

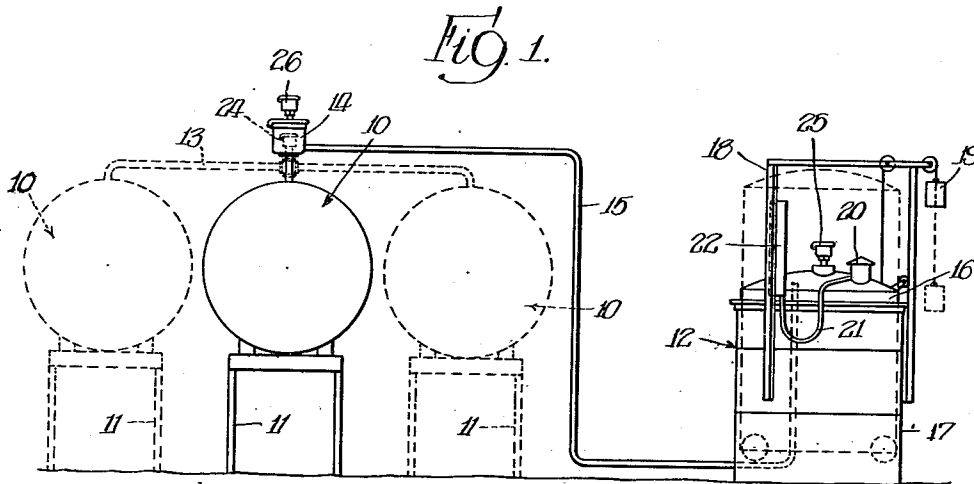
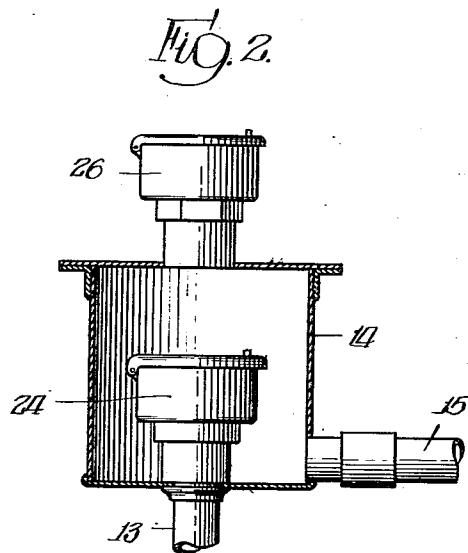
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C. L. MARNER

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VAPOR CONSERVATION SYSTEM FOR BULK STORAGE PLANTS

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VAPOR CONSERVATION SYSTEM FOR BULK STORAGE PLANTS

Charles L. Marner, East Chicago, Ind., assignor to
Graver Tank & Mfg. Co., Inc., Catasauqua, Pa.,
a corporation of Delaware

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The invention relates to apparatus for conserving vapors from bulk storage plants such as those storing gasoline and other volatile liquids.

In storage tanks for gasoline and the like vapors are given off during the heat of the day and unless means are provided to conserve said vapors it becomes necessary to expel them to the atmosphere. As a result of the temperature drop normally occurring during the night, the vapors remaining in the tank will condense and very often a vacuum is produced which draws in air to relieve the same. The vapors expelled to the atmosphere are known as "breathing losses" and over a period of time, especially for large storage tanks, said losses will considerably reduce the quantity of liquid stored.

For economical operation, therefore, of bulk storage plants comprising a number of large tanks it is absolutely necessary to conserve the vapors during generation thereof and to subsequently supply the vapors to the tanks during those periods when condensation takes place in order to relieve any vacuum which may develop.

An object of the invention is to provide improved apparatus for conserving the vapors from storage tanks for gasoline and the like and which will eliminate evaporation losses to a large extent and also prevent air from coming in contact with the tank contents except under abnormal conditions. When air is prevented from contacting the gasoline during its storage period the formation of gum in the liquid does not occur and the octane number and color of the gasoline are thus maintained. Also the fire hazard is reduced since the vapors are thoroughly saturated at all times, which makes ignition and explosion practically impossible.

With these and various other objects in view the invention may consist of certain novel features of construction and operation, as will be more fully described and particularly pointed out in the specification, drawing and claims appended hereto.

In the drawing which illustrates an embodiment of the invention, and wherein like reference characters are used to designate like parts—

Figure 1 is an elevational view showing the improvements of the invention as applied to a group of storage tanks for gasoline and the like having connection through a vapor line with a breather reservoir; and

Figure 2 is a sectional view taken through the expansion chamber of the vapor conservation system as illustrated in Figure 1.

Referring to the drawing, the group of storage

tanks 10 supported by means 11 are connected to a breather reservoir 12 of the gas holder type. The vapor line 13 from the storage tanks conducts the vapors to an expansion chamber 14 which is connected by vapor line 15 with the breather reservoir 12.

The holder bell 16 of the reservoir, which is sealed with respect to the tank 17 by a sealing liquid, is guided in its vertical movements by means 18 which support the balancing weights 19 having connection with said holder bell.

In order to compensate for the gradually diminishing buoyant effect of the liquid as the holder bell 16 moves upwardly said holder supports a tank 20 having connection by the flexible conduit 21 with the compensating tank 22 supported on the guiding means. As a result of this compensating feature the holder bell of the reservoir travels upwardly at a substantially uniform pressure. The liquid flows out of tank 20 as the holder bell moves up and this gradually lightens the bell to compensate for the decrease in the buoyant effect above described.

Between the vapor lines 13 and 15 there is located the expansion chamber 14 as previously described. Said chamber is thus interposed between the storage tanks 10 and the breather reservoir 12. The purpose of the expansion chamber is to reduce the quantity of vapors expelled from the tanks as a result of evaporation either from breathing or a filling operation. The vapors from the tanks 10 will be retained within the vapor space thereof until the pressure exceeds the limit of valve 24 located within expansion chamber 14 and suitably fitted to the terminal end of the vapor line 13. It will be understood that valve 24 will be set at a pressure depending on the strength of the particular storage tanks 10. The vapors entering the chamber 14 will expand and said vapors will flow through the line 15 into the breather reservoir 12. Said reservoir is set for operation on a predetermined pressure, which, in this instance depends on the strength of the holder bell 16. At the top of the holder bell a pressure and vacuum relief valve 25 is provided in order to vent the vapors to the atmosphere in the event the holder bell should be inflated to its capacity. Valve 26 on the expansion chamber 23 may be considered a secondary pressure and vacuum relief valve set to operate on a pressure somewhat higher than valve 25 on the bell holder 16 and also operating on a vacuum in excess of that for valve 25.

The proper design of a system for conserving vapors from a group of bulk storage tanks re-

quires a breather reservoir having a capacity sufficiently large to take care of vapors as a result of the normal breathing and filling of said tanks. Thus under abnormal conditions the pressure within the breather reservoir may exceed the maximum limit of the same, which is, of course, taken care of by valve 25 located on bell holder 16. The excess vapors are vented to the atmosphere through this valve and may also be expelled through valve 26 should the vapor pressure become great enough. When conditions within the tanks are reversed and condensation of the vapors therein takes place, a relatively slight pressure drop will cause valve 24 to open and allow the vapors from the breather reservoir to flow back into the vapor space of said tanks. In this manner the vacuum which would otherwise be produced is taken care of by said vapors. Here also in the event of an abnormal vacuum occurring within the expansion chamber 23, and thus within the breather reservoir 12, the valve 25 will open and admit air for relieving said vacuum. However, any air which may be drawn into the system is admitted to the breather reservoir at a point farthest removed from the vapor space of the tanks. The vapors within said tanks are richer and are therefore substantially saturated at all times which makes ignition and explosion practically impossible.

For a practical system including a group of tanks and a breather reservoir such as shown in Figure 1, the valve 24 within the expansion chamber will be set for a pressure which will be determined by the weakest tank in the system. A pressure of sixteen ounces may be taken as illustrative. The vapors generated within the tanks are retained within the vapor space thereof until a pressure in excess of sixteen ounces is attained, whereupon the valve 24 will open and these vapors will expand within the expansion chamber 14 to a pressure of approximately five ounces. The arrangement of valve and expansion chamber therefore reduces the quantity of vapors expelled from the tanks. Thus the capacity of the breather reservoir may be reduced accordingly. In fact, it has been possible to reduce the size of the reservoir from approximately twenty-five to fifty per cent, depending upon the vapor pressures of the product stored within the tanks. A pressure of sixteen ounces may also be considered a typical pressure for the breather reservoir 12. The holder bell 16 will of course operate on a much lower pressure and when the capacity is reached the holder bell will have been inflated to its uppermost limit. Any pressure in excess of sixteen ounces will be vented through valve 25 to the atmosphere.

When the vapors within the storage tanks condense and the pressure within drops to a predetermined minimum the vacuum side of valve 24 will open and allow the vapors which had been previously expelled from the tanks to flow back into the tanks. A vacuum within the tanks greater than vapors in the breather reservoir to relieve it would result in opening of valve 25 on the bell holder to admit air. If this is not sufficient the secondary relief vacuum valve 26 may also open, admitting air directly to the expansion chamber 14.

The invention is not to be limited to or by details of construction of the particular embodi-

ment thereof illustrated by the drawing, as various forms of the device will of course be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. In apparatus for storing and conserving liquids such as gasoline and the like, a plurality of storage tanks for said liquid, a breather reservoir, an expansion chamber, a vapor line connecting the expansion chamber with the breather reservoir, said expansion chamber also having connection with the top of said tanks whereby vapors from the tanks will flow to the expansion chamber and will be conducted by the vapor line to the breather reservoir, a pressure and vacuum relief valve located within the expansion chamber and operative to control the pressure of the vapors within the tanks, and a second pressure and vacuum relief valve located on the expansion chamber for exhausting vapors to the atmosphere on abnormal pressure and for admitting air when an abnormal vacuum exists in the expansion chamber.

2. In apparatus for storing and conserving liquids such as gasoline and the like, a plurality of storage tanks for said liquid, a breather reservoir having a pressure and vacuum relief valve, an expansion chamber, a vapor line connecting the expansion chamber with said breather reservoir, said expansion chamber also having connection with the top of said tanks whereby vapors from said tanks will flow to the expansion chamber and will be conducted by the vapor line to the breather reservoir, a pressure and vacuum relief valve in the expansion chamber operative to control the pressure of the vapors within said tanks, and a safety valve on the expansion chamber for exhausting vapors to the atmosphere on abnormal pressure and for admitting air when an abnormal vacuum exists in the chamber, said last mentioned valve having a setting for both pressure and vacuum greater than that of the valve within the expansion chamber and also greater than the setting for the valve on the breather reservoir.

3. In apparatus for conserving and storing liquid such as gasoline and the like, a plurality of storage tanks for said liquid, a breather reservoir having a pressure and vacuum relief valve, an expansion chamber, a vapor line connecting the expansion chamber with said breather reservoir, said expansion chamber also having connection with the top of said tanks, whereby vapors from said tanks will flow to the expansion chamber and will be conducted by the vapor line to the breather reservoir, a pressure and vacuum relief valve on the expansion chamber closing said chamber with respect to the vapor space in the tanks and which thereby controls the pressure within said tanks, and a safety valve on the expansion chamber adapted to operate on a predetermined pressure to exhaust vapors to the atmosphere and on a predetermined vacuum to admit air to the expansion chamber, said last mentioned valve having a setting for both pressure and vacuum greater than that of the valve within the expansion chamber and also greater than the setting for the valve on the breather reservoir.

CHARLES L. MARNER.