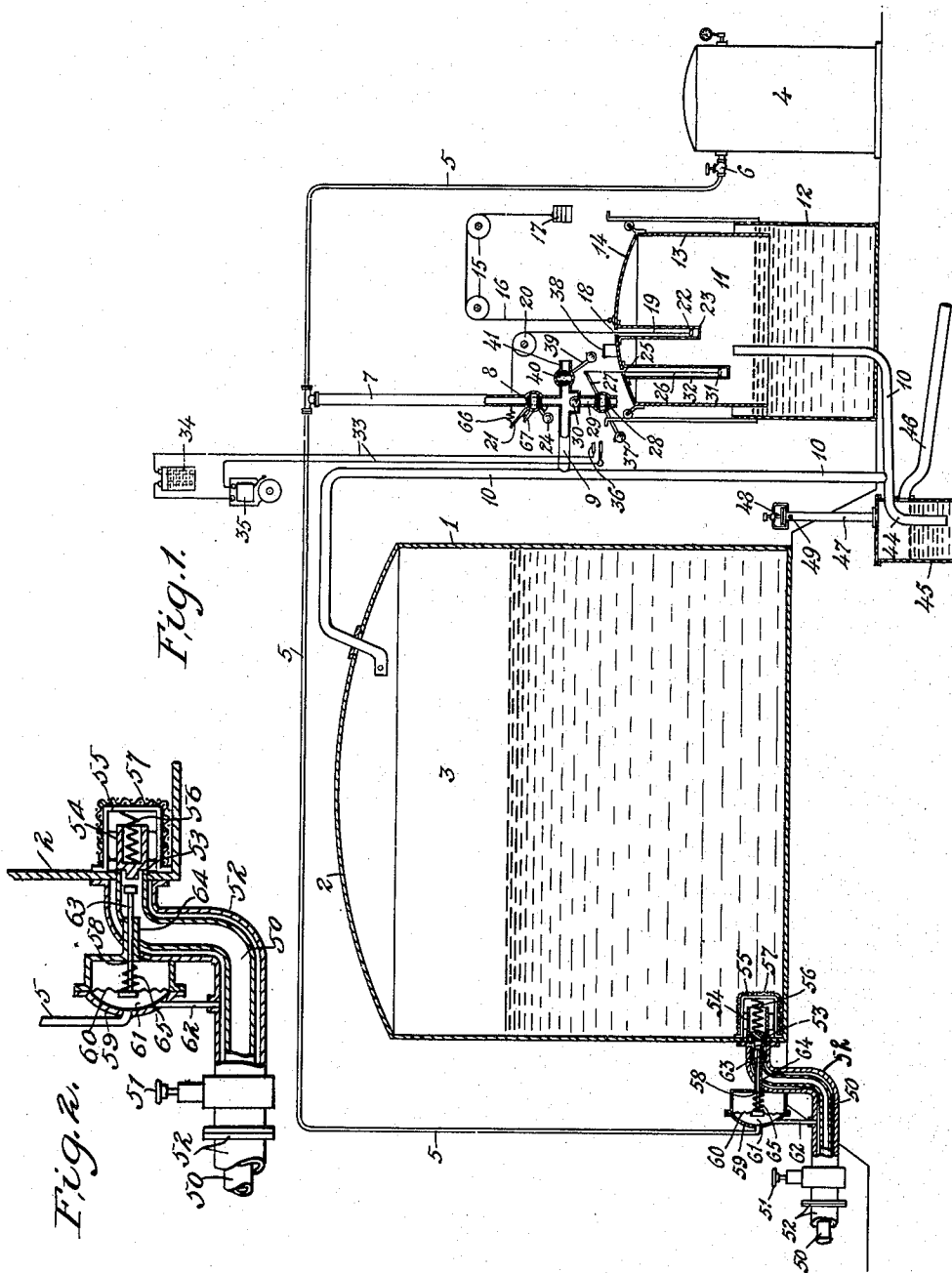


E. HURLBRINK.
 DEVICE FOR TANKS CONTAINING INFLAMMABLE LIQUIDS.
 APPLICATION FILED JAN. 13, 1915.

1,147,729.

Patented July 27, 1915.



WITNESSES

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ERNST HURLBRINK, OF BERLIN-FRIEDENAU, GERMANY, ASSIGNOR TO MARTINI & HÜNEKE MASCHINENBAU-AKTIE-GESELLSCHAFT, OF BERLIN, GERMANY, A CORPORATION OF GERMANY.

DEVICE FOR TANKS CONTAINING INFLAMMABLE LIQUIDS.

1,147,729.

Specification of Letters Patent.

Patented July 27, 1915.

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To all whom it may concern:

Be it known that I, ERNST HURLBRINK, a subject of the German Emperor, and a resident of Berlin-Friedenau, Germany, have
5 invented certain new and useful Improvements in Devices for Tanks Containing Inflammable Liquids, of which the following is a specification.

This invention relates to safety devices for
10 tanks containing inflammable liquids, and particularly tanks located above the ground and provided with a draw-off pipe surrounded by a jacket filled with gas under pressure, said jacket being in communication with a
15 chamber containing a pressure member operatively connected with a shut-off valve in said pipe. With this arrangement the valve will close automatically whenever the pressure in the jacket falls below a predetermined amount. According to the present invention, the shut-off member or valve is located at the intake end of the draw-off pipe. With this arrangement, should the jacket and the draw-off pipe break, the shut-off
25 member by closing will prevent the inflammable liquid from escaping at the break.

In connection with devices having underground tanks for inflammable liquids and a draw-off pipe provided with a pump and a
30 protective gas, a jacket surrounding said pipe and itself surrounded by a protective chamber, there has been proposed heretofore the use of a yielding pressure member exposed to the pressure prevailing in said
35 chamber and operatively connected with a double-seat valve located in said pipe adjacent to the pump. The object of this double-seat valve was to connect the draw-off pipe with the gas jacket whenever the pressure in the protective chamber fell below a predetermined limit. In the present invention, however, the double-seat valve will prevent the liquid from running out of the tank in case the draw-off pipe should break or leak.

When applied to apparatus in which the gas space of the tank and the jacket of the draw-off pipe are filled with a non-oxidizable protective gas (say, carbon dioxide), the pressure chamber of the pressure member
45 controlling the shut-off member according to the present invention is preferably connected with a conduit, communicating with the storage reservoir of the protective gas, which

conduit serves to convey the protective gas to the gas space of the tank and to said jacket. This arrangement affords an increased degree of safety against accidents, since the shut-off device in the draw-off pipe will be closed automatically even if the replenishing of the gas supply to the tank is
60 interrupted for any reason, as for instance, a leak in the pipe which conveys said gas. Thus inflammable liquid can be withdrawn from the tank only so long as a proper supply of protective gas to said tank is insured, so that there is no danger of explosions.

In the accompanying drawing Fig. 1 is a diagrammatic vertical section through one form of a plant embodying this invention, and Fig. 2 is a detail section thereof on an enlarged scale.

The tank 1 which is located above the ground and provided with a solid cover 2, so as to be gas tight, is adapted to receive in its lower portion the inflammable liquid, such as gasoline, while its upper portion 3 is supplied with gas of a non-oxidizing character, for instance carbonic acid, say from a storage receptacle 4 containing such gas under pressure. With this storage receptacle is
80 connected a conduit 5 of relatively small cross section connected with a pressure chamber referred to hereinafter. Adjacent to the receptacle 4 the conduit 5 is provided with a shut-off valve 6. A branch conduit 7
85 containing a reducing valve 8 connects the conduit 5 with another conduit 9 leading to a conduit 10 which is connected with the gas space 3 of the tank 1 and also with the gas space 11 of a gasometer 12. The conduits 7, 9, 10 and the passageway of the reducing valve 8 are of a considerably larger diameter than the conduit 5.

To the roof or cover 14 of the gasometer bell 13 is secured a flexible connection 16
95 guided by engagement with stationary rollers 15 and connected with a weight 17 for partly counterbalancing the bell 13. Thus the protective gas contained in the gas spaces 3 and 11 and in the conduits 9 and 10 is under a pressure but slightly above atmospheric pressure.

The roof 14 of the bell 13 is provided with an opening 18 which passes a flexible connection 19 guided by engagement with a stationary pulley 20 and secured at one end to a

lever 21 of the reducing valve 8. The other end of the flexible connection 19 is provided with a disk or other engaging member 22 contained in a vertical pipe 23 secured to the bell below the roof 14. This pipe is gas tight and is closed at the bottom while its top has an opening for the passage of the flexible connection 19. The pressure reducing valve 8 is normally kept in the closed position by a weight 24.

A spring 66 is interposed in the connection with cord or other flexible connection 19 and the lever 21. The casing of the reducing valve 8 is provided with a stop 67 located in the path of the counterweight 24 so as to arrest it when the reducing valve has been turned to the open position. The spring 66 is of such strength that when a pull is exerted on the connection 19 the reducing valve 8 will be opened, the weight 24 being raised at the same time. When this weight comes against the stop 67 further movement of the reducing valve is prevented but the pull on the connection 19 will simply increase the tension of the spring 66.

The roof 14 of the bell 13 is further provided with an opening 25 through which a cord or wire 26 extends. One end of this cord is secured to a lever 27 connected with a valve 28 which controls the connection from the outside air to a branch 29 connected with the conduits 7 and 9. The branch 29 also contains a check valve 30 which, under certain conditions, will allow air to enter into the conduit 9 from the branch 29, but which will always prevent gas from passing out from the conduit 9 through the branch 29. The valve 28 is provided with a counterweight 37 which normally keeps the valve closed. The lower end of the cord 26 is secured to a disk or the like 31 contained in a pipe 32 which is located below the roof 14 and has a closed bottom so as to have no connection with gas space 11. There is further provided an electric circuit comprising wires 33, a battery 34, an electric bell 35, and a contact device 36 comprising a fixed contact member and a movable one located in the path of the weight 37 so that as the latter moves upward the circuit will be closed and the bell rung. The roof of the bell 13 also carries a projection 38 adapted to engage the weight 39, adapted to normally close a valve 40, which controls the connection, with the atmosphere of a pipe 41 connected with the conduits 7 and 9.

As the gasometer bell 13 approaches its lowermost position the roof 14 will first engage the disk 22 and carry it downward so as to open the reducing valve 8. If the bell 13 continues to fall after said valve has been fully opened, the roof 14 will also come in engagement with the disk 31 thereby opening the air admission valve 28. During this time the reducing valve 8 is held in the

opened position with the weight 24 against the stop 67, and the spring 66 is put under further tension as described. If the bell 13 then rises again, the valves 28 and 8 will be brought back to the closed position, shown in the drawing, by the action of the counterweights 27 and 34 respectively. As the bell 13 approaches its uppermost position, the projection 38 by engaging the counterweight 39, will cause the valve 40 to be opened, and when the bell 13 moves down again, the counterweight 39 will restore said valve 40 to its closed position. It will be understood that instead of counterweights springs may be employed for closing the valves 8, 28 and 40.

If, on account of condensation, liquid should collect in the lower portion of the conduit 10, such liquid might oppose a considerable resistance to the flow of protective gas passing from the gasometer 12 to the tank 1 and a detrimental vacuum might thus be produced in the tank. In order to prevent this a pipe 44 is connected with the lowermost point of the conduit 10 and this pipe is inclined downwardly to a receptacle 45, the lower end of the pipe dipping into a suitable sealing liquid (say water) contained in this receptacle. Thus any liquid resulting from condensation in the conduit 10 will be conveyed to the sealing receptacle 45 from which the excess of such liquid may escape through an overflow pipe 46. When required, the supply of sealing liquid may be replenished through a filling pipe 47 provided at its upper end with a movable cover 48 and with vent holes 49.

The inflammable liquid contained in the tank 1 is drawn off from it through a pipe 50 connected with said tank at one side close to its bottom. This pipe contains a shut-off valve 51 adapted to be operated by hand and is surrounded by a jacket 52 which also surrounds the valve 51. The end of the pipe 50 within the tank 1 or, in other words, the intake end of said pipe, is formed as a valve seat 53 for a valve 54 movable horizontally in a stationary frame or guide 55 located within the tank 1. The valve 54 may be pressed toward its seat by a spring 56, but this is not absolutely necessary since the pressure of the outflowing liquid will be sufficient to close the valve. A strainer 57 may be provided in connection with the guide 55 to prevent dirt from reaching the valve 54.

On the jacket 52 is secured a frame 58 to which a vertical diaphragm 60 is secured by means of a cover 59. The cover 59 and diaphragm 60 form a chamber 61 which is connected with the jacket 52 by means of a tube 62; furthermore the chamber 61 is connected with the gas receptacle 4 by means of the conduit 5 referred to above. The diaphragm 60 is connected with a horizontal

rod 63 mounted to slide in a tubular guide 64 projecting into the pipe 50 and located in axial alinement with the valve 54. As long as the pressure is the same on both sides of the diaphragm 60 a spring 65, tending to press the diaphragm toward the left, will keep the rod 63 away from the valve 54 as shown in the drawing, so that the latter is kept closed either by the spring 56 or by the pressure of the liquid in the tank. If, however, the pressure increases in the chamber 61, the diaphragm, together with the rod 63, will be moved inwardly, that is, toward the valve 54, against the tension of the spring 65. When the free end of the rod 63 engages the rod 54, the latter will be opened. It will thus be evident that upon opening the manually operated valve 51, liquid can be withdrawn from the tank 1 through the pipe 50 only if the pressure in the chamber 61 is such as to keep the automatic valve 54 open. It will be obvious that a piston may be substituted for the diaphragm for operating the valve opening rod 63. The tank 1 may be filled with gasoline or other inflammable liquid through a suitable pipe (not shown) passing through the cover of said tank.

The operation is as follows: Normally the conduits 5, 52, 62, the chamber 61, and that portion of the conduit 7 which is above the reducing valve 8, are filled with protective gas of a relatively high pressure. This causes the diaphragm 60 to be verged toward the right so as to bring the rod 63 against the rod 54 and keep the latter open. The conduits 9, 10 and the gas spaces 3, 11 are filled with protective gas of a relatively low pressure as determined by the reducing valve 8. When it is desired to draw liquid from the tank 1 all that is necessary is to open the shut-off valve 51. The liquid will then flow through the pipe 50 owing to its natural head. At the same time a corresponding amount of protective gas will pass from the gas space 11 of the gasometer 12, through the conduit 10 into the gas space 3 of the tank 1. When the protective gas flows out of the space 11, the gasometer bell 13 will move down until the disk 22 is engaged and carried along by the roof 14, causing the reducing valve 8 to be opened in the manner described above. This will cause a supply of fresh protective gas from the conduit 7 to the conduits 9, 10 and to the gas space 11. As protective gas is admitted to the space 11, the bell 13 will rise again allowing the reducing valve 8 to be closed again by the counterweight 24 thus interrupting the supply of fresh protective gas from the conduit 7. The gasometer 12 is of such dimensions that generally the up and down movement of the bell 13 will compensate for the periodical variations of volume (caused by temperature fluctuations) of the

protective gas contained in the space 3 of the tank 1. This offers the advantage of avoiding the necessity for allowing protective gas to escape from the tank 1 through the sealing receptacle 45 when the gas contained in said tank expands with rising temperature, and also the necessity of supplying an extra amount of protective gas to the tank when subsequently to the escape of such excess gas, a fall of temperature causes a contraction of the gases. Thus a saving in protective gas is effected, and at the same time a saving in inflammable liquid, in view of the fact that whenever gas is allowed to escape such gas will carry along with it vapors of the inflammable liquid, and also when fresh gas is admitted such gas will absorb a certain amount of vapors from the liquid. Assuming that the daily temperature fluctuations with hot days and cool nights amounts to about 30° C., it would be sufficient to so construct the gasometer 12 that its maximum volume (with the bell 13 fully raised) will be one-tenth of the maximum volume of the gas space 3 of the tank 1. If the gasometer bell 13 should rise beyond the highest allowable point owing to expansion of the gas contained in the tank by a rise of temperature, the valve 40 will be opened by the projection 38 striking against the counterweight 39 so that the excess of gas may escape into the atmosphere through the pipe 41. If then the gas contained in the tank 1 contracts again by cooling, the first result will be the passage of gas from the gasometer 12 to the tank 1, the bell 13 falling to a corresponding extent. If the cooling effect is a very strong one so that the amount of gas contained in the gasometer will not be sufficient to replenish the tank 1, then upon the further sinking of the bell 13, the disk 22 will be carried along by said bell thus opening the reducing valve 8 so that then fresh protective gas may pass along through the conduits 5, 7 connected with the storage receptacle 4 so that the supply of gas in the spaces 3 and 11 will be replenished.

Should the valve 6 be closed or the storage receptacle 4 be empty, a cooling and contraction of the gas might cause a partial vacuum in the gas space 3 in which case air would be drawn by suction through the sealing liquid of the gasometer 12 or that of the sealing receptacle 45. This vacuum might also expose the roof or cover of the tank to being crushed in by the external pressure. In order to prevent this the valve 28 above referred to has been provided. This valve is opened whenever the bell 13 in discontinued downward movement carries the disk 31 along, thus admitting air into the tank through the pipe 29 and the conduits 9 and 10. In this manner there is no possibility of a partial vacuum being created

within the tank. Whenever air enters the tank 1 it dilutes and thereby renders less effective the protective gas contained in the tank and in order to call attention to this undesirable condition, there has been provided the alarm 35 in connection with the circuit closer 36 which alarm may be located at any desired point, say in an attendant's room, so that a signal will be given whenever the air admission valve 28 is opened. The attendant will then know that the cock 6 ought to be opened or the storage receptacle 4 refilled with protective gas.

The check valve 30 prevents the protective gas from escaping through the valve 28 to the outside air when the bell 13 is in its lowermost position and the valves 8 and 28 are open. It will be obvious that this check valve allows air to pass inward through the pipe 29, but will not allow gas to escape outwardly from said pipe. If at the time the valve 28 is open, a fresh supply of protective gas is conveyed through the conduit 7, the bell 13 will rise again and the valve 28 will be closed by its counterweight. The arrangement of the valve 54 controlled by the diaphragm 60 offers a two-fold advantage. First, in the event of a break or leak in the draw-off pipe 50 and in the jacket 52 a further withdrawal of liquid from the tank 1 will be prevented automatically. Second, the same action of closing the valve 54 will take place whenever the supply of protective gas to the tank is interrupted. If for instance, the draw-off pipe 50 and the jacket 52 are broken or if even only the jacket 52 leaks, the protective gas will escape at the break or leak, thereby causing the pressure to be reduced in the jacket 52, the tube 62 and the chamber 61. As soon as the pressure is reduced to a predetermined limit, the diaphragm will move toward the left sufficiently to cause the rod 63 to allow the valve 54 to be closed by its spring 56. Therefore, in the case of any injury to the conduits 50, 52, all danger of the escape or withdrawal of the inflammable liquid from the tank 1 is avoided. On the other hand, should there be a break or leak in one of the conduits serving to convey the protective gas to the tank 1, as, for instance, the conduit 10, the protective gas will again escape at the damaged point and the resulting reduction of pressure in the chamber 61 will cause the valve 54 to close in the same manner as described above. Inasmuch as the conduits 7, 9, and 10, as well as the passageway in the plug of the reducing valve 8 have a materially larger cross-section than the conduit 5 connected with the storage receptacle 4 and with the chamber 61, a reduction of pressure sufficient to close the valve 54 at once is insured in the conduits 7, 9, 10 and 5 whenever there is a break or leak in any one of them. The valve 54 will

also close automatically in case the supply of protective gas to the tank 1 should be interrupted on account of closing the valve 6 or of exhausting the contents of the storage receptacle 4, whenever one or the other of these causes brings the pressure in the chamber 61 below a predetermined limit. It will thus be seen that the valve 54 will be closed automatically so as to prevent the withdrawal of inflammable liquid from the tank 1 whenever conditions are such that a sufficient replenishing supply of protective gas to the tank 1 is not insured.

I claim as my invention:

1. A storage system for inflammable liquids, comprising a tank, a draw-off pipe connected therewith, a shut-off member located at the intake end of said pipe, a jacket surrounding said pipe and adapted to contain a gas under pressure, a chamber communicating with said jacket, a pressure member in said chamber, and an operative connection between said pressure member and the shut-off member to cause the latter to close in the event of a break or leak in the jacket and pipe.

2. A storage system for inflammable liquids, comprising a tank, a draw-off pipe connected therewith, a shut-off member located at the intake end of said pipe, a jacket surrounding said pipe and adapted to contain a gas under pressure, a chamber communicating with said jacket, a pressure member in said chamber, an operative connection between said pressure member and the shut-off member to cause the latter to close when the pressure falls in said chamber, and a holder for protective gas, connected with the said chamber and jacket and with the upper portion of the tank.

3. A storage system for inflammable liquids, comprising a tank, a draw-off pipe connected therewith, a shut-off member located at the intake end of said pipe, a jacket surrounding said pipe and adapted to contain a gas under pressure, a chamber communicating with said jacket, a pressure member in said chamber, an operative connection between said pressure member and the shut-off member to cause the latter to close when the pressure falls in said chamber, a holder for protective gas, a relatively narrow conduit leading from said holder to said chamber, a comparatively wide conduit leading from the first-named conduit to the upper portion of the tank, and a reducing valve in said wide conduit.

4. A storage system for inflammable liquids, comprising a tank, a draw-off pipe connected therewith, a gasometer having a connection to supply protective gas to the upper portion of said tank and a vertically movable bell, a valve, adapted to be opened by said bell when it falls to a predetermined position, to admit air to the interior of the

tank, and an alarm adapted to be operated by the bell at the same time as the said valve.

5 A storage system for inflammable liquids, comprising a tank, a draw-off pipe connected therewith, a gasometer having a connection to supply protective gas to the upper portion of said tank and a vertically
10 movable bell, a valve, adapted to be opened by said bell when it falls to a predetermined position, to admit air to the interior of the tank, and an inwardly opening check

valve interposed in the connection of the first named valve with the tank, to prevent the escape of gas from the tank at the time
15 said air-admission valve is open.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ERNST HURLBRINK.

Witnesses:

WOLDEMAR HAUPT.

HENRY HASPER.