May 5, 1931. S. H. BROOKS 1,803,460

FIRE PREVENTION SYSTEM FOR TANKS

Filed Dec. 15, 1926

Fig. 1.

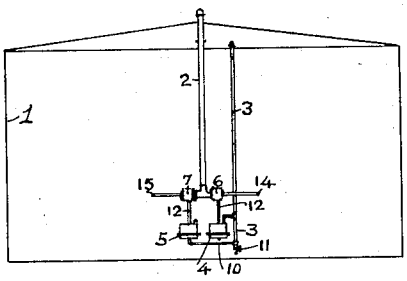
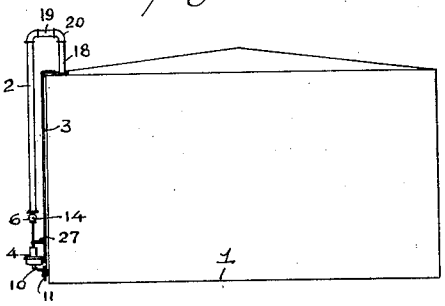


Fig. 2.



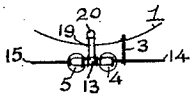


Fig. 3.

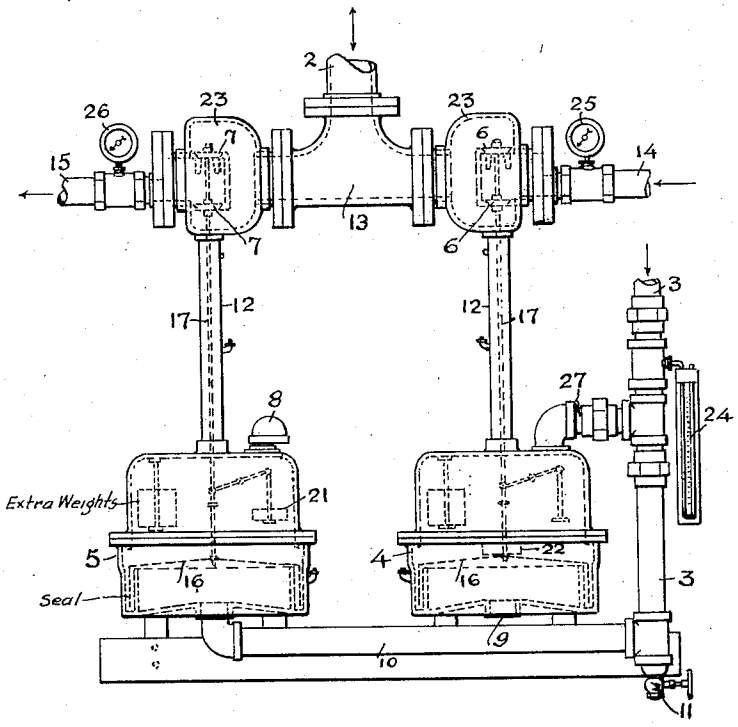


Fig. 4.

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1,803,460

UNITED STATES PATENT OFFICE

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FIRE PREVENTION SYSTEM FOR TANKS

Application filed December 15, 1926. Serial No. 154,937.

My invention relates to improvements in fire prevention systems for tanks, and it more especially consists of the features pointed out in the annexed claims.

The purpose of my invention is to provide a fire prevention system that is sensitive to all the varying conditions of pressure and vacuum found in tanks which contain inflammable materials; that is positive in its actions; that safeguards the tank against the accumulation of fire hazard vapors at predetermined pressures; that likewise safeguards the tank's contents against fire when a vacuum is created in the tank above the contents; that automatically feeds into the tank natural gas, always found in an oil field, or feeding into it dry gas, a by-product of gasoline distillation, which by reason of its richness prevents the formation of an inflammable mixture within the tank; that hermetically seals the tank against an uncontrolled egress of vapors and the ingress of oxygen laden vapors, both of these precautions serving to guard the contents of the tank against explosion and the loss of the entire tank and its contents, and in addition jeopardizing other tanks located in the nearby vicinity; and that enables me to secure a hundred per cent vapor recovery and a hundred per cent fire prevention, an attainment hitherto unknown in vapor conservation systems.

With these and other ends in view, I illustrate in the accompanying drawings such instances of adaptation as will disclose the broad underlying features of my invention without limiting myself to the specific details shown thereon and described herein.

Figure 1 is a diagrammatic side elevation of a tank equipped with my invention.

Fig. 2 is a front elevation in diagrammatic representation of Fig. 1.

Fig. 3 is a diagrammatic plan view of Fig. 1.

Fig. 4 is an enlarged diagrammatic elevation of my vacuum and pressure regulators.

In practically carrying out my invention I may use whatever alternatives of construction that the exigencies of various installation conditions may demand without departing from the broad spirit of my invention.

My system is applicable to any kind of container or tank in which inflammable materials are stored. As instanced in the drawing, a tank 1 has a short outlet 18 from the top of the tank. This is connected by means of an elbow 20 to a short lateral pipe 19, which in turn is connected to the vertical pipe 2 that leads to the regulating valves 6 and 7 placed near the bottom of the tank. The valves 6 and 7 are in separate casings 23 that are joined by a T 13 into which the vapor line 2 is secured. A mercury seal tube 12 leads from the bottom of each of the casings 23 to the casings 4 and 5 which contain the regulating disks 16. These disks have a depending flange which dips into a mercury or other seal in a well known manner. The disks are separately connected by stems 17 to the valves 6 and 7. Weights 22 of any desired value may be placed directly on the disks to increase the lifting force required to actuate them. Weights 21 connected by a simple lever system to the stems 17 reduce the force required to move the disks.

The regulators 4 and 5 are connected to the top of the tank by separate control pipe 3. This pipe is connected to the control 4 by a short pipe 27 above the disk 16 and it is connected beneath the disk 16 of the control 5 by means of a pipe 10. At the intersection of pipes 3 and 10, a condensation drain outlet 11 may be placed, and above the pipe 27 a manometer 24 is attached to the pipe 3. The manometer indicates the positive or negative pressure condition of the tank. A pressure gage 25 and a vacuum gage 26 placed respectively adjacent the valve casings 6 and 7 also serve to indicate pressure indications in the system. The vacuum gage indicates negative pressures for the controller 5 and the pressure gage serves as an indicator for the controller 4.

A controller 5 has an opening 8 to the atmosphere above the disk 16 and the controller 4 has an opening 9 to the atmosphere below its disk 16. A pipe 14 attached to the valve casing 6 serves to admit natural gas from the field, or so-called dry gas, into the top of

the tank through the elbow 13 and the pipe 2 when a negative pressure develops in the tank. A pipe 15 connected to the valve casing 7 leads whatever vapor is formed in the tank 1 to any desired type of vapor recovery means. The inflow through pipe 14 and the outflow through pipe 15 may be controlled by the disks 16 from .05 to .4 ounce operating pressure or in any other desired range. The double valves 6 and 7 are in balance under vacuum or flow so as to place a minimum stress on the control disks 16.

By reason of the interrelated parts of my system, I am able to secure one hundred per cent vapor recovery through pipe 15 and one hundred per cent fire protection through pipe 14 because the vacuum of the tank is only equalized by a very rich petroleum gas that is too rich to be ignited. If, instead of the protective gas coming through pipe 14, air was allowed to enter the tank 1 to equalize the vacuum a dangerous explosive mixture would be readily formed; hence, as already stated, my system secures entire freedom from fire and the highest possible efficiency in the recovery of tank vapors.

The operation of my system is quite simple. Suppose that an increase of atmospheric temperature produces a vapor pressure within the tank, which traverses the pipe 3 to the underside of the disk 16 of controller 5 and to the upper side of the disk 16 of controller 4. This results in the double valve 7 being raised and the double valve 6 being held closed, hence the accumulating vapor from the tank passes out through pipe 15 to be recovered. In the case of a vacuum the disk 16 of the controller 4 is raised by air entering the opening 9 which in turn opens the double valve 6 to admit natural gas through the pipe 14 into the tank. The pressure of a vacuum under the disk 16 of controller 5 will in connection with air admitted through the opening 8 press the disk downward and thus hold the double valve 7 closed. When the conditions are neutral both valves 6 and 7 remain closed. It will be seen that my system not alone secures a full recovery of vapors and the elimination of fire hazard, but it also prevents the accumulation of excessive positive and negative operating pressures within the selected range of the controllers.

If desired, any form of cooperating safety vent may be attached to the elbow 20 as a continuation of the pipe 19 to provide a free vent for any pressures of an explosive order in excess of the capacity of the regulators. A flame arrester may be placed between the elbow 20 and the tank 1 to guard against the admission of any flame incident to an explosion occurring in the system which might otherwise be transmitted to the interior of the tank. These provisions, however, are extraordinary safe-guards which under ordinary service conditions would not be called into action.

This invention is of commanding importance in that results hitherto unattainable are secured by means that are all enclosed without the use of sliding parts subject to mechanical friction. There is no opportunity for any of the parts to become disarranged through accident or malice, for the reason that the actuating portions of the controllers are sealed against ordinary access.

What I claim is:

1. In a combined vapor recovery and fire prevention system, a tank for holding inflammable material, a pipe connection from beneath the roof of the tank leading to a pair of differential regulators, a separate vapor flow pipe communicating with the inside of the tank said pipe terminating in oppositely positioned outlets, a valve casing connected to each of said outlets, valves within the casings, means for separately connecting the valves to the controllers, and separate external pipe connections to the valve casings.

2. A maximum fire prevention and vapor recovery system, a storage tank, a pair of automatic controls connected at the tank in differential relation by a single control pipe, a separate valve system subject to each control, a vapor line from the tank in common to both valve systems, a recovery line connected to one valve to lead away vapors at a set pressure, and a fire prevention line connected to the other valve to equalize a vacuum within the tank at a predetermined pressure.

3. In a fire prevention vapor recovery system, a tank, a positively operated control, a negatively operated control, a pipe leading from the tank and differentially connected to the controls, a valve system for each control, a common pipe leading from between the valves to the tank, a recovery pipe connected to one valve, and an equalizing pipe connected to the other valve whereby the respective valves are operated by the controls through the variable pressure conditions within the tank.

4. In a fire prevention recovery system, a gas tight storage tank, a single control pipe leading from the free space above the contents of the storage tanks to a pair of automatic controls differentially connected to each other in respect of said pipe, a separate valve system subject to each control, a vapor line from the tank in common to both valve systems, a recovery line connected to one valve to lead away vapors at a set pressure, and a fire prevention line connected to the other valve to equalize a vacuum within the storage tank at a predetermined pressure.

5. In a fire prevention recovery system, a gas tight storage tank, a control responsive to positive pressure, a control responsive to negative pressure, a separate valve system for each control, a vapor connection from the

tank in common to both valve systems, a recovery line connected to one valve to lead away vapors at a set pressure, a fire prevention line connected to the other valve to equalize a vacuum within the storage tank at a predetermined pressure, and means for connecting the controls to the free space above the contents of the storage tank.

In testimony whereof I affix my signature.

STEPHEN H. BROOKS.