W. H. McNUTT.

SAFETY TUBE AND POP-OFF VALVE.

APPLICATION FILED AUG. 16, 1907.

967,544.

Patented Aug. 16, 1910

Fig. 1.

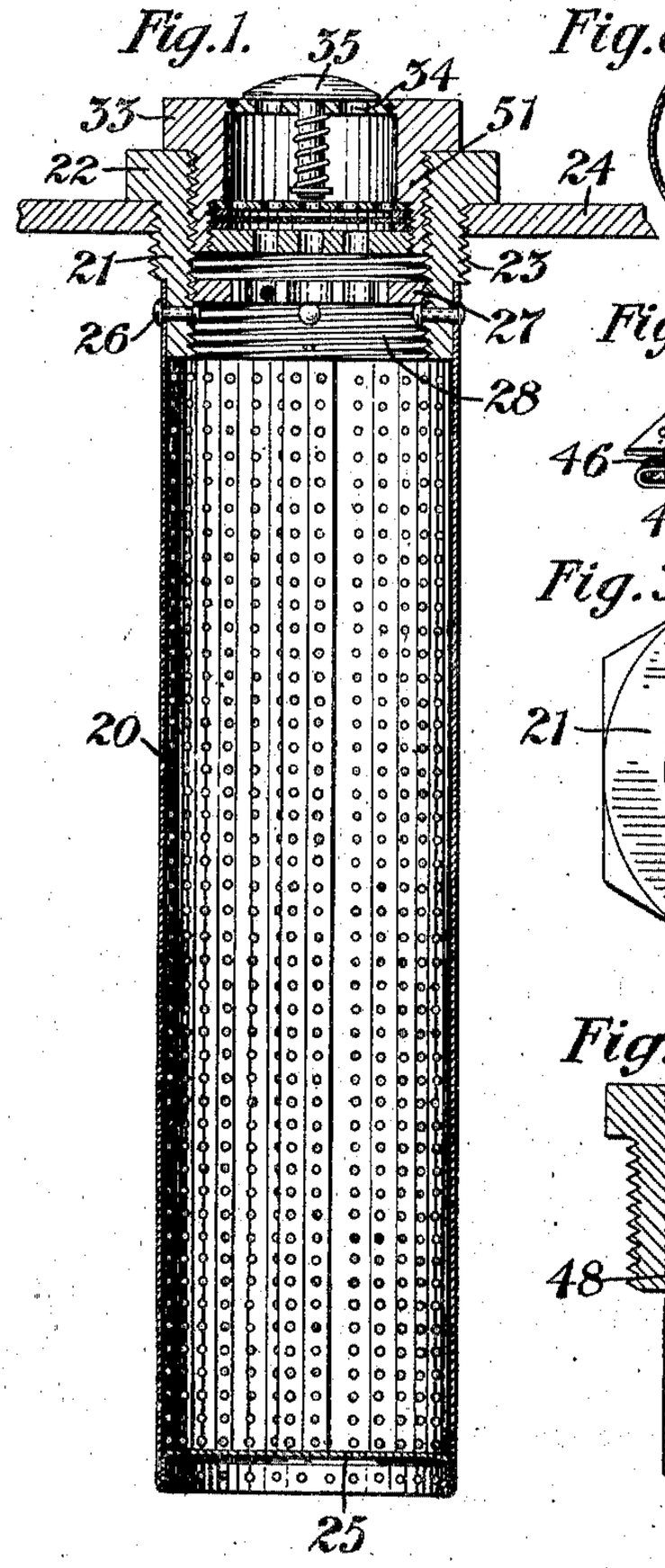


Fig. 8.

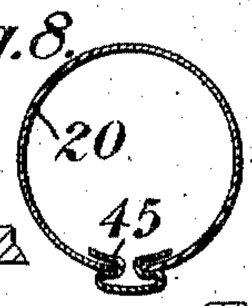


Fig. 6.

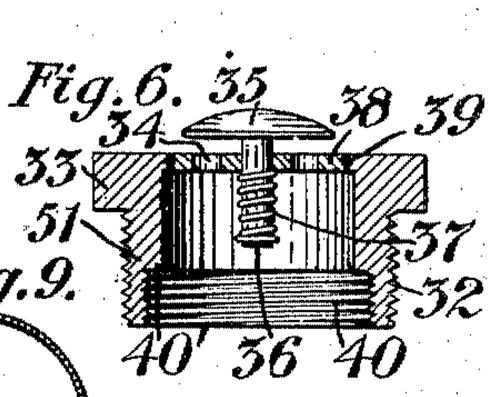


Fig. 7.

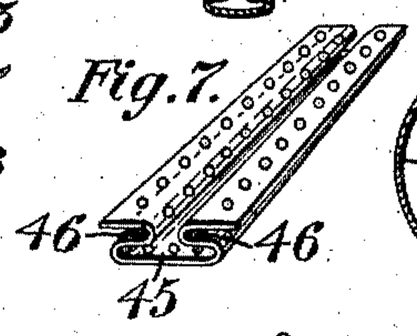


Fig. 9.

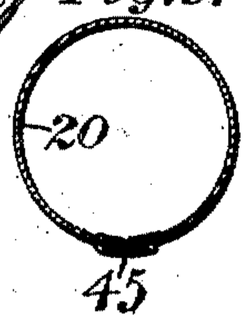


Fig. 12.

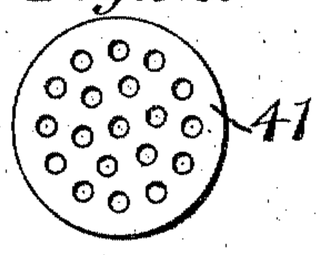


Fig. 3.

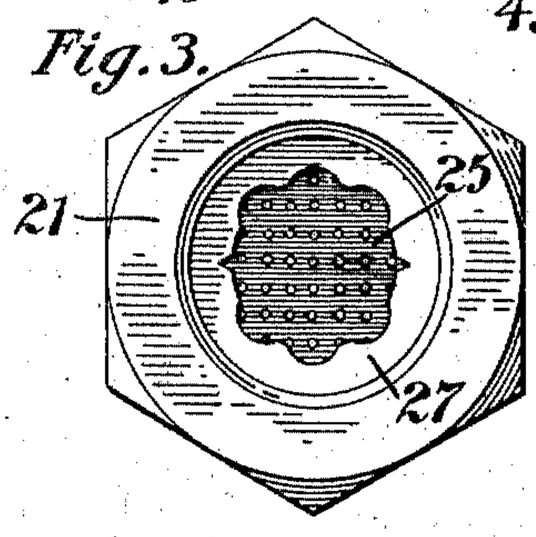


Fig. 13.

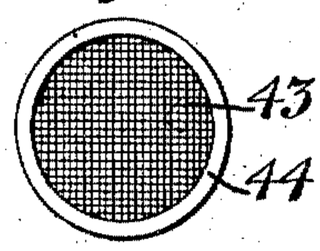


Fig. 5.

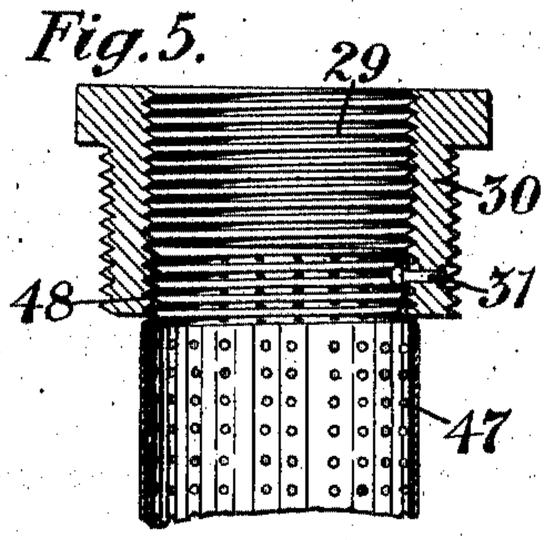


Fig. 14.

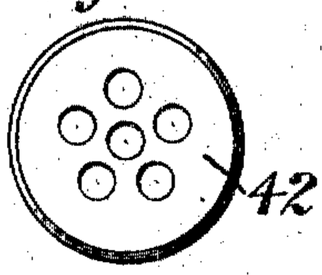


Fig. 4.

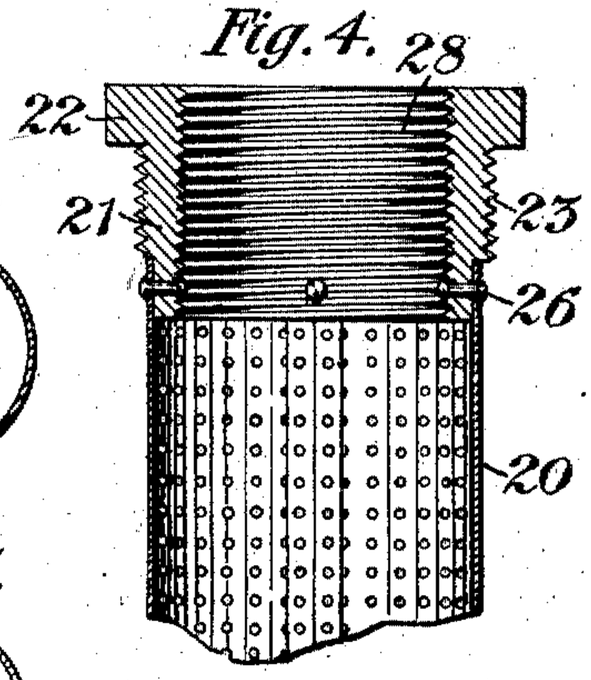


Fig. 10.

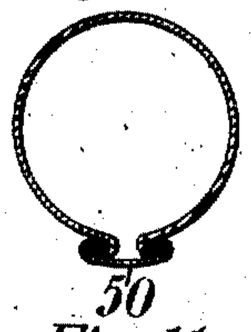


Fig. 2.

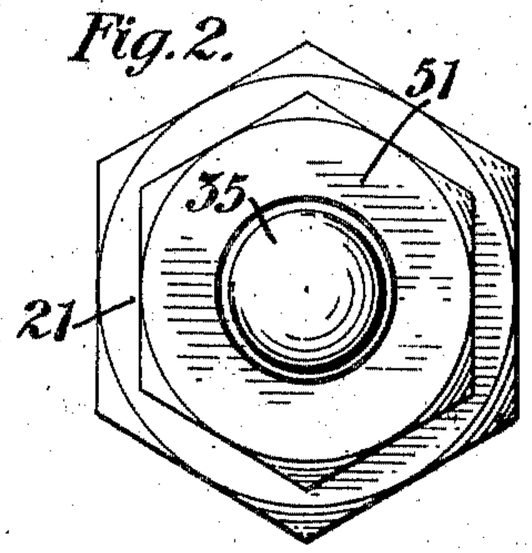
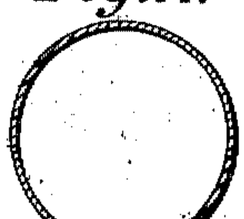


Fig. 11.



Witnesses:

M. Levy.

H. D. Penney.

Inventor:

William H. McNutt,

By his Attorney, F. H. Richards.

UNITED STATES PATENT OFFICE.

WILLIAM H. McNUTT, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE McNUTT NON-EXPLOSIVE MFG. CO., OF NEW YORK, N. Y.

SAFETY-TUBE AND POP-OFF VALVE.

967,544. Specification of Letters Patent. **Patented Aug. 16, 1910.**

Application filed August 16, 1907. Serial No. 388,805.

To all whom it may concern:

Be it known that I, WILLIAM H. McNUTT, a citizen of the United States, residing in New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Safety-Tubes and Pop-Off Valves, of which the following is a specification.

My invention relates to appliances for preventing the explosion of confined volatile gases or vapors, such as the vapors of kerosene, naphtha, gasolene and the like and particularly to such devices as are based upon the principle embodied in the Davy safety lamp, wherein the passage of flame to the explosive gases is prevented by a surrounding cylinder or tube of wire gauze through which the flame is unable to pass, such devices comprising a container provided with an opening screened by wire gauze or perforated metal, such screen usually, or in the best forms, extending downward in the form of a cylinder or tube into the container.

The object of the present invention is to provide an improved safety device of this character, in which the perforated tubular member has a removable closure, provided with safety devices for permitting exit in case of undue pressure yet preventing entrance of flame therethrough.

In the accompanying drawings, Figure 1 shows the safety device in longitudinal section. Fig. 2 is a top view. Fig. 3 is a top view with the tube cap removed. Fig. 4 is a fragmentary section showing the upper portion of the tube and the collar. Fig. 5 is a similar view of a modification. Fig. 6 is a diametrical section through the tube cap showing the pop-off valve open. Fig. 7 is a perspective view of the seam interlocking strip. Fig. 8 is a transverse section through the tube showing the interlocking strip in the assembled position before closing. Fig. 9 is a similar view showing the tube closed and the interlocking strip clenched. Fig. 10 shows another form of interlocking strip in its assembled position. Fig. 11 is a similar view with the interlocking strip closed; and Figs. 12, 13 and 14 show separately the three diaphragms which are mounted in the cap.

In the drawings, 24 designates the wall of any suitable tank, vessel or other container designed to hold explosive fluids, such as gasolene, naphtha, and the like, and provided with an opening through which my safety vent and filler projects into the interior of the container. The main portion of my device consists of the cylinder or tube 20 which is preferably made of finely perforated metal, either brass or copper, as best resisting corrosion. This is preferably of relatively heavy sheet metal of about 20 gage, with the perforations preferably of about 100 mesh, the tube being preferably closed at the bottom with similar perforated metal, such perforations or apertures being practically flame-proof, that is, they will prevent the ignition of vapor on one side from flame on the other side. The tube should be of such length that the aggregate area of the small perforations will be about twice the area of the tube bore. The tube might be drawn into shape, but it being very difficult to draw a tube of the length required, it is preferably formed from the sheet of finely perforated sheet metal turned into a cylinder, the meeting edges thereof being securely interlocked by suitable means such as the seam lock shown in Figs. 7 to 10 and hereafter described. The tube 20 is secured at its upper end to a collar 21, preferably of cast iron, this collar having an annular flange 22 at its outer end adapted to engage tightly with the outer face of the container wall and being screw-threaded at 23 to permit the collar to be screwed into the threaded opening in the walls of the receptacle. The outside diameter of the tube is less than that of the threaded opening into which the collar 21 screws to permit the insertion and removal of the tube. The tube has its lower end closed preferably by a perforated end disk 25. To hold this in position the disk has downwardly turned margins. The end of the tube is crimped inward upon the flange of the cap thus formed and thus readily secures the end member in position when soldered and holds the same against being blown outward by an explosion within the tube.

In Figs. 1 and 4 the collar 21 is shown as reduced at its lower end to a depth greater than the thickness of the metal of tube 20 so that the outside diameter of the tube will be less than the threaded portion 23. The tube is secured in position by rivets 26. These rivets also form stops against which the ring plate 27 will bear. This ring plate is screwed into the threaded bore 28 of the collar.

Another form of connection between the perforated tube and the collar 21 is shown in Fig. 5 where the tube 47 has its upper portion 48 screw threaded and screws into the threaded bore 29 of a collar 30. The tube can be locked against rotation on the collar by a rivet 31. The threaded portion 48 may be formed by crimping the upper end of the tube to form the thread. The tube being made of relatively thick material is rigid and cannot become bent or buckled in the ordinary handling of the container. As it is not made of mesh or metal fabric it does not collect oil or the hydrocarbon products within its meshes, and therefore cannot be burned out or become incandescent, as there is nothing retained therein which will ignite, and the tube, being a finely perforated plate, would not become incandescent even if there were a flame at the bottom of the tube. Being rigid it may be cleaned, which is permitted by its easy removal from the container. Being of sheet metal it may be attached more firmly to the collar 21 than it could be if made of wire gauze.

In order to protect the tube from contact with the spouts of filling cans and derangement and damage therefrom I provide the ring 27 above referred to. This has an irregular central opening as shown in Fig. 3. The ring plate prevents funnels or spouts from contacting with and damaging the inner wall of the tube and the irregularities of the opening provide air spaces around an inserted funnel or spout, permitting escape of air from the vessel as the liquid is poured in. The opening of the collar 21 is closed by a hollow cap 51 that is threaded at 32 to screw into the collar, and is provided with a hexagonal flange 33 engageable by a wrench. The upper end of the cap 51 is provided with openings 34 that are closed by a suitable pop-off valve. In the form shown, the valve 35 has a stem 36 sliding through a central opening in the cap to form means to open and close the apertures 34. A coiled spring 37 on the stem inside the cap serves to normally retain the valve in its closed position. Abnormal pressure within the tube 20, however, will cause the valve to open and permit escape of vapor until equilibrium is restored. It is also desirable to provide means whereby if by any chance the vessel is subjected to heat, thus increasing the pressure within the container and the chances of an explosion, a larger exit may be provided for the vapor in the tube than will be provided by the apertures 34. To that end I have provided the upper end of the cap with a plate 38 which forms the top portion of the cap, and which is secured to the outer portion by means of a fusible ring 39. Heat of a certain degree will melt this ring, and permit the central portion with the valve to be blown out by pressure of the vapor generated in the container.

One of the most important objects of my invention is to provide a means for preventing any chance for the back firing of flame down into the tube 20, thus safe-guarding the tube from any possibility of an explosion therein which would tend to damage the tube or destroy its attachment to the container. While the finely perforated metal tube under normal circumstances will prevent any explosion, yet under abnormal circumstances, as for instance where the low mixture of a high degree of explosiveness has accumulated at the bottom of the container, there is a chance that the mixture will ignite and explode within the tube and that in some way it will open the tube, and in doing so, ignite the vapor within the container itself. To prevent all possibility of this I provide the cap 51 with a finely apertured diaphragm 43. While this may be of finely perforated flame-proof metal, yet I have found in practice that for this purpose copper or brass gauze is a thoroughly reliable material, for the reason that the area of the disk is small and that though the gauze is weak yet by protecting it on either side by apertured diaphragms 41 and 42, the gauze diaphragm is held flat and protected from damage. The protective diaphragms 41 and 42 are made of relatively heavy metal and are perforated with any desirable number of comparatively large apertures. In order to receive this set of diaphragms, the interior of the cap is formed with a shoulder, being shown as cut away at 40, and screw threaded, thus forming a shoulder 40′. The diaphragm 41 is put in place against this shoulder. The gauze disk 43 is then placed against the diaphragm 41 and the final threaded diaphragm 42 is screwed into place. I separate the three diaphragms by rings 44. The diaphragm plate 42 is screwed up tightly against the lowermost of these rings, thus holding the gauze disk absolutely tight. The effect of this construction is that the outlet of the tube is itself provided with a perforated or gauze screen, which is so protected by the diaphragms 41 and 42 that it is not liable to puncture or disarrangement from outside, nor can it be blown out by any explosion from the interior of the tube, and the effect of this diaphragm is that it prevents any flame passing within the tube 20. A flame igniting the escaping vapor can only burn above the cap 51 or above the diaphragm 41 if the plate 38 has been blown off. It will thus be seen that while under service conditions, explosion within the container is prevented not only by the tube 20 but by the diaphragm 43; yet that

the cap 51 containing this diaphragm is easily removable either for pouring out the contents of the container or for filling the container. If the cap were not removable for this purpose it would be difficult to fill the container through the diaphragms 41, 42 and 43, and the said diaphragms would collect impurities, hydrocarbons, etc., in the space between them and would soon clog up.

As before stated, a tube formed of sheet gauze or sheet metal whose edges are connected by rivets or by solder, is not safe, the tube being liable to open if riveted and the solder being liable to melt, if the edges are soldered. In addition it may be said that the tube 20 is required to be of relatively thick and rigid sheet metal. As a means of connecting the adjacent edges of the sheet metal tube, I have provided a lock, one form of the locking strip of which is shown in Fig. 7. In this figure, the strip 45 which is made of comparatively soft brass and is preferably finely perforated, has its longitudinal edges bent toward each other and then bent outwardly in opposite directions, forming opposed outwardly opening channels 46. The opposite edges of the tube are fitted into the channels 46 as indicated in Fig. 8. The channeled portions of the strip are afterward tightly pressed together as shown in Fig. 9 clamping the edge portions of the tube therein. The strip being made of soft brass, while the tube is formed of hard metal, such pressing together of the metal of the strip will clench it down upon and force it into the perforations of the tube and thus act as an additional locking means. A modification of this locking strip is shown in Fig. 10, in which a strip 50 has its edges bent toward each other, forming opposite channels. The tube has its edges bent outwardly in opposite directions and the flanges so formed extend into the channels in the strip. The channeled portions of the strip are tightly pressed together as indicated in Fig. 11, closing the tube and securely holds the seam throughout its length, the tube being secured, at its upper end to the collar 21, while at its other end it is securely closed by the end disk 25.

It will be seen from the foregoing that I have provided by the arrangement and combination of parts herein described, a safety inlet or outlet tube for explosive mixture containers which is easily removable from the container, which may be easily cleaned, which resists any buckling strain upon it, which is not liable to become incandescent under an explosion, which may be easily used for filling or pouring out, and particularly which prevents under all circumstances an explosion within the safety tube or any ignition of flame within the safety tube or container, which prevents backfiring into the safety tube, and which allows of the blowing off of vapor in case of increase of pressure within the container, of an enlarged opening of the closing cap if the temperature is increased to a dangerous degree.

It will be noted that the material of the tube is of brass or copper or other substantially non-corrosive metal, while the material of the collar 21 is stated as of iron. There is an important function incident to the use of this latter material in this connection. It is absolutely necessary that there shall be no leakage between the tank and the collar that is around the edge of the opening into which the collar fits. Rubber gaskets or other packing tend to disintegrate and deteriorate particularly in the presence of hydrocarbon vapors and hence cannot well be used for any length of time. The iron cap, however, will rust, and rust so formed around the lower face of the shoulder 22 and around the screw threaded exterior of the cap will not only hold the cap rigidly in place from any ordinary chance of turning and loosening, but also serves to pack the space between the cap and the wall of the container, thus absolutely preventing any escape of vapor in this manner. This may at first sight seen an unimportant function but when it is considered that every portion of my invention is directed to preventing the escape of explosive vapor under wrong conditions, it will be seen that the material of the cap is of considerable importance.

Having described my invention what I claim is:

1. A safety device for containers carrying volatile explosive fluids, comprising a tubular portion adapted to extend into said container from the outside having its walls containing minute flame-proof apertures, the opening of said tubular portion being provided with a ring-plate having a central opening permitting the introduction of a filling nozzle, and with a removable cap adapted to close the outer end of said tubular portion beyond the said ring plate, said cap being hollow and provided with a perforated screen across its opening and with outlets.

2. A safety device for containers carrying volatile explosive fluids, comprising a tubular portion adapted to extend into said container from the outside and having the walls perforated with minute flame-proof apertures, the opening of said tubular portion being provided with a removable cap adapted to close the end of said tubular portion, said cap being hollow and provided with a perforated screen across its opening and with outlets, and with a valve normally held in position to close said opening but adapted to open upon pressure from within.

3. A safety device for containers carrying volatile explosive fluids, comprising a tubular portion adapted to extend into said con-

tainer from the outside and having walls containing minute flame-proof openings, the opening of said tubular portion being provided with a closure adapted to close said opening but to be removed therefrom, said closure being provided with a removable perforated screen of wire gauze and perforated plates of relatively thick and rigid material adjacent to said gauze and located on both sides of the same.

4. A safety device for containers carrying volatile explosive fluids, comprising a tubular portion adapted to extend into said container from the outside and having the walls perforated with minute flame-proof apertures, the opening of said tubular portion being provided with a removable cap adapted to close the end of said tubular portion, said cap being hollow and provided with a perforated screen across its opening and with outlets and with a valve normally held in position to close said opening but adapted to open upon pressure from within, said cap having a plug therein closing the same and attached to the body of the cap by a fusible compound to allow the said plug to be blown out.

WILLIAM H. McNUTT.

Witnesses:
FRED. J. DOLE,
HENRY E. GREENWOOD.