Nov. 24, 1953

O. G. DUNCAN

2,660,611

NONSPILLABLE VENT PLUG FOR STORAGE BATTERIES

Filed March 9, 1953

Fig. 1.

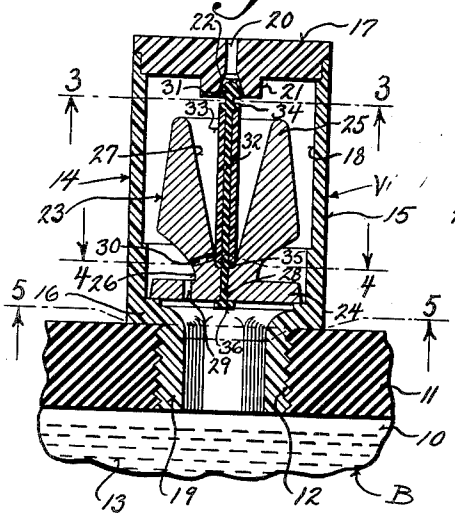


Fig. 2.

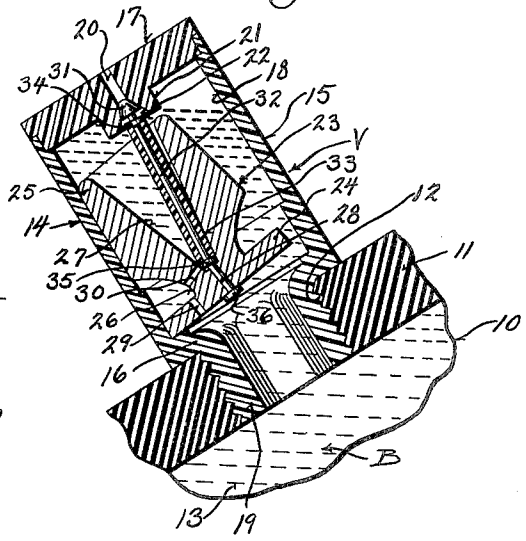


Fig. 3.

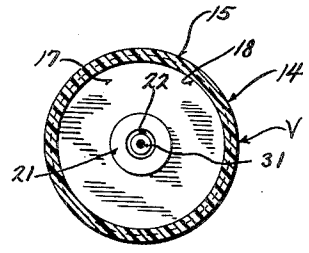


Fig. 4.

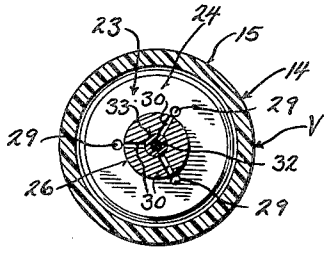
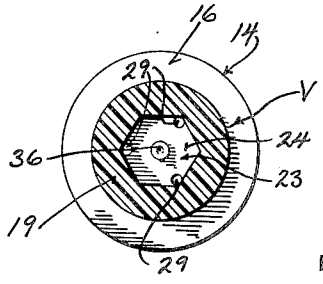


Fig. 5.



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Patented Nov. 24, 1953

2,660,611

UNITED STATES PATENT OFFICE

2,660,611

NONSPILLABLE VENT PLUG FOR STORAGE BATTERIES

Owen G. Duncan, Racine, Wis.

Application March 9, 1953, Serial No. 341,317

7 Claims. (Cl. 136—178)

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This invention appertains to vent plugs for storage batteries, and more particularly to a nonspillable vent plug; the plug being an improvement over the vent plug shown in my pending application, Serial No. 302,517 filed August 4, 1952.

In storage batteries for aeroplanes and motorcycles, it is highly desirable to provide a vent plug so constructed that the vent opening or port will be automatically closed when the battery is tilted at and beyond a certain critical angle to prevent the escape of electrolyte and to instantly and automatically open the vent port when the battery approaches its upright normal position to permit the escape of gases developed in the battery.

It is, therefore, one of the primary objects of my present invention to provide an extremely sensitive and highly efficient nonspillable vent plug in which the valve controlling the vent port will close when the battery is tilted at a certain critical angle, say 40 degrees, and which will instantly and automatically open, when the battery starts to return to its upright position and reaches an angle of say, 38 degrees.

Another salient object of my invention is to provide a novel combination of valve and weight, the weight functioning with the vent plug to actuate the valve, the connection between the valve and weight being such that a substantially universal joint is provided between the valve and weight, whereby rocking of the weight (say when the battery is in an inverted position), will not effect the seating of the valve.

A further important object of the invention is the provision of a valve seat directly in the vent port of the plug with a valve positioned in the seat but in an open position for closing the seat upon the slight tilting of a weight confined directly in the body portion of the plug, the tilting of the weight functioning to exert an outward push on the valve to snugly engage the seat.

With these and other objects in view, the invention consists in the novel construction, arrangement and formation of parts, as will be hereinafter more specifically described and claimed and illustrated in the accompanying drawing, in which drawing,

Figure 1 is a fragmentary vertical sectional view through the upper end of a storage battery showing my novel vent plug associated therewith; the plug being shown in vertical section and the battery and plug being disposed in their normal upright position.

Figure 2 is a view similar to Figure 1, but showing the battery in a partly tilted position and the weight shifted to cause the closing of the vent port.

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Figure 3 is a horizontal sectional view through the plug taken on the line 3—3 of Figure 1, looking in the direction of the arrows and showing the position of the valve in the seat.

Figure 4 is a horizontal sectional view taken on the line 4—4 of Figure 1, looking in the direction of the arrows and illustrating the vent and drain openings in the weight.

Figure 5 is a horizontal sectional view through the shank of the plug taken on the line 5—5 of Figure 1, looking in the direction of the arrows and looking toward the bottom of the weight.

Referring to the drawing in detail, wherein similar reference characters designate corresponding parts throughout the several views, the letter V generally indicates my novel vent plug for a storage battery B.

The battery B can be considered of a type now commonly found in the open market, but preferably of a character for use with aeroplanes, motorcycles and the like. The battery will not be described in detail, but the same includes a case 10 having a top wall 11 provided with a filling opening 12, the wall of which is threaded. The casing 10 houses the cells of the battery and contains the acid or electrolyte 13.

My novel vent plug V includes a hollow body 14 having a cylindrical side wall 15, a bottom wall 16 and a top wall 17. This provides an interior chamber 18, and it is to be noted that the side wall 15 is decreased in thickness a slight distance above its lower end to increase the interior diameter of the chamber 18, for a purpose, which will later appear. The bottom wall 16 has formed thereon an exteriorly threaded shank or stem 19 for engagement with the threads of the opening 12 in the cover 11. The shank or stem 19 is of a less diameter than the diameter of the body 14, so as to define a bottom shoulder on the body 14 for contact with the upper surface of the battery cover 11. A way is formed through the shank or stem 19 so that communication will be had between the battery and the chamber 18.

The top wall 17 of the vent plug is formed separate from the side wall 15 for the purpose of assembling the various parts of the vent plug, and after the assembly of the various parts, the top wall 17 can be securely sealed to the side wall 15. This top wall at its axial center is provided with a port 20 to vent the chamber 18 to the atmosphere and the lower surface of the

top wall can be provided with a depending boss 21 through which the port 20 opens into the chamber. The boss and consequently, the port 20, is provided with a tapered valve seat 22, the purpose of which, will be more clearly brought out.

Mounted within the chamber 18 is a weight 23 of a desired mass, and preferably, but not necessarily, formed from lead. This weight 23 includes a disc-shaped base 24 and an upper body 25 connected to the base by an axially disposed reduced neck 26. The body 25 gradually flares outwardly from the neck so that the center of gravity of the weight is located well up toward the top of the weight to render the weight unstable during the tilting of the battery. To insure the proper tilting of the weight, the outer surface of the body 25, above the neck 26, is gradually tapered inward and the upper portion of the body 25 takes the form of a truncated cone. The body is provided with an axially disposed cavity 27 and this cavity gradually tapers toward the lower end of the body and extends into the neck portion 26. The base 24 and the neck portion 26 are provided with an axially disposed bore 28 which opens out through the lower end of the base and into the cavity 27. The taper of the cavity 27 and the inclination of the outer surface of the body 25 of the weight will later more fully appear. It is to be noted, however, that the lower edge of the base 24 rests upon the upper surface of the bottom wall 16 of the plug around the stem or shank 19 and that the base is provided with drain and vent openings 29. Communicating with the bottom of the cavity 27 are downwardly inclined drain openings 30 so that any electrolyte caught in the cavity can drain back into the plug and thence into the battery.

In accordance with my invention, I provide a valve body 31 for the valve seat 22. This body is preferably formed from elastic or resilient rubber, and as illustrated, can be of a conical shape. It is to be understood, however, that this valve body can take various forms, such as the shape of a hemisphere, without departing from the field of my invention. The valve body 31 is formed on the upper end of an elastic or resilient stem 32 and this stem is threaded through a rigid sleeve 33, the lower end of which fits into the bottom of the cavity 27. To limit the sliding up of the sleeve 33 on the stem 32, against the valve body 31, a stop collar 34 can be formed on the stem against which the sleeve abuts. The portion of the stem between the collar 34 and the body 31 constitutes a flexible neck whereby the stem and the sleeve can move in any direction relative to the valve body. The extreme lower end of the stem is threaded through the opening 24 formed in the lower end of the body 25 of the weight 23 and base 24 and downward movement of the stem in the weight is limited by a stop collar 35 formed on the stem. The extreme lower end of the stem has formed thereon a like stop collar 36, which engages the base 24. In actual practice, the stem is formed of a considerable length and is threaded through the sleeve 33 and the opening 28 by the use of a suitable tool, and after the shoulder 35 has been pulled through the weight, the excess length of the stem is trimmed off. Due to the flexibility of the stem, the sleeve 33 can rock in any direction relative to the weight, as best shown in Figure 2.

In operation of my improved nonspillable vent plug, the various parts of the plug are assembled as shown in Figure 1 and with the battery B in an upright position as shown in Figure 1, the valve body 31 is disposed within the seat but spaced from the walls thereof, and consequently, the plug can perform its function of venting the gases from the battery. By having the valve body normally within the valve seat, displacement of the valve body from the seat during movement of the battery and plug is prevented. Upon the tilting of the battery, say at an angle of 40 degrees, the weight 23 will tilt and this is permitted by the tapered outer surface of the body of the weight. As the sleeve 32 is rigid an outward thrust will be exerted by the base of the weight against the sleeve causing the valve body 31 to fit tightly on its seat 22 immediately shutting off the vent port. Upon continued tilting movement of the battery, or the movement of the battery to a complete inverted position, the weight will function to hold the valve body tight on its seat and any shaking movement of the weight will not disturb the position of the valve body due to the flexible connection at the base of the weight and the flexible connection between the valve body and the stop collar 34. The tapered cavity 27 permits the desired tilting movement of the weight without danger of the weight pulling the valve body from or off of its seat.

As the battery B returns to its normal position and say, reaches an angle of 38 degrees, the weight will fall back on the bottom wall 16, pulling the valve body away from its intimate contact with the walls of the valve seat, and thus permit the instant venting of the battery again.

From the foregoing description, it can be seen that I have provided a simple form of nonspillable vent plug which is extremely sensitive but which will effectively perform its desired function.

Changes in details may be made without departing from the spirit or the scope of this invention, but what I claim as new is:

1. A self-closing vent plug for storage batteries comprising a hollow body having an opening for communication with the interior of a storage battery and an atmospheric vent port, a valve for closing said atmospheric vent port when the battery and plug assume a predetermined angle relative to the normal upright position of the battery, a tiltable weight in the body, and a flexible connection between the bottom of the weight and said valve, said flexible connection having a rigid sleeve surrounding the same for a portion of its length with the lower end of the sleeve engaging the bottom of the weight, whereby to exert an outward thrust on the valve upon the tilting of the weight at a certain angle relative to the vertical.

2. A self-closing vent plug for storage batteries comprising a hollow body having an opening for communication with the interior of a storage battery and an atmospheric vent port, said port being provided with a valve seat opening into the hollow body, a tiltable weight in said hollow body between the opening and the valve seat, said weight having a base normally resting upon the bottom wall of the body when the plug is in an upright vertical position, said weight having an interior cavity tapering inwardly toward the base, a valve body disposed in the valve seat and normally spaced from the walls thereof, a flexible stem on said valve body anchored to the base of the weight and positioned in said cavity,

and a rigid sleeve around said stem terminating at the base of the cavity and short of the valve body, said sleeve functioning to exert an outward thrust on the valve body when the weight is tilted in the hollow body and when the plug reaches a predetermined angle relative to the vertical.

3. A self-closing vent plug for storage batteries as defined in claim 2, the spacing of said rigid sleeve from the valve body defining a flexible universal joint between the valve body and said rigid sleeve.

4. A self-closing vent plug for storage batteries as defined in claim 2, and said connection between the base of the weight and the stem constituting a flexible universal joint between the weight and the lower end of the sleeve.

5. A self-closing vent plug for storage batteries as defined in claim 2, and said base having vent openings therein.

6. A self-closing vent plug for storage batteries as defined in claim 2, and said weight having drain openings communicating with the bottom of the cavity and said base of the weight having vent openings.

7. A self-closing vent plug for storage batteries as defined in claim 2, the outer surface of said weight above said base being tapered inwardly toward its upper end and the upper end of the cavity.

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No references cited.