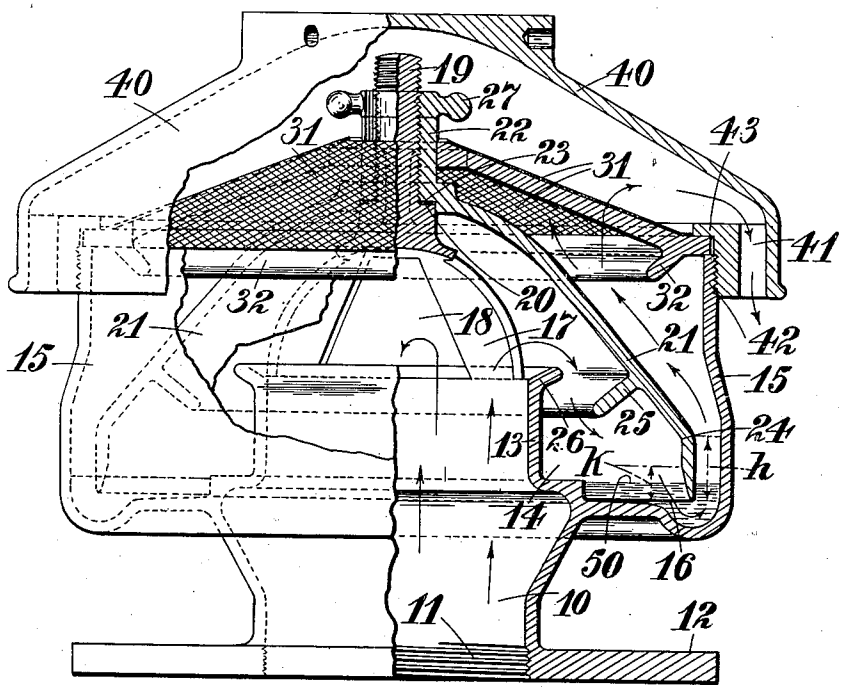
T. A. CROMPTON, JR.

RELIEF VALVE.

APPLICATION FILED DEC. 4, 1919.

1,371,866. Patented Mar. 15, 1921.



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RELIEF-VALVE.

1,371,866. Specification of Letters Patent. Patented Mar. 15, 1921.

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To all whom it may concern:

Be it known that I, THOMAS ALBERT CROMPTON, Junior, a subject of the King of England, residing in Limehouse, London, E., England, have invented certain new and useful Improvements in Relief-Valves, of which the following is a specification.

This invention is for improvements in or relating to relief-valves and has for its object to provide an improved construction of double-acting valve for use with containers of volatile substances such as petrol, so that the valve may operate both as a vent to allow the escape of gas when the pressure in the container rises, and also to admit air when the pressure in the container is lowered.

Containers for such liquids are frequently of very light construction so that it is essential that they should not be subjected to any great external pressure, whereas they are capable of withstanding a greater internal pressure, and it is the object of the present invention to provide a double-acting valve which shall operate to permit the entry of air to the container under a smaller pressure difference than is permissible in the case of the excess pressure being in the interior of the container. In other words, the valve is to operate to admit air into the container when the internal pressure is, say, one ounce per square inch less than atmosphere, but when the pressure inside the container is in excess of atmospheric pressure, the valve does not operate to release the pressure until such excess is, say, four ounces per square inch. These figures are, of course, given by way of example only.

According to this invention, a double-acting relief-valve adapted to operate in one direction under a smaller pressure difference than that which is necessary to operate it in the other direction, comprises a liquid seal whereof the exposed surfaces of the liquid in the two limbs are unequal in area.

The accompanying drawing which illustrates one embodiment of this invention is an elevation partly in section and partly broken away to show the internal parts of the device.

Referring to this drawing, the valve-body comprises a conduit 10 adapted to be mounted vertically on a container to be vented. It may be provided with a screw-thread 11 at the lower end, and with a flange 12 whereby it may be connected alternatively to a pipe or direct to the container. On the outside of the wall 13 of the conduit 10 there is formed an annular chamber 14 whereof the outer wall 15 extends upward above the upper end of the conduit 10. This annular chamber contains a non-volatile liquid 16, suitable liquids being mercury, glycerin, or other material which shall not be deleteriously affected by the gases or vapors in the container to be vented.

A frame or cage 17 is secured to or formed integrally with the upper end of the conduit 10 and it is provided with perforations 18. The upper end of the frame 17 terminates in a screwed spindle 19 formed at its lower end with an upwardly directed shoulder 20.

A dome or bell 21 is formed with a suitable boss 22 at its apex and this boss is bored and threaded to fit on the spindle 19 so that the dome can be screwed onto the spindle. Thin washers 23 or other suitable packing material may be provided on the shoulder 20 to permit adjustment of the height of the bell 21 which is secured by a locknut 27. The lower edge 24 of the bell is so positioned that it is immersed in the liquid 16 to constitute the liquid seal, and the depth of immersion is adjusted by means of the aforesaid washers 23.

The special feature of the invention is that the bell is of such dimensions relatively to the diameters of the annular chamber that its lower edge is nearer one wall thereof than the other, so that the area of the liquid inside the bell is not equal to the area of the liquid outside the bell. In the case illustrated, the exposed area inside is greater than the exposed area outside.

The bell is conveniently provided with a downwardly sloping flange 25, in its interior, near the surface of the liquid to prevent loss of liquid by surging or splashing, and an outwardly-directed flange 26 is preferably provided at the top of the conduit 10 to coöperate with the flange 25 for the same purpose.

When dealing with inflammable vapors, it is desirable to prevent the possibility of flame entering the container even although vapor is issuing from the relief-valve. This is effected by means of a cover 30 which is mounted above the bell 21 and comprises an open frame whereof the openings are covered by a fine wire gauze 31 or other equivalent device, which prevents the passage of flame therethrough but permits the free pas-

sage of air or vapor. This cover 30 may be provided with a downwardly sloping flange 32 on its inner face to assist in preventing loss of liquid by splashing or surging.

Relief-valves of this type are usually used in the open air and are therefore exposed to rain, and in the case of installations on board ship they may also be exposed to foam and spray. A drip-proof cover 40 is therefore provided to protect the whole device. This cover 40 is provided with openings 41 which are directed only downward so that rain or spray cannot enter. Conveniently this cover 40 is screwed on to the upper part of the wall 15 as at 42, and is provided with an inwardly-directed flange 43 whereby it grips and retains in place the above-mentioned cover 30.

In the operation of this device, the interior of the conduit 10, and of the bell 21, is in communication with the interior of the container or tank which is to be vented. Assuming that the pressure in the tank rises, the liquid 50 inside the bell is forced out until its level is the same as that of the lower edge of the bell 21. Since the area of the liquid 50 is greater than the area 51 outside the bell, the difference of the levels inside and outside the bell will be considerable, for example as indicated by the height *h*.

In the reverse operation, when the pressure in the tank falls below that of atmosphere, the liquid 51 is transferred to the interior of the bell at 50. Owing to the area of the liquid 50 being greater than that of the liquid 51, the level will rise by a smaller amount than in the previous instance, say, for example as indicated at *k*. That is to say, the gases or vapor passing out from the tank have to do so against a head of liquid *h*, whereas air can pass into the tank against a smaller head of liquid as indicated by *k*. The ratio of the heights *h* and *k* can be arranged to any predetermined value by suitably proportioning the areas of liquid exposed inside and outside the bell respectively.

The liquid selected for use will be one which is unaffected by the gases or vapors to which it is subjected, and also according to the range of pressures over which the device is required to work. Where only very small pressure differences are required, a light liquid such as glycerin may be used, whereas if larger pressures are required, a heavier liquid such as mercury may be found desirable in order to prevent the over-all dimensions of the device from becoming inconveniently large. These and other modifications as to the precise construction and arrangement of details are all held to lie within the scope of the present invention as set forth in the appended claims.

What I claim as my invention and desire to secure by Letters Patent is:—

1. A relief valve for containers comprising a conduit in communication with the interior of the container, a chamber in connection with the conduit, a bell extending down into said chamber and dividing the same into unequal parts, the large part being next the conduit while the smaller part is exposed to the atmosphere, and a liquid in said chamber normally extending above the lower end of the bell on both sides, said liquid being raised through a lesser height on the inside of the bell by atmospheric pressure acting on the surface of the liquid column outside of the bell and being raised through a comparatively greater height on the outside of the bell by the pressure within the container before the atmospheric and container pressures respectively are enabled to displace the seal formed by the liquid, substantially as described.

2. In a double-acting relief-valve, the combination of a vertically-disposed conduit, an open frame extending co-axially upward from the upper end of said conduit, an annular chamber open at its upper side formed on said conduit, a non-volatile liquid in said chamber, a bell adjustably secured on said open frame co-axially therewith extending downward with its open end immersed in the liquid and dividing the surface of said liquid into two unequal areas.

3. In a double-acting relief-valve, the combination of a vertically-disposed conduit, an open frame extending co-axially upward from the upper end of said conduit, an annular chamber open at its upper side formed on said conduit, a non-volatile liquid in said chamber, a bell adjustably secured on said open frame co-axially therewith extending downward with its open end immersed in the liquid and dividing the surface of said liquid into two unequal areas, a gauze cover inclosing the annular chamber and bell and permitting communication from the surface of the liquid outside the bell to atmosphere.

4. In a double-acting relief-valve, the combination of a vertically-disposed conduit, an open frame extending co-axially upward from the upper end of said conduit, an annular chamber open at its upper side formed on said conduit, a non-volatile liquid in said chamber, a bell adjustably secured on said open frame co-axially therewith extending downward with its open end immersed in the liquid and dividing the surface of said liquid into two unequal areas, an outwardly-directed flange on the inner wall of the annular chamber, and an inwardly-directed flange on the inner surface of the bell coöperating with said outwardly-directed flange to retain the said liquid in the said annular chamber.

5. In a double-acting relief-valve, the combination of a vertically-disposed conduit, an open frame extending co-axially up-

ward from the upper end of said conduit, a screw-threaded extension on said frame formed with an upwardly-directed shoulder, spacing means on said shoulder, an annular chamber open at its upper side formed on said conduit, a non-volatile liquid in said chamber, a bell perforated centrally, threaded on said extension and resting on said spacing means with its open end directed downward and immersed in said liquid dividing the surface of said liquid into two unequal areas, an upward extension of the outer wall of said annular chamber, a perforated cover secured on said wall and extending over said bell, a metallic gauze-filling on the perforations of said cover, and an outer drip-proof cover extending over the whole device.

In testimony whereof I affix my signature.

THOMAS ALBERT CROMPTON, Junior.