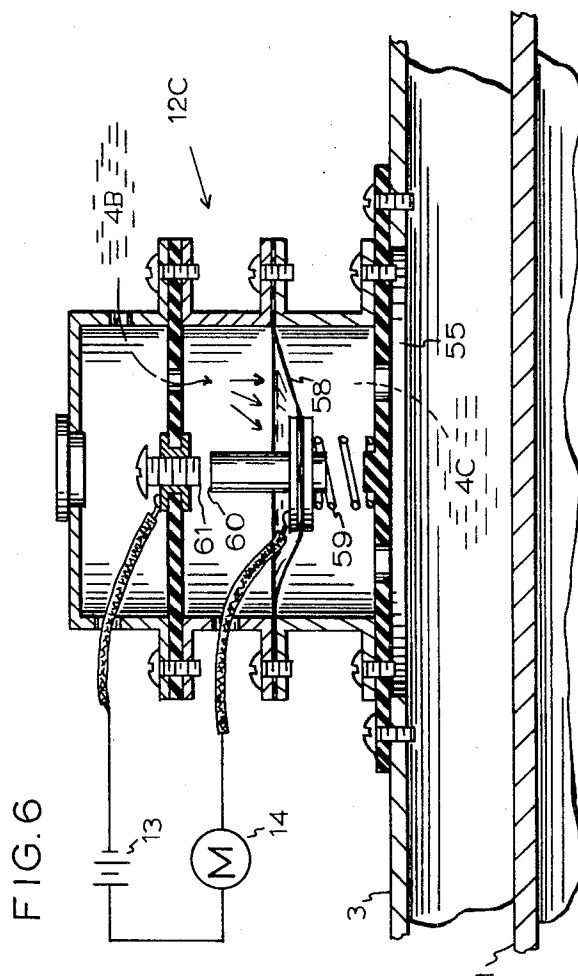
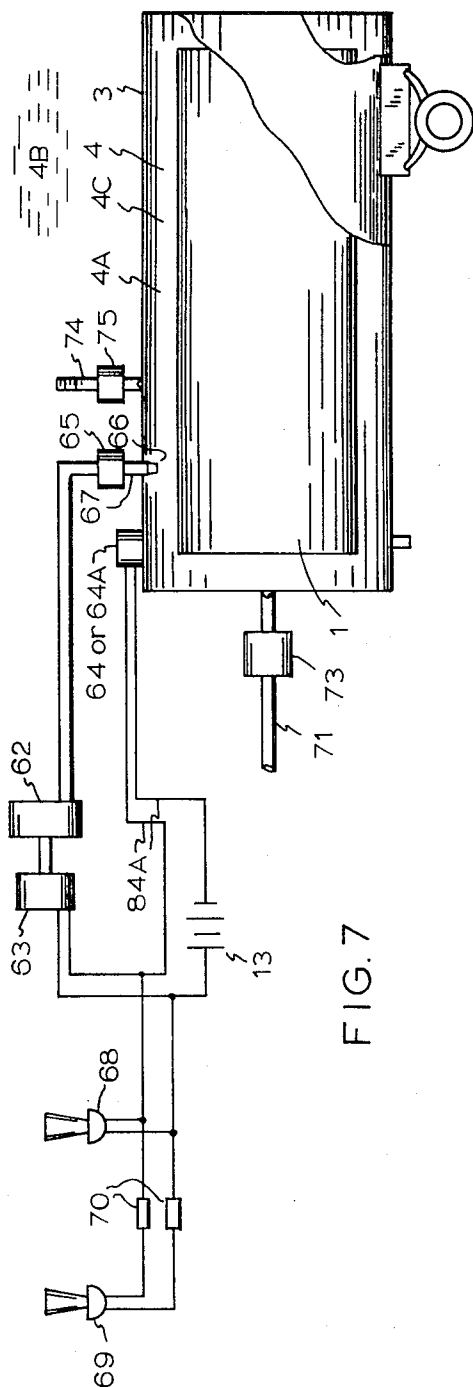


FIG. 4

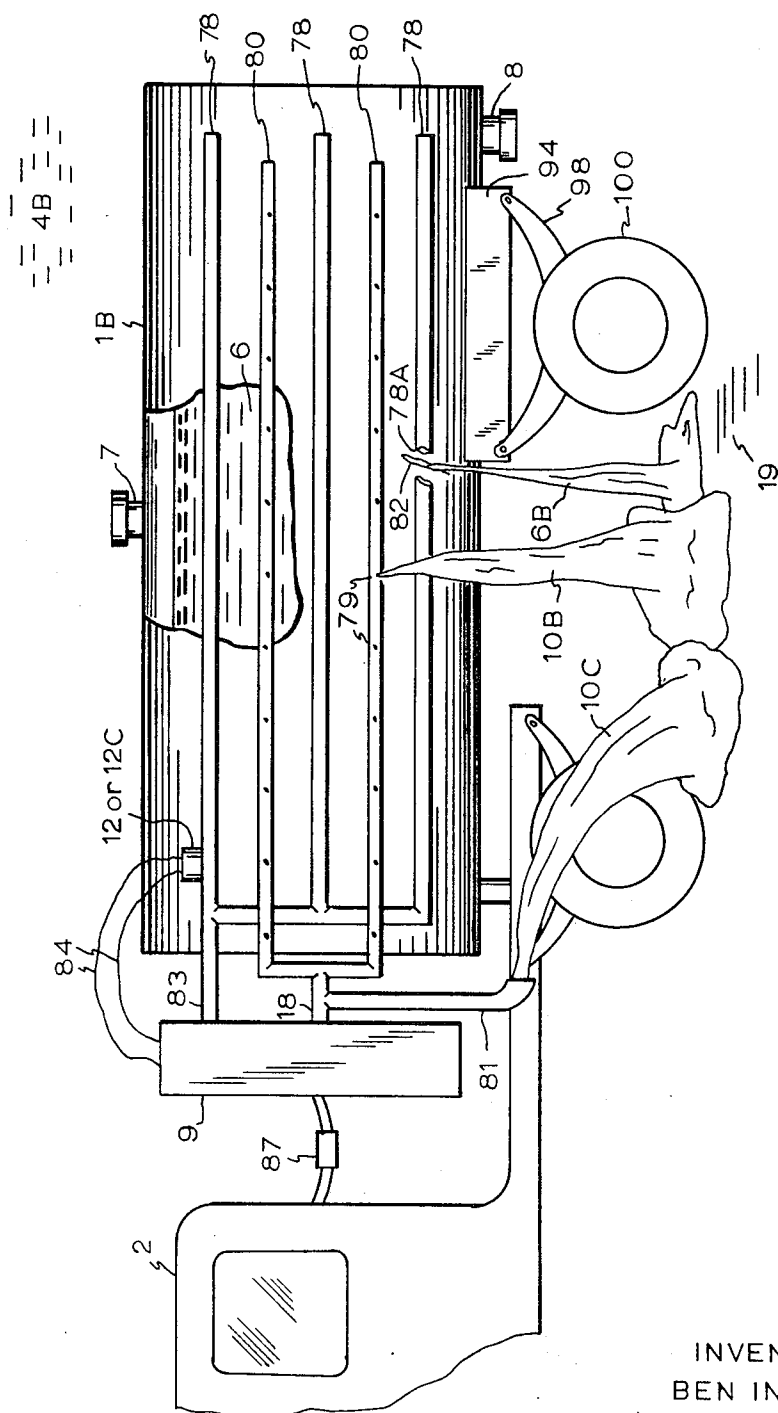
INVENTOR
BEN INGRO
by *Alberts, Bragina & Lund*
Attys



INVENTOR

BEN INGRO

by *Alberts, Brezina & Lund,*
Attys



INVENTOR
BEN INGRO
by *Alberta, Bregina & Lund,
Attys*

FIG. 9

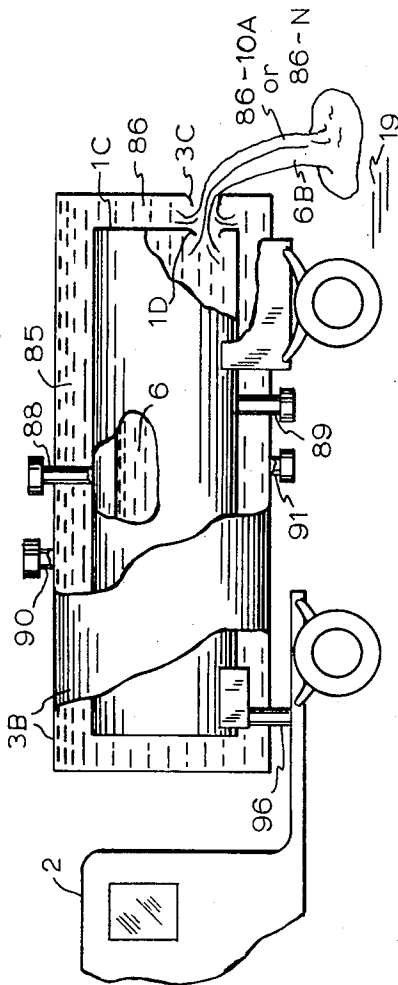


FIG. 10

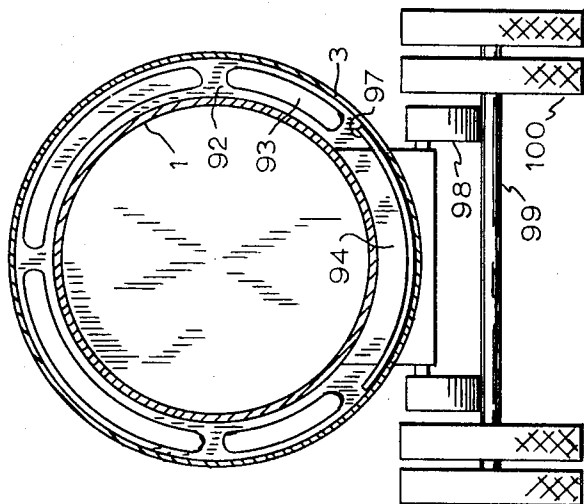
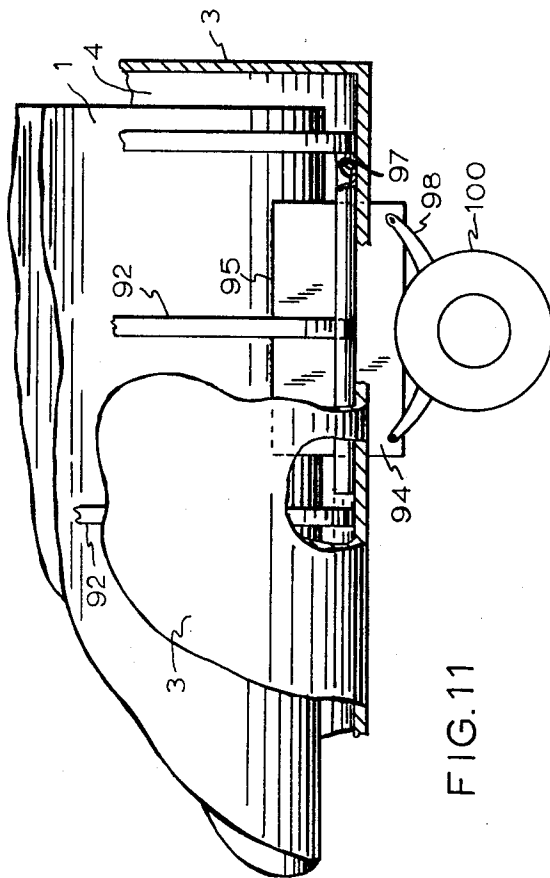


FIG. 11



INVENTOR
BEN INGRO
by *Alberts, Bregina & Lund.*
Attys

SAFETY FUEL TANKS

This invention relates to an improvement in fuel transporting equipment. More specifically, it relates to a safety system for use in tank trucks which normally carry liquid fuels such as gasoline or other highly flammable liquids and the like.

A common means of transporting flammable liquids, hereinafter referred to as "fuels," is by tank trucks which travel the highways and city streets. These tank trucks are constructed to hold, on the average, between 1,000 to 10,000 gallons of highly flammable gasoline.

In the past, many accidents have occurred involving fuel tank trucks in which there has been a serious loss of life and property.

It is therefore an object of this invention to provide fuel carrying tank trucks with an automatic means to inhibit fire or explosion in the event that the tank truck is involved in accident.

It is also an object to provide the tank portion of a tank truck with a safety system which surrounds the tank so that when the safety system is injured, as through an accident, any spilled fuel will be prevented from successful combustion.

It is also an object to surround the tank portion of a tank truck with a safety system such that when said safety system is injured, as through an accident, a chemical is brought into action which will inhibit successful combustion of any spilled fuel.

It is also an object to surround the tank portion of a tank truck with a pressurized system so that in the event that the contained pressure is changed or altered, as through an accident, a fire inhibiting fire foam is automatically released to cover any spilled fuel to prevent said fuel from attaining successful combustion.

It is also an object to provide the tank portion of a tank truck with a pressurized jacket which when punctured, as through an accident, the altered pressure in the jacket automatically starts fire foam generating equipment to flood the ground in the area of the tank truck with a fire inhibiting fire foam to prevent any spilled fuel from combusting.

It is also an object to provide fuel carrying tank trucks with means for dispensing fire inhibiting chemicals to prevent successful combustion of any spilled fuel.

It is also an object to provide fuel carrying tank trucks with fire inhibiting chemicals and means for automatically dispensing said chemicals in the tank truck area to prevent any spilled fuel from combusting.

It is also an object to provide the tank portion of a fuel carrying tank truck with pressurized tubes, which when said tubes are punctured, as from an accident, the pressure in said tubes is altered and the altered pressure in turn starts fire foam generating equipment through a sensing device.

It is also an object to provide the tank portion of fuel carrying tank trucks with one or more tubes for dispensing fire inhibiting chemicals.

It is also an object to provide fuel carrying tank trucks with means for producing fire inhibiting fire foam, a pressurized system surrounding the tank portion of the tank trucks, and means for automatically starting the production of, and the dispensing of, fire foam in the area of the tank truck to cover any spilled fuel.

It is also an object to provide fuel carrying tank trucks with self-contained means for automatically in-

hibiting a fire in the event that the tank trucks are involved in an accident. It is desirable that the fire inhibiting system is automatic as in some cases a truck driver may not be able to operate the fire inhibiting equipment.

This invention contemplates other objects, advantages and features which will become more fully apparent from the following detailed description taken in conjunction with the accompanying drawings which illustrate preferred embodiments and in which:

FIG. 1 is a partial cross-sectional side view of a fuel carrying tank constructed according to the principals of this invention.

FIG. 2 shows a fuel carrying tank with fire foam generating equipment with controls and circuits.

FIG. 3 shows a cross-sectional side view of a 'plus' pressure sensing device.

FIG. 4 shows circuitry and connections between a truck tractor and a fuel carrying tank.

FIG. 5 shows a cross-sectional view of a pressure release port.

FIG. 6 shows a cross-sectional side view of a 'minus' pressure sensing device.

FIG. 7 shows a partial cross-sectional side view of a fuel carrying tank and means for pressurizing the jacket space of the tank.

FIG. 8 is a side view of another form of this invention which uses pressurized tubes instead of a pressurized jacket.

FIG. 9 is a partial cross-sectional side view of another form of this invention which carries a fire inhibiting chemical in the jacket space.

FIG. 10 shows a cross-sectional view of the tank in FIG. 1 taken along line X—X.

FIG. 11 shows a fragmentary view of a portion of the tank in FIG. 1 showing the structure of the tank and the jacket.

FIG. 1 shows a tank truck constructed according to the principals of this invention. Shown in FIG. 1 is a fuel carrying tank 1 and tractor 2. The tank 1 has a jacket 3 which surrounds the tank 1 in its entirety. A space 4 is provided between the tank 1 and the jacket 3. The inside area 5 of the tank 1 is normally used for holding the transported fuel 6. The space 4 between the tank 1 and the jacket 3 is provided with an air pressure which is different than atmospheric pressure 4B. The pressure in the space 4 can be suitably greater 4A or suitably less 4C than atmospheric pressure 4B.

The tank 1 is normally provided with a capped filler opening 7 and a capped delivery duct 8. The tank 1 is also provided with equipment, shown as 9 in FIG. 1, for generating fire inhibiting "fire foam" 10. Equipment 9 is shown suitably mounted outside the front end 11 of the tank 1 and the jacket 3. The fire foam generating equipment 9 is shown in detail in FIG. 2 and will be described later.

The jacket 3 is also provided with a pressure sensing device 12 or 12C which compares the jacket pressure 4A or 4C with the outside atmospheric pressure 4B. A pressure sensing device 12 is shown in FIG. 3. The construction shown in FIG. 3 is for example only as there are many types of pressure sensors available which can be used.

The fire foam generating equipment 9 can be powered by its own battery 13 and an electric motor 14 as shown in FIG. 2. The battery 13 can be kept in charged-up condition through a plug-in connection 15

with the tractors generator 16 along with the tractors battery 17 as shown in FIG. 4. The batteries 13 and 17 are connected, preferably, in parallel to each other and the two are in series with the generator 16. In the event that the tank 1 is disconnected from the tractor 2 for parking, the battery 13 will remain suitably charged for quite some time. In FIG. 4 the dotted line 2 represents the tractor 2 portion and the dotted line 1 represents the tank 1 portion.

In operation, and referring to FIGS. 1, 2 and 3, in the event that the jacket 3 or the tank 1 or both have been punctured, as shown by 3A and 1A respectively in FIG. 1, through an accident or the like, the pressure 4A, for example, in the space 4 becomes equal to the atmospheric pressure 4B as a result of the interchange through the puncture 3A. The drop in jacket pressure 4A is sensed by the pressure sensing device 12 which in turn completes the electrical circuit between the battery 13 and the electric motor 14.

With the electrical circuit completed, the fire foam generating equipment 9 starts producing fire foam 10 which is fed through a tube 18 into the space 4. The fire foam 10 fills the space 4 and ultimately finds its way out through the punctured opening, as shown by 3A, where it will fall upon the ground 19 to cover any fuel 6A that may have spilled and thus prevent the fuel 6A from combusting.

The tube 18, as shown in FIG. 2, is provided with a valve 20 which is normally closed to seal in the jacket pressure 4A. The valve 20 is automatically opened to permit passage of the fire foam 10 into the space 4. The valve 20 is electrically operated and can be connected in parallel with the motor 14, as shown in FIG. 2. With this connection the valve 20 will open automatically when the motor 14 starts to operate.

The jacket 3 is also provided with a spring-loaded port 21, shown in detail in FIG. 5, which opens automatically when the fire foam generating equipment 9 starts operating. The purpose of the port 21 is to provide a vent whereby pressure can escape if there is an explosion of fumes in the jacket space 4.

The port 21 is normally latched in a closed position and is provided with a seal 22 to prevent leakage of the jacket pressure 4A or 4C. Upon operation of the fire foam generating equipment 9 a solenoid 23 pulls a latch 24 and the port 21 flies open through the urging of a coiled spring 25. The solenoid 23 is also connected in parallel with the motor 14 as shown in FIG. 2.

Referring to FIGS. 1 and 2, the method of delivering fire foam 10 is through the tube 18 and into the jacket space 4 and from the jacket space 4 the fire foam 10A will find its way out through the puncture 3A in the jacket 3 where it will fall to the ground 19 to cover any spilled fuel 6A.

Other methods of delivery can be used alternatively or in combination with the jacket system of delivery. One of such methods can be in the form of one or more tubes 26, shown in FIGS. 1 and 2, which are located along the outside length of tank 1, whether or not the tank 1 is provided with a pressure jacket 3. The tubes 26 are connected to the fire foam generating equipment 9 through the tube 18 and provided with holes 27 spaced along their length through which the fire foam 10B is dispensed to fall upon the ground 19.

Another method of dispensing fire foam 10, either alternatively or in combination with either or both of the above two mentioned systems, is through a short

dispensing nozzle 28 which is also connected to the fire foam generating equipment 9 through the tube 18. FIG. 1 shows the nozzle 28 dispensing fire foam 10C.

As stated before, the primary objective is that in case the tank truck is involved in an accident which is sufficient to cause the risk of fire or explosion, the tank 1 or the tractor 2 is equipped with means for automatically inhibiting or suppressing fire or explosion.

The provision of automatic controls makes it unnecessary for the driver or anyone else to approach the tank truck to start or to operate the fire foam generating equipment 9, as to do so would be hazardous to anyone approaching the tank truck. In some cases, as in the past, the driver might be injured and would not be able to start the equipment 9.

It may be mentioned here, and referring to FIG. 1, that the jacket 3 is also provided with a capped opening 29 at the top and a capped opening 30 at the bottom which can be used for flushing the space 4 if necessary.

The jacket 3 is also provided with a glass covered inspection port 31 which can be used to see if any fire foam 10 or any fuel 6 has accumulated in the space 4 between the tank 1 and the jacket 3.

In FIG. 2 is shown a diagram of the tank 1 with the jacket 3. Also shown is the fire foam generating equipment 9 with the controls. The typical ingredients commonly used for making fire foam include water and a foaming liquid. When these two ingredients are mixed and then air is introduced into the mixture, the mixture becomes "foam." This process is similar to that involved in making soap bubbles in that water, soap and air would be used in the latter. The equipment used for making fire foam is well known and no claims are made in this respect. It will be understood that with time, new and improved methods may be found for making fire foam and any of the newer methods may be used with this invention.

Referring to FIG. 1, the equipment 9 for making fire foam 10 is conveniently shown as being enclosed in a compact box form. It will be understood that the actual working parts can be arranged in any manner and located anywhere in the tank portion 1 of the tank truck, or such equipment can even be located on the tractor portion 2 of the tank truck, although the arrangement shown in FIG. 1 would be ideal, as there may be times when the tractor 2 would be disengaged from the tank 1 and the tank 1 would be left standing unattended in a lot. In this position, the tank 1 and the fuel 6 are always fully guarded against fire or explosion due to the presence of the automatic fire foam generating equipment 9 which is mounted on the tank 1 section.

Referring to FIG. 2, the water 32 used in connection with making fire foam 10 is shown being contained in a large tank 33, and the chemical 34 used in connection with making fire foam 10 is shown being contained in a small tank 35. Also shown is the electric motor 14 which drives the two pumps 36 and 37 and an air blower 38. The pumps 36 and 37 and the blower 38 are driven preferably through a single motor shaft 39 so that the pumps 36 and 37 and the blower 38 are all synchronized so that all the ingredients are proportionately mixed.

In operation, in the event that the jacket 3 of tank 1 is punctured, the pressure 4A, for example, in the jacket space 4 drops to the equal of atmospheric pressure 4B which causes the pressure sensing device 12 to complete an electrical circuit. With the electrical cir-

cuit completed, the current leaves the battery 13, goes through the electric motor 14 to energize it, through the contacts points 39 and 40 in the pressure sensing device 12 (shown in FIG. 3), are returns to the battery 13.

With the electrical circuit completed and with the electric motor 14 operating, the pumps 36 and 37 draw the chemical 34 and the water 32 into the mixing region 41. From the mixing region 41, the mixture is directed toward the tube 18 where it is airiated by the blower 38 to produce fire foam 10.

In the event that the jacket means of dispensing fire foam is used and the valve 20 is provided, the valve 20 is opened electrically to allow the fire foam 10 to enter the space 4 where it will exit out of the puncture 3A to fall upon the ground 19. If the jacket method of dispensing is not used, the valve 20 can be omitted and the tube 18 can be sealed at that end. The fire foam 10 can be dispensed through the tube or tubes 26 or through the nozzle 28, whichever is used. The valve 20 is shown connected in parallel with the motor 14.

A horn or alarm 41 can be provided which can be connected in parallel with the motor 14 to sound an alarm in the event that the fire foam generating equipment 9 starts to operate. The horn 42 can have a peculiar sound of its own so that it will be recognized as coming from a fuel carrying tank truck so that persons nearby may escape a possible hazard. A manually operated switch 43 may also be provided to turn off the fire foam generating equipment 9.

Referring to FIG. 2, heat sensors 44 can be used to start the fire foam generating equipment 9. The heat sensors 44 may be used optionally or in combination with the pressurized systems to start the fire foam generating equipment 9. One or more heat sensors 44 are located at strategic points along the outside of the tank 1 or the jacket 3, if it is used.

The sensors 44 are connected in series with the battery 13 and the motor 14. In the event that there is a fire near the tank 1 the heat sensors 44 complete the electrical circuit which starts the fire foam generating equipment 9. With the use of the heat sensors 44 it is not necessary for the tank 1 or the jacket 3 to have been punctured or involved in an accident in order to start the fire foam generating equipment 9. If two or more heat sensors 44 are used they may be connected in parallel to each other and each in series with the battery 13 and the motor 14. The heat sensors 44 can be of a type having a bimetal thermostatic spring which closes a set of contact points to complete the electrical circuit when the thermostatic spring has flexed due to the presence of heat.

Optional means for starting the fire foam generating equipment 9 is through a manually operated electrical switch 45 which is in series with the battery 13 and the motor 14. The switch 45 can be located on the tank 1 portion and is easily accessible if the tank 1 is parked with the tractor 2 disengaged. Another manually operated switch 46, of the same type as switch 45, can be installed in the cab of the tractor 2. The switch 46 is in parallel with switch 45 and is also in series with the battery 13 and the motor 14. The switch 46 can be connected to the circuit through a plug-in connection 47 between the tank 1 and the tractor 2 as shown in FIG. 4.

Still referring to FIG. 2, the water container 33 and the chemical container 35 may be provided with grav-

ity operated swivel sumps 48 and 49 which always aim downwardly so that they are always immersed to the bottom of the water supply and the chemical supply. This is important in case the tank 1 has tipped over on its side due to an accident. For cold weather use, the water 32 and the chemical 34 can have a chemical additive, such as ethylene glycol, for example, to prevent them from freezing, or optionally the water container 33 and the chemical container 35 can be provided with insulating jackets, shown in portion by 50 and 51, respectively. Also, or optionally, thermostatically controlled electrical heating elements 52 and 53 can be used to keep the water 32 and the chemical 34 above the freezing points. The heating elements 52 and 53 are connected across the battery 13 and their circuit can be provided with a manually operated switch 54 to disable their circuit in warm weather.

The system described thus far pertains to a pressurized system wherein the pressure 4A in the jacket space 4 is slightly higher than atmospheric pressure 4B and the pressure sensing device 12 is constructed to respond to a drop in jacket pressure 4A.

Referring to FIG. 3, an example of the pressure sensing device 12 is shown. The jacket 3 is provided with an opening 55 over which is secured the pressure sensing device 12. A diaphragm 56 in the pressure sensing device 12 seals the opening 55. The diaphragm 56 is bulged outwardly from the jacket space 4 due to the jacket pressure 4A as indicated by the arrows. Upon a drop in jacket pressure 4A, due to a puncture in the jacket 3, a spring 57 forces the contact 39 and the diaphragm 56 downwardly to cause the contact 39 to make electrical contact with contact 40 thereby completing the electrical circuit between the battery 13 and the motor 14 which in turn starts the equipment 9 to produce fire foam 10.

In this invention, and referring to FIGS. 1 and 6, it is possible to use a jacket pressure 4C which is suitably less than atmospheric pressure 4B. The jacket pressure 4C would, in effect, be a slight vacuum. The pressure sensing device 12 would be substituted by the pressure sensing device 12C, shown in FIG. 6, which responds to a rise in jacket pressure 4C. The diaphragm 58 is held inwardly, toward the space 4, by the heavier outside atmospheric pressure 4B, as indicated by the arrows. Upon puncture of the jacket 3, atmospheric pressure 4B would enter into the jacket space 4 through the puncture and cause the diaphragm 58 to move upwardly through the urging of the spring 59 which would cause the contact 60 to make contact with contact 61 which in turn would complete the electrical circuit between the battery 13 and the motor 14 to start the equipment 9 to produce fire foam 10. The pressures 4A or 4C can be supplied by pumps at a depot or optionally they can be provided and maintained by equipment carried on either the tank 1 portion or the tractor 2 portion.

FIG. 7 shows the tank 1 surrounded by the jacket 3. Also shown are means for supplying and maintaining pressures 4A or 4C in the jacket space 4. Pressure 4A, which is higher than atmospheric pressure 4B, is provided by a pump 62 which is driven by an electric motor 63. A pressure sensing device 64 is connected in series with the motor 63 and the battery 13. The pressure sensing device 64 is similar to the one shown in FIG. 3 and is mounted on the jacket 3 in a similar manner. In operation, when initially charging the pressure

4A in the jacket space 4, the contact points in the pressure sensing device 64 are in contact with each other to complete the electrical circuit. When the desired pressure has been reached, through the operation of the motor 63 and the pump 62, the contact points in the pressure sensor 64 separate which opens the electrical circuit and stops the pumping action. A pressure regulator 65 can be added in the duct between the pump 62 and the jacket space 4 to prevent an accidental over-pressure of the space 4. The pressure regulator 65 is provided with a check valve to seal in the jacket pressure 4A.

If it is desired to use pressure 4C in the jacket space 4, which is suitably less than atmospheric pressure 4B, the pump 62 can be arranged to draw air out of the jacket space 4 so that the pressure 4C in the jacket space 4 becomes a slight vacuum. A pressure regulator similar to 65 can be provided which will operate under the reduced jacket pressure 4C. A pressure sensing device 64A for use in producing reduced pressure 4C is similar to that shown in FIG. 6. In operation of the pressure sensitive device 64A, when reducing the air pressure 4C in the jacket space 4, contacts similar to 60 and 61 in the pressure sensing device 12C shown in FIG. 6, are in contact with each other which completes the electrical circuit between the battery 13 and the motor 63. When sufficient air has been pumped out of the jacket space 4 the contacts in the pressure sensor 64A separate and the pumping action stops. A small orifice 66, shown in FIG. 7, is provided in the tube 67 to meter the speed of replacement pressure 4A or 4C. In the event that the jacket 3, or fittings, has developed a leak the orifice 66 will allow only a slow replacement of pressure 4A or 4C. With the provision of the orifice 66, and in the event that there occurred an actual puncture in the jacket 3, the pressure in the jacket space 4 would be allowed to change quickly to the equal of atmospheric pressure for B without being unduly resupplied by the pressure maintaining system of FIG. 7. The pressure maintaining system of FIG. 7 supplies just enough replacement pressure to overcome a small loss of pressure, as from a small leak, but it will not overcome a great loss of pressure as would occur if the jacket 3 was actually punctured. In the event that a leak has developed in the jacket 3, or in any of the pipes or fittings the pump 62 would intermittently or continuously be in operation. Alarm means have been provided to warn the driver, or anyone else, of the operation of the pump 62, which would indicate a leaking of jacket pressure 4A or 4C.

Referring to FIGS. 4 and 7, the alarm system comprises two horns or buzzers 68 and 69 which could be suitably located as one horn on the tank 1 portion and one horn on the tractor 2 portion. The horns 68 and 69 would not need to be as loud as horn 42 in FIG. 2, but just loud enough to be heard in the immediate vicinity. The horns 68 and 69 are connected in parallel to each other through couplings 70, as shown in FIG. 4. The horns 68 and 69 are in turn connected in parallel with the pump motor 63, as shown in FIG. 7. When the pressure sensing device 68 or 68A completes the electrical circuit, as a result of a change in jacket pressure 4A or 4C, the horns 68 and 69 will operate along with the pump motor 63.

If the above described pressure maintaining system is not used, which include parts 62 to 67, in FIG. 7, then

alternate systems of charging and maintaining the jacket pressure 4A or 4C can be used.

Still referring to FIG. 7, if a pressure 4C, which is less than atmospheric pressure 4B, is used, then the source of pressure evacuation can be through a tube 71 which has one end opening into the jacket space 4 and the other end connected to the intake manifold of the tractor 2 engine (not shown) through a coupling 72, shown in FIG. 4. A pressure regulator 73 with a built-in check valve can be provided in the tube 71.

In another alternate system, if a jacket pressure 4A is used, which is greater than atmospheric pressure 4B, then the tube 71 with the associated parts are omitted, and tube 74 is used instead. One end of tube 74 opens into the jacket space 4 with the opposite end connected to a pump, at a depot, for example, for charging the jacket space 4 when the occasion makes it necessary. A pressure regulator 75 with a built-in check valve may also be connected in the tube 74. If either of the two alternate systems for pressurizing the jacket space 4 is used, which use the tubes 71 or 74, the alarm system using horns 68 and 69 with associated parts may also be used, to indicate a change in operating pressure.

Referring to FIG. 2, it may be added that the containers 33 and 35 for the water 32 and the chemical 34 are provided with capped filler openings with air-breather check valves built into the caps 76 and 77.

In another form of this invention, and referring to FIG. 8, a pressurized jacket 3 is not provided for the tank 1B. Instead, one or more pressurized tubes 78 are used which are disposed along the outside of tank 1B. The pressure in the pressurized tubes 78 can be greater, 4A, than atmospheric pressure 4B, or less, 4C, than atmospheric pressure 4B. The pressurized tubes 78 are provided with a pressure sensing device 12, as shown in FIG. 3, or with a pressure sensing device 12C, as shown in FIG. 6, depending on whether the tubes 78 are pressurized according to pressure 4A or with pressure 4C, respectively. The fire foam generating equipment 9 and the pressure maintaining systems are the same as that shown in FIGS. 1, 2, 4 and 7.

In operation, in the event that the tank truck is involved in an accident, and in the event that one of the pressurized tubes 78 is punctured, as shown by 78A in FIG. 8, the pressure change in the tubes 78 would be sensed by the pressure sensing device 12 or 12C, whichever is used, which in turn would cause the fire foam generating equipment 9 to start operating. The fire foam 10B would be dispensed through holes 79 which are located along the length of the dispensing tubes 80 which are also disposed along the outside of the tank 1B. The free end portions of the tubes 80 are sealed if desired. Included or optional means of dispensing fire foam 10C may be through a dispensing nozzle 81. Numeral 82 indicates a puncture in the tank 1B, and numeral 6B indicates spilled fuel being covered by fire foam 10B.

Pressure tube 83, shown in FIGS. 1 and 8, respectively, is shown connected between the pressure maintaining system and the pressurized system as described for FIG. 7. Tube 83 is indicative of tubes 67, 71 or 74, shown in FIG. 7. Wires 84, shown in FIGS. 1 and 8, are connected between the pressure sensing device 12 or 12C and the battery 13 and the motor 14 to operate the fire foam generating equipment 9. Wires 84A, shown in FIG. 7, are connected between the pressure sensing device 64 or 64A and the battery 13 and the pressure

maintaining pump motor 63. Helium or some other inert gas or liquid may be used to fill the jacket space 4, or the tubes 78, with a plus pressure 4A or a minus pressure 4C.

Referring to FIG. 9, another form of this invention is shown, a fuel transporting tank 1C has a jacket 3B surrounding its entirety. The jacket space 85 may contain a chemical 86 which can be installed at a depot or at a filling location. The chemical 86 can be similar to fire foam 10. In the event that the jacket 3B and the tank 1C are punctured, as shown by 1D and 3C, the fuel 6B and the fire foam material 86—10A would spill to the ground 19 together where the fire foam material 86—10A would cover the fuel 6B and prevent it from burning. Optionally, the chemical 86 could be such that upon mixing with the spilled fuel 6B it would neutralize the fuel 6B to some extent and either render it non-combustible or inhibit its combustibility to some extent. For example, the neutralizing chemical 86—N could be a form of soapy solution, or a solution of detergent and water, or it could be a heavy oil with a high flash point, or it could be a chemical such as ethylene-glycol, which is normally used as an anti-freeze and which has a high flash point, such as oil. FIG. 9 also shows a capped filler tube 88 for the fuel tank 1C and a capped delivery tube 89. The jacket 3B is provided with capped openings 90 and 91 which are used for filling the jacket space 85 or for flushing same.

Referring to FIGS. 1 and 4, numeral 87 indicates a cluster of connectors, as shown by 15, 47, 70 and 72 in FIG. 4. On each side of the connector cluster 87 are the wires and hoses also shown in FIG. 4.

FIG. 10 shows a cross-sectional view of the tank in FIG. 1, taken along lines X—X. FIG. 11 shows a fragmentary side view of the tank in FIG. 1. In FIGS. 10 and 11, the tank 1 is shown provided with circular brace members 92 which are spaced along the outside circumference of the tank 1 and are welded thereto. The jacket 3 is shown encircling the brace members 92 and is welded thereto. The brace members 92 have slots 93 to allow the free passage of the pressurizing medium 4A or 4C. The slots 93 also permit the free passage of the fire foam 10, or in the case of FIG. 9, the slots 93 permit the passage of chemical 86. Also shown in FIGS. 10 and 11 is a saddle 94 which is welded 95 to the underside surface of the tank 1. The saddle 94 provides a support structure for the springs 98, axle 99 and the wheels 100. A saddle may be provided on the front end of the tank 1 to support the yoke 96, as shown in FIG. 9. The saddle 94 is provided with flanges 97 which are welded thereto and which provide a seat for the jacket 3. The jacket 3, at that area, is welded to the flanges 97. The combination of the saddle 94 and the flanges 97 and the welded jacket material, together, make an air tight structure around the tank 1. The circular braces 92 and the saddle members 94 can also be provided on the tank 1C, shown in FIG. 9.

Referring to FIGS. 1, 10 and 11, the jacket 3 can be of suitable thin material and can be spaced 1 to 4 inches from the tank 1, for example, which would provide a jacket space 4 of 1 to 4 inches.

In another form of this invention, and referring to FIGS. 10 and 11, a jacket 3 of heavier material could be provided for the tank 1. The jacket 3 could serve as an impact absorbing barrier to protect the tank 1. In effect, a tank within a tank. The outer tank would serve to protect the inner tank from injury. In this form of

this invention, the pressurized system and the chemicals can be omitted.

It will be appreciated that other modifications and variations may be effected without departing from the spirit and scope of the novel concepts of this invention.

I claim as my invention:

1. In a system for use with flammable material storage means, safety means adapted to be secured in proximity to said storage means and including a fluid system containing a fluid normally maintained at a certain pressure, dispensing means for storing a fire suppressing material separate from said fluid in said fluid system and operable for rapidly dispensing a substantial volume of said fire suppressing material into the external space surrounding said storage means and said fluid system, and pressure responsive means responsive to a predetermined change in pressure in said fluid system to initiate operation of said dispensing means to effect rapid dispensing of a substantial volume of said fire suppressing material into said external space.

2. In a system for use with flammable material storage means, safety means adapted to be secured in proximity to said storage means and including a fluid system normally having a certain fluid pressure, dispensing means for dispensing a fire suppressing material, and pressure responsive means responsive to a change in pressure in said fluid system from said certain pressure for initiating operation of said dispensing means, said dispensing means being electrically activated, and said pressure responsive means including means for electrically activating said dispensing means.

3. In a system as defined in claim 2, wherein said flammable material storage means is in the form of vehicle-carried tank means, battery means separate from the vehicle electrical system and arranged for supplying power for energization of said dispensing means.

4. In a system for use with flammable material storage means in the form of tank means containing a flammable fluid, safety means adapted to be secured in proximity to said storage means and including a fluid system normally having a certain fluid pressure, dispensing means for dispensing a fire suppressing material, and pressure responsive means responsive to a change in pressure in said fluid system from said certain pressure for initiating operation of said dispensing means, said fluid system including wall means adapted to form an outer jacket for cooperation with said tank means to form a fluid-containing enclosed space, said certain fluid pressure being substantially different from atmospheric pressure and said pressure responsive means being responsive to a change in fluid pressure toward atmospheric pressure caused by puncture of said wall means.

5. In a system as defined in claim 4, said certain fluid pressure being greater than atmospheric pressure.

6. In a system as defined in claim 4, said certain fluid pressure being less than atmospheric pressure.

7. In a system for use with flammable material storage means, safety means adapted to be secured in proximity to said storage means and including a fluid system normally having a certain fluid pressure, dispensing means for dispensing the fire suppressing material, and pressure responsive means responsive to a change in pressure in said fluid system from said certain pressure for initiating operation of said dispensing means, said dispensing means including conduit means for extending alongside said storage means and having a plurality of openings for flow of said fire suppressing material therefrom.