

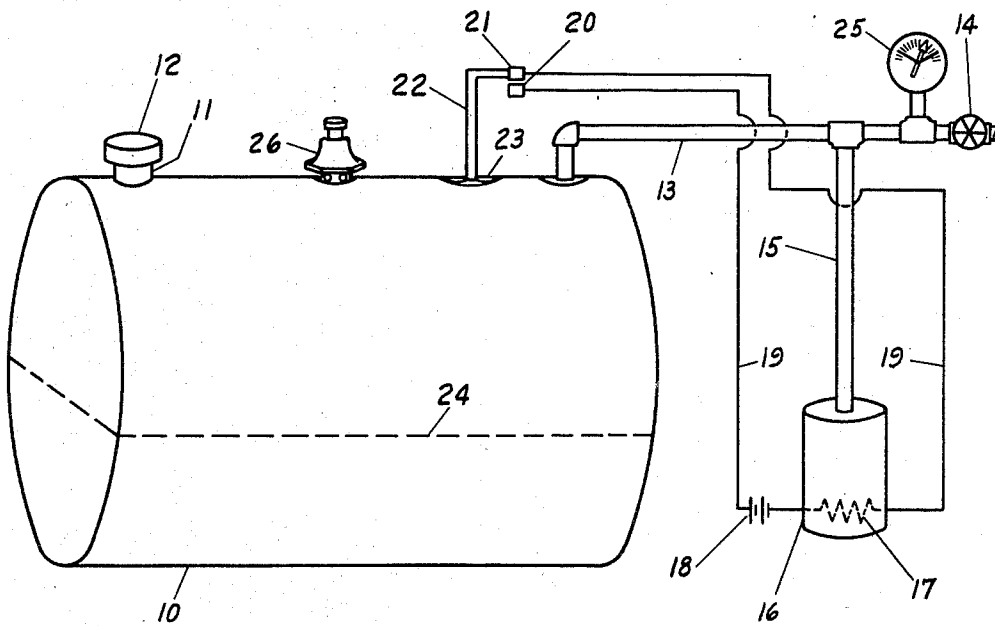
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GASOLINE STORAGE TANK EXPLOSION-HAZARD ELIMINATING DEVICE

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GASOLINE STORAGE TANK EXPLOSION- HAZARD ELIMINATING DEVICE

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This invention relates to a gasoline storage tank explosion-hazard eliminating device, whether the storage be a tank car or located in an airplane, motor boat, automobile or other vehicle, or other gasoline storage device.

In ordinary conditions of storage of gasoline, air is usually admitted to the tank as the gasoline is removed therefrom. With such conditions, in any partially filled tank the upper part of the tank contains a mixture of gasoline vapor and air, a dangerous explosive mixture. If a spark occurs in the upper part of the tank for any reason a dangerous explosion and fire will surely result.

In the case of an aircraft an explosion-producing heat may be supplied in any one of a number of ways, such as by a fire in the vicinity of the gasoline tank, by lightning, by a spark from static electrical changes in the structure of the plane, by a spark from the engine exhaust, by an incendiary bullet piercing the upper part of the tank, by a crash which liberates the explosive mixture in the neighborhood of the exhausts, or by any other means.

It is an object of this invention to eliminate this explosion hazard by replacing the air in the space above the gasoline by means of an inert gas such as carbon dioxide, which is heavier than air and which will not form an explosive mixture with gasoline.

It is a further feature of this invention to provide a means for causing the carbon dioxide to automatically replace the gasoline as it is expended from the tank, whether it is expended at a rapid or at a slow rate.

A further feature of this invention is to connect a source of carbon dioxide ice to a gasoline tank and to provide automatic means for heating the carbon dioxide ice as the gasoline is expended from the tank so as to evaporate a sufficient quantity of the carbon dioxide ice to replace in volume the gasoline that is being expended.

A further feature of this invention is to prevent the occurrence of any excessive pressure or vacuum within the tank by providing a pressure and relief valve which will allow excessive pressure in the tank to escape and which will likewise prevent an excessive vacuum from forming in the tank. Under normal conditions the carbon dioxide gas will replace the gasoline and prevent the formation of a vacuum, but should the system fail for any reason, such as the carbon dioxide ice becoming exhausted, the vacuum relief valve will automatically operate to prevent collapse of the tank through the formation of an excessive vacuum.

A pressure and vacuum indicating gauge will

likewise be connected to the tank so as to indicate to an operator just what pressure or vacuum is present in the tank, and this pressure and vacuum indicating gauge will preferably be of the recording type, so that should an excessive vacuum be present in the tank, causing the admission of atmospheric air thereto, the recording needle will show that such excessive vacuum had been present, and the operator may take such precautions as may be necessary to place the system into operation again and eliminate any explosive mixture that may in the meantime have been formed within the tank.

With the foregoing and other objects in view, the invention consists in the construction, combination and arrangement of parts, as will be described more fully hereafter.

In the drawing:

The figure is a diagrammatic showing of the invention.

There is shown at 10 a conventional representation of a gasoline tank which may be located anywhere that gasoline is stored, either for storage or for transportation. This tank 10 is fitted with the usual filling spout 11 adapted to be closed by an airtight sealing cap 12 and provided with a vent pipe 13 having a valve 14 at its end for opening it to the atmosphere should the same be necessary. Secured to the vent pipe 13 by another pipe 15 is a carbon dioxide container 16 having a heating coil 17 connected to any suitable source of power, such as a vehicle battery 18. Conduits 19 are connected to a diaphragm-operated switch 20, one of the contacts 21 of the switch 20 being attached by means of an arm 22 to a flexible diaphragm 23 set in the top of the tank 10.

As will be apparent, withdrawal of gasoline from the tank 10 by a suitable pipe (not shown) will tend to cause a vacuum within the tank 10 above the gasoline level 24. This will cause the diaphragm 23 to move inwardly and thus through arm 22 move the contact 21 to the circuit completing position of the switch 20, thereby setting the heating coil 17 into operation whereby the carbon dioxide ice therein will give off carbon dioxide gas at its top. The gas will pass through the pipe 15 and vent pipe 13 into the top of the tank 10 above the gasoline level 24. A gauge 25 mounted on the vent pipe 13 is preferably of the pressure and vacuum gauge maximum recording type, so that it will not only indicate the instant pressure within the tank 10 but will also record the maximum vacuum as well as the maximum pressure reached within the tank.

A pressure and vacuum relief valve 26 is fitted to the top of the tank 10 and is set to operate upon the tank reaching a determined pressure. Obviously, such excessive pressure may be caused through sudden changes in temperature, as well as through over heating of the carbon dioxide container 16. In the meantime, the recording gauge 25 will show the presence of such excessive pressure, even though it occurs only temporarily, so that the operator discovering the same later on may take any necessary steps to eliminate the causes for such excessive pressure and possibly prevent the repetition thereof. At the same time, the vacuum relief in valve 26 is set to relieve the vacuum in the tank when it approaches the collapsing value. In normal operation during the withdrawal of gasoline, the diaphragm 23 keeps the switch 20 in its closed position and carbon dioxide is fed to the tank from container 16, thus preventing the formation of any excessive vacuum. Should the vacuum increase for any reason, such as the supply of carbon dioxide ice becoming unexpectedly exhausted, an excessive vacuum would be created, except that just before this vacuum approaches the collapsing value for the tank, valve 26 operates to relieve such excessive vacuum. In the meantime, the recording gauge 25 will indicate that such vacuum had been present so that the operator upon inspection of the system may replace the carbon dioxide ice, if exhausted, or make any repairs necessary to place the system again in operation. The hand control valve 14 permits the venting of the tank to the atmosphere manually.

Under normal conditions of operation the tank will be filled with carbon dioxide gas above the gasoline level 24, irrespective of whether the gasoline level 24 is almost at the full tank level or almost at the empty tank level, thus normally preventing the presence of an explosive mixture of air and gasoline above the gasoline level 24.

Under normal conditions the rate of evaporation of the carbon dioxide ice within the container 16 will serve to keep the atmosphere of carbon dioxide gas within the tank 10 above the level 24 very slightly in excess of atmospheric pressure. When the gasoline is being used up at a rapid rate, however, this normal rate of evaporation will probably not be sufficient, in which case the vacuum formed within the tank will operate the switch 20 through the diaphragm 23, coil 17 will be heated by the power source 18 and the carbon dioxide gas will boil off more rapidly to replace the gasoline being removed.

Other modifications and changes in the proportions and arrangements of the parts may be made by those skilled in the art without departing from the nature and scope of the invention, as defined in the appended claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

Having thus set forth and disclosed the nature of this invention, what is claimed is:

1. A fuel tank explosion-hazard eliminating device including a tank, a container for solidified inert gas connected to the fuel tank, means operated by a vacuum within said tank controlling the flow of inert gas into the tank, said means comprising a diaphragm operated switch fitted on the fuel tank and means operated by said switch for accelerating flow of inert gas from the container to the tank.

2. A fuel tank explosion-hazard eliminating device including a fuel tank, an inert gas container connected to the fuel tank, means operated by a vacuum within said tank controlling the flow of the inert gas into the tank, said means comprising a diaphragm operated switch connected to the fuel tank and means operated by said switch for causing an increased flow of inert gas from the container to the tank, said latter means comprising a heating coil associated with said container for heating the inert gas therein to cause it to flow more rapidly.

3. A fuel tank explosion-hazard eliminating device including a fuel tank, a container for solidified inert gas connected to the fuel tank, means operated by the presence of a vacuum in said tank causing the solidified inert gas to sublimate and flow into the tank, vacuum and pressure relief means on said tank preventing any excessive pressure within said tank, the vacuum relief part being operable at a vacuum in excess of the normal vacuum for operating the inert gas operating means.

4. A fuel tank explosion-hazard eliminating device including a fuel tank, an inert gas container connected to the fuel tank, means operated by a vacuum within said tank causing the inert gas to flow into the tank, vacuum and pressure relief means on said tank preventing any excessive pressure within said tank, the vacuum relief means being operable at a vacuum in excess of the normal vacuum for operating the inert gas operating means, and a pressure and vacuum recording gauge for indicating the pressure or vacuum within the tank and for recording the presence of an excessive pressure or an excessive vacuum.

5. A gasoline tank explosion-hazard eliminating device including a gasoline tank, a carbon dioxide ice container, a pipe line connecting the carbon dioxide ice container to the top of the gasoline tank, a diaphragm operated switch fitted to the gasoline tank and a heating coil connected to said diaphragm operated switch and associated with said carbon dioxide ice container for evaporating the carbon dioxide ice whenever the vacuum within the tank causes said diaphragm to operate the switch, and thus cause carbon dioxide gas from the container to neutralize the vacuum.

6. A gasoline tank explosion-hazard eliminating device including a gasoline tank, a carbon dioxide ice container, a pipe line connecting the carbon dioxide ice container to the top of the gasoline tank, a diaphragm operated switch mounted in the gasoline tank, a heating coil connected to said diaphragm operated switch and associated with said carbon dioxide ice container for evaporating the carbon dioxide ice whenever the vacuum within the tank causes said diaphragm to operate the switch, and thus cause carbon dioxide gas from the container to eliminate the vacuum, said tank having a vacuum and pressure relief valve set therein, the pressure relief part being set to operate slightly above the normal atmospheric pressure conditions within the tank, and the vacuum relief part being set to operate at a vacuum in excess of the vacuum which will operate the diaphragm-operated switch.

7. A gasoline tank explosion-hazard eliminating device including a gasoline tank, a carbon dioxide ice container, a pipe line connecting the carbon dioxide ice container to the top of the gasoline tank, a diaphragm operated switch mounted in the fuel tank, a heating coil connected

to said diaphragm operated switch and associated with said carbon dioxide ice container for evaporating the carbon dioxide ice whenever the vacuum within the tank causes said diaphragm to operate the switch and thus cause carbon dioxide gas from the container to eliminate the vacuum, said tank having a vacuum and pressure relief valve set therein, the pressure relief part being set to operate slightly above normal atmospheric

pressure conditions within the tank, and the vacuum relief part being set to operate at a vacuum in excess of the vacuum which will operate the diaphragm-operate switch, and a pressure and vacuum recording gauge connected to said tank for indicating the pressure therein and recording the presence of any excess vacuum or pressure.

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