Jan. 12, 1932. R. E. TOWNSEND, JR 1,840,986

FIRE EXTINGUISHING DEVICE FOR AEROPLANES

Filed Nov. 28, 1930

Fig.1.

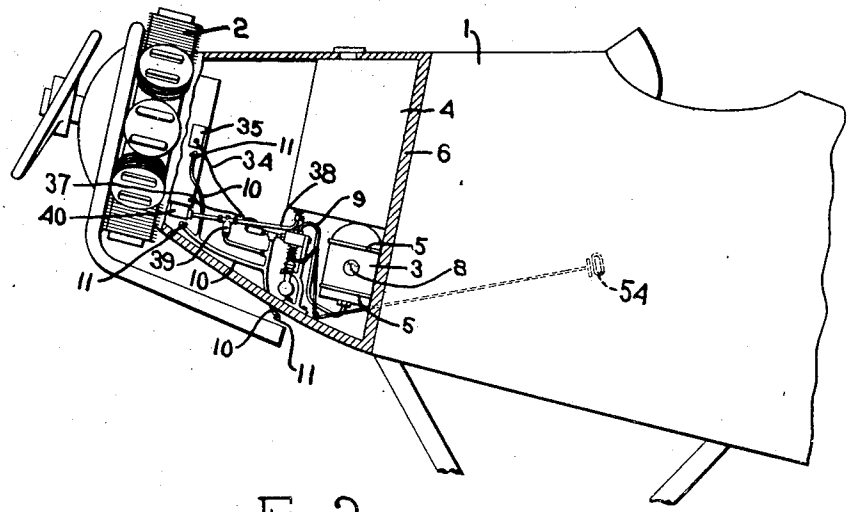


Fig.2.

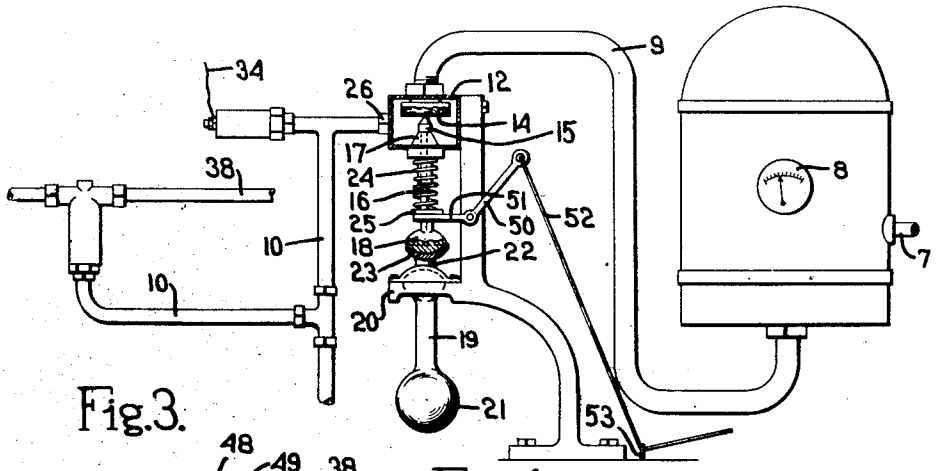


Fig.3.

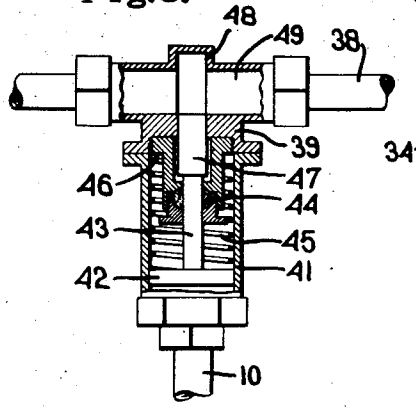
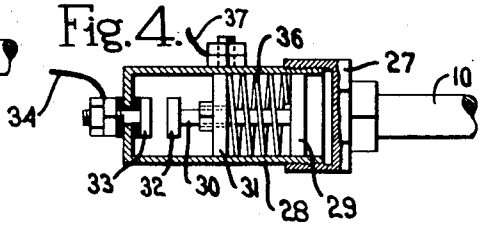


Fig.4.



Inventor.
Robert E. Townsend Jr.
by Howard Smith & Pennant
Attys.

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UNITED STATES PATENT OFFICE

ROBERT E. TOWNSEND, JR., OF BOSTON, MASSACHUSETTS

FIRE EXTINGUISHING DEVICE FOR AEROPLANES

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This invention relates to fire extinguishing apparatus and particularly to such apparatus adapted for use in vehicles such as aircraft, boats or automobiles.

When an accident occurs involving aircraft and other vehicles propelled by internal combustion engines one of the serious causes of loss of life and property is the fire hazard due to disruption of the fuel system. This is especially true of high speed vehicles such as aircraft and certain types of racing vehicles.

The principal object of the present invention is to provide a means to prevent or extinguish fire immediately upon the occurrence of the accident.

A further object of the invention is to provide a fire extinguishing apparatus which is automatically rendered operative by the shock of impact when the vehicle crashes from the air in the case of aircraft or when the vehicle comes into contact with another object.

A further object of the invention is to provide a fire extinguishing apparatus which is set in operation by the movement of a pendulum pivoted upon the vehicle, such movement of the pendulum being induced by the sudden stopping of the vehicle when the accident occurs.

A further object of the invention is to provide a fire extinguishing apparatus which automatically renders the ignition system inoperative and cuts off the supply of fuel to the engine.

A further object of the invention is to provide a fire extinguishing apparatus which is automatic in operation and which may also be rendered operative by manually-controlled means.

The particular form of the invention illustrated herein is especially adapted to be installed in aircraft. It will be understood, however, that the broad principles of the invention cover an apparatus which may be adapted to any type of vehicle. A reservoir of suitable proportions is provided which contains a quantity of fire extinguishing fluid under pressure. A system of conduits is connected to the reservoir and has a plurality of branches leading to the points of the engine where a fire hazard is greatest such as the carbureter, the exhaust manifold or the oil sump.

Normally the extinguishing fluid is excluded from the distributing system by means of a seal of any desirable form such as a thin diaphragm of metal or other suitable material. When the aircraft or other vehicle crashes a pendulum which is normally held immovable relatively to the vehicle is caused to move by reason of its own inertia. The movement of the pendulum is transmitted to a pointed ram which punctures the seal permitting the fluid to enter the distributing system to prevent or extinguish a fire.

As the fluid from the reservoir is admitted to the distributing system a pressure is built up therein. This pressure is utilized to actuate a switch mechanism which renders the ignition system inoperative. Furthermore, to insure complete safety the supply of fuel to the engine is also cut off during the period that the fire extinguishing fluid is acting to prevent or extinguish a fire.

In the drawings:

Fig. 1 is a partial view of an aeroplane with its forward compartment broken away to show the installation of a preferred embodiment of the invention.

Fig. 2 is an enlarged view of the apparatus detached from the aeroplane.

Fig. 3 is a detail view of the automatic fuel supply cut off.

Fig. 4 is a detail view of the automatic ignition cut out device.

The apparatus is herein shown installed in the forward compartment of an aeroplane 1 equipped with a standard air-cooled internal combustion engine 2. The apparatus is, however, readily adapted to be installed in any type of vehicle. A reservoir 3 of fire extinguishing fluid is conveniently situated beneath the main fuel supply tank 4 containing fuel for the engine. The reservoir 3 may contain any suitable fire extinguishing fluid which is maintained under pressure sufficient to properly distribute the fluid in case of fire. The fluid preferably is of a character espe-

cially adapted to extinguish oil or hydrocarbon fires.

The reservoir 3 is secured in position by means of one or more straps 5 which extend circumferentially about the reservoir and are fastened to a rigid part of the aeroplane such as the partition 6. The fluid may be introduced in the reservoir in any desirable way. A connection 7 is herein shown which may be connected to a pump or other pressure device not shown. The pump acts to introduce the fluid and build up the required pressure within the reservoir 3 which is indicated by a gauge 8. A distributing system serves to convey the fluid to various parts of the aeroplane where the fire hazard is greatest. The system consists of a main conduit 9 connected to the reservoir communicating with a plurality of conduits 10 having outlet points which may be provided with nozzles 11. The outlet points may be located at any desired point where they will be the most effective, such as near the carbureter, the exhaust manifold or the oil sump. The conduit 9 terminates in a fluid tight chamber 12 which is supported on a bracket 13 rigidly mounted on a fixed part of the aeroplane.

The end of the conduit 9 extends into the chamber 12 and is sealed by means of a thin metal diaphragm 14 which is soldered or otherwise secured to the end of the conduit. The seal normally excludes the fluid from the conduits 10 leading to the outlet points.

Directly below the seal 14 is slidably mounted a pointed ram 15 with its pointed end normally positioned near the seal. The ram is provided with a stem 16 slidable vertically within and closely fitting an aperture in a guiding member 17 which passes through and has a fluid tight union with the lower wall of the chamber 12. The member 17 functions to guide the ram 15 vertically. The lower end of the ram is provided with an enlarged head 18 having a substantially spherical bottom face. Directly below and in axial alignment with the ram is a pendulum 19 which is universally pivoted in an arm 20 extending substantially horizontally from the bracket 13. The lower end of the pendulum is provided with a heavy head portion 21 and also has an upwardly projecting arm 22 which is provided with a substantially spherical concave face 23 in which is received the spherical face of the head portion on the ram 15.

The ram 15 is normally held in its downward position by means of a spring 24 bearing at its upper end against a shoulder on the member 17 and at its lower end against a collar 25 fixed to the stem 16 of the ram. The spring 24 is at all times under tension forcing the head 18 into engagement with the concave face 23 of the pendulum. The head 18 by engagement with the upwardly extending arm 22 of the pendulum prevents movement of the pendulum relatively to the frame of the aeroplane when relatively slight forces are acting upon the pendulum. Such slight forces are created upon taking off and landing, or starting and stopping the vehicle. Under such circumstances the apparatus is inoperative.

When the aeroplane crashes or the vehicle protected by the device comes in contact with another body which causes damage thereto an excessive force is brought to bear upon the pendulum due to its inertia. Such force overcomes the action of the spring 24 and causes the pendulum to swing about its pivot. As the pendulum swings the concave face 23 acts as a cam upon the head 18 of the ram forcing it upwardly until its pointed end pierces the seal 14 thereby permitting the extinguishing fluid to flow into the chamber 12 from where it passes into the conduits leading to the outlet points since the distributing conduits are directly connected with the chamber 12 at the point 26. The fluid is thus distributed to the danger points and by reason of the pressure within the reservoir 3 is sprayed over a considerable area by the nozzles 11 thus preventing or extinguishing a fire.

Automatic means are also provided acting simultaneously with the flow of fluid to render the ignition system inoperative by grounding the main circuit. This is accomplished by means of an especially constructed switch 27 having a cylinder 28 connected to one of the distributing conduits 10. The cylinder 28 is provided with a piston 29 having a stem 30 which is guided in a partition 31 within the cylinder. The stem 30 has a contact face 32 at its outer extremity. Disposed in axial alignment with the stem 30 is a contact member 33 which extends through the outer end of and is electrically insulated from the metal cylinder 28. The contact member 33 is connected by a wire 34 to the output of the magneto 35 or other ignition system. The contact points 32 and 33 are normally retained out of engagement by means of a compression spring 36 on the stem 30 bearing at one end against the piston 29 and at its other end against the partition 31.

When an accident occurs and the seal 14 is broken pressure is immediately built up in the conduits 10. Such pressure is transmitted, therefore, to the piston 29 causing it to move against the action of the spring 36 thus forcing the contact member 32 into engagement with the member 33 establishing an electrical circuit from the ignition system to ground. In order to insure proper grounding of the circuit a special grounding wire 37 may be provided which is electrically connected to the partition 31 which is in direct contact with the contact member 32. The wire 37 is connected to the frame of the engine thus completing the circuit to the ground. Other

suitable means may be employed however to establish a positive ground. By grounding the ignition circuit the engine immediately ceases to function.

A pressure-actuated fuel supply cut-off valve 39 is provided which automatically interrupts the flow of fuel to the engine from the fuel supply tank 4. The valve is inserted in the supply pipe 38 which extends from the fuel tank 4 to the carbureter 40 on the engine and has a laterally disposed cylinder 41, the outer end of which is connected to one of the distributing conduits 10. The cylinder 41 has a piston 42 slidably mounted therein having a piston rod 43 extending upwardly passing through a packing gland 44 which serves as a guide therefor. The piston 42 is normally held at the bottom of the cylinder by means of a compression spring 45 which is situated on the piston rod and bears at one end on the piston 41 and is seated against the upper end 46 of the cylinder.

At the upper end of the piston rod is attached a gate 47 which closely fits guideways 48 extending into the valve chamber 49. The gate 47 is normally held out of the chamber 49 permitting flow of fuel in the supply pipe 38. When the seal 14 is broken, however, pressure is immediatly built up in the cylinder 41 which moves the piston 42 upwardly against the action of the spring 45 thus forcing the gate 47 into the valve chamber where it acts to interrupt the fuel supply during the period when the fire extinguishing fluid is flowing thereby greatly minimizing the danger of serious fire loss.

A manual control is provided which enables the operator to control a fire as he sits at the controls. A lever 50 is pivoted upon the bracket 13 and has a bifurcated arm 51 embracing the piston rod 16. A flexible cord 52 is connected to the other end of the lever and extends downwardly to a guide eye 53 fixed at a convenient point in the cockpit of the aeroplane. From the guide eye the cord extends upwardly to a convenient position in the cockpit of the aeroplane. The cord is desirably provided with a suitable handle 54 by means of which the cord is pulled in case of emergency. When the cord is pulled the ram 15 is raised through the action of a lever 51 which engages the collar 25 upon the stem 16 thereof. The ram is thus caused to puncture a seal 14 to liberate the fluid at the will of the operator in cases where a fire starts from other causes than a crash or collision with another object.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is:

1. A fire extinguishing apparatus for vehicles propelled by internal combustion engines comprising a reservoir containing fire extinguishing fluid under pressure, a conduit leading therefrom to a distributing system, a seal for said conduit acting normally to prevent flow of the fluid to the distributing system, and inertia-operated means including a pendulum mounted for universal movement acting to break said seal upon excessive impact of the vehicle with another body thereby to permit the fluid to flow into the distributing system to prevent or extinguish a fire.

2. A fire extinguishing apparatus for vehicles propelled by internal combustion engines comprising a reservoir of fire extinguishing fluid under pressure, a conduit leading therefrom to a distributing system, a thin metallic diaphragm sealing said conduit and acting normally to exclude liquid from said system, a pendulum universally pivoted on the vehicle, means operable by said pendulum to break said seal upon swinging movement of said pendulum in any direction caused by violent impact of the vehicle with another body thereby permitting flow of fluid in said distributing system to prevent or extinguish a fire and means acting normally to prevent operative movement of said pendulum.

3. A fire extinguishing apparatus for vehicles propelled by internal combustion engines comprising a reservoir of fire extinguishing fluid under pressure, a conduit leading from said reservoir to a distributing system, a seal for said conduit acting normally to exclude fluid from said system, a pendulum universally pivoted on the vehicle, a cam-actuated ram operable by the movement of the pendulum in any direction caused by violent impact of the vehicle with another object to break said seal thereby permitting the fluid to flow in said system to extinguish or prevent fire and means acting normally to prevent motion of the pendulum.

4. A fire extinguishing apparatus for vehicles propelled by internal combustion engines comprising a reservoir for fire extinguishing fluid under pressure, a conduit leading therefrom to a distributing system, a seal for said conduit acting normally to exclude fluid from said distributing system, a pendulum pivoted on the vehicle, means operable to break said seal when actuated by movement of said pendulum in any direction upon violent impact of the vehicle with another object thereby permitting pressure from the reservoir to accumulate in said system and causing the fluid to flow therein and means operable to render the ignition system of the engine inoperative actuated by the pressure thus accumulated in the distributing conduits.

5. A fire extinguishing apparatus for vehicles propelled by internal combustion engines, a reservoir of fire extinguishing fluid under pressure, a conduit leading therefrom to a distributing system, a seal for said

conduit acting normally to exclude fluid from said distributing system, a pendulum pivoted on the vehicle, means operable to break said seal actuated by movement of said pendulum in any direction upon violent impact of the vehicle with another object thereby permitting pressure from said reservoir to accumulate in said distributing system and causing the fluid to flow therein and means operable to interrupt the flow of fuel to the engine actuated by the pressure thus accumulated in the distributing conduits.

6. A fire extinguishing apparatus for vehicles propelled by internal combustion engines comprising a reservoir of fire extinguishing fluid under pressure, a conduit leading therefrom to a distributing system, a seal for said conduit acting normally to exclude the fluid from said system, a pendulum pivoted on the vehicle, means operable to break the seal actuated by movement of the pendulum in any direction caused by violent impact of the vehicle with another object thereby permitting pressure from the reservoir to accumulate in said system and causing the fluid to flow therein to prevent or extinguish a fire, means in said system actuated by the pressure thus accumulated therein to render the ignition system of the engine inoperative and pressure-operated means in the system operable to cut off the supply of fuel to the engine.

7. A fire extinguishing apparatus for vehicles propelled by internal combustion engines comprising a reservoir of fire extinguishing fluid, a conduit leading therefrom to a distributing system, a thin metallic diaphragm acting as a seal for said conduit normally to exclude liquid from said system, a pendulum pivoted on the vehicle, a ram, positioned to engage said seal, a cam operable by the swinging movement of said pendulum in any direction to cause said ram to break said seal upon violent impact of the vehicle with another body thereby permitting flow of fluid in said distributing system to prevent or extinguish a fire, means acting normally to prevent operative movement of said pendulum and manual means operable independently of said inertia-operated means to break said seal.

In testimony whereof, I have signed my name to this specification.

ROBERT E. TOWNSEND, JR.