

PATENT SPECIFICATION

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- (72) Inventor LEONARD TAYLOR



(54) IMPROVEMENTS IN AND RELATING TO PYROTECHNIC DEVICES

(71) We, SCHERMULY LIMITED, a British Company, of Spra Works, Newdigate, Dorking, Surrey, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following Statement:—

This invention relates to a pyrotechnic store comprising a casing containing a pyrotechnic device, the casing serving to contain the device at least until it has been ignited. Throughout this specification such a pyrotechnic store will be referred to as a "pyrotechnic store of the kind specified". Many pyrotechnic devices are susceptible to moisture and most are normally stored for several months (and in some cases many months) before they are used. In order to prevent deterioration of any moisture-susceptible components of the pyrotechnic device, it is common to keep such a device in an air-tight casing. In order to allow the pyrotechnic device to be used when required it is known to provide the casing with a removable closure member which may be a simple push-fit into, or onto, one end of the casing of the store.

Pyrotechnic stores of the kind specified may contain within the casing chemical compositions which give off gaseous products during storage, particularly in the period immediately after such compositions have been prepared. If such compositions are located within an air-tight casing which has a removable closure member, the evolution of gas from the composition during storage can generate an over-pressure within the casing which is sufficient to eject the closure member from the casing and/or deform the casing. In either eventuality the pyrotechnic store is of reduced further use and commonly of no further use. Pyrotechnic stores of the kind specified are sometimes employed in aircraft and are taken to

[Price 25p]

considerable altitudes. In such circumstances if the casing is air-tight and has a removable closure member which is not adequately fixed in place, taking the store to a sufficiently high altitude will generate such a pressure difference across the closure member that this is forcibly removed from the casing again reducing the usefulness of the pyrotechnic store. If the closure member is only loosely fitted into or onto the casing (i.e. to permit gas leakage past the closure member) the closure member remains in place as the ambient pressure drops, but air (which can be moisture-laden) will enter the casing through the gap between the loosely fitting closure member and the casing when the ambient pressure rises again. It will be appreciated therefore that there is a problem associated with keeping moisture away from moisture-susceptible components of a pyrotechnic device whilst protecting a pyrotechnic store of the kind specified against damage caused by pressure-differences appearing across the casing either as a result of generation of gas from pyrotechnic compositions within the casing or as a result of pressure changes caused by varying external pressure changes, (e.g. changing altitudes).

This invention relates to a pyrotechnic store of the kind specified which incorporates means for equalising pressure differences generated across the casing when there are in a direction which could effect removal of a removable closure member.

According to the present invention a pyrotechnic store of the kind specified comprises a plug of flexible resilient air-impermeable material located in an aperture in the casing, the plug cooperating with the casing to define a non-return valve whose flow direction is outwardly of the casing, the casing, apart from the unidirectional flow path provided by the plug being gas-tight.

Conveniently the plug is fabricated from a rubber-elastic material such as natural rubber, synthetic rubber or a resilient plastics material. Conveniently the plug comprises a head portion designed to overlie the aperture in the casing on the outer surface thereof, a base portion designed to retain the plug within the aperture and to be located within the casing and an integrally formed stem interconnecting the head and base portions. Preferably, when viewed in the axial direction of the stem, the head portion is of larger cross-sectional area than the base portion. Conveniently both head and base portions (again when viewed in the axial direction of the stem) are of circular cross-section. The head portion may be in the form of a cap of a sphere and desirably the peripheral region of the head portion defines a feather edge. This can easily be obtained by making the head portion of concavo-convex shape. The base portion is conveniently of frusto-conical shape and the length of the stem (measured in the axial direction thereof) is dimensioned with respect to the wall thickness of the casing so that when the plug is located in the aperture, the base portion is urged against the inner surface of the casing as the head portion (preferably a feather edge on the head portion) is urged against the outer surface of the casing.

It is necessary to provide a passage for air to flow from the interior of the casing past the peripheral region of the head portion and this can conveniently be achieved by locating the plug in a non-circular aperture so that if the aperture (with the plug located therein) were to be viewed from the interior of the casing there would be at least one part of the aperture which was unobstructed by the base portion and through which one could view the side of the head portion confronting the casing. For ease of production, simple geometric shaped apertures are preferred and a triangular aperture has been found to be particularly suitable.

One embodiment of pyrotechnic store in accordance with the invention will now be described, by way of example, with reference to the drawing accompanying the provisional specification in which:—

Figure 1 is a side elevation of a completed store showing a non-return valve located in the lid of the casing.

Figure 2 is a sectional side elevation of the non-return valve of Figure 1 shown on a greatly enlarged scale and,

Figure 3 is a plan from below of the valve shown in Figure 2.

Referring to the drawing, the pyrotechnic store comprises a casing (generally designated 1) which is formed from a main portion 2 and removable end portions 3 and 4.

The removable end portion 3 covers an igniting mechanism 5 of any conventional kind. The end portions 3 and 4 are held in place and the gap between the end portion and the main portion sealed, by means of removable adhesive tape strips 6 and 7, or other sealing means.

The store illustrated in Figure 1 is typical of many pyrotechnic stores and the procedure for firing the device within the main portion 2 of the casing 1 may involve removing the tape strips 6 and 7, removing the end portion 3 (and possibly also end portion 4) and operating the igniting mechanism 5 to fire the pyrotechnic device. This may be a hand-held flare or smoke generator or a rocket. If the end portion 4 does not have to be removed prior to actuating the igniting mechanism 5, the pyrotechnic store will be responsible for removing it. Pyrotechnic stores of this general character are well known in the art and since the present invention is not concerned with the particular form of store or its mode of operation it will not be described further.

In accordance with the present invention the casing 1 is provided with a non-return valve which permits gas to flow out of the casing but which sensibly prevents any gas (or liquid) flow into the casing. In the embodiment shown in Figure 1 the non-return valve is indicated at 8 and is located in the end portion 4. Figures 2 and 3 show the valve 8 in greater detail, Figure 2 being a section on the line II-II of Figure 3.

Referring to Figure 2 the valve 8 is seen to comprise a resilient plug 9 having a head portion 10, a circular cylindrical stem 11 and a frusto-conical base portion 12. The plug 9 is formed in one-piece from polychloroprene, the stem 11 is located in a triangular aperture 13 in the wall 14 of the casing 1, the relative positioning of the plug within the aperture being best seen with reference to Figure 3.

The base portion 12 is tapered in the manner shown to facilitate insertion of the plug 9 into the aperture 13 from outside the casing and the length of the stem 11 is determined, relative to the thickness of the wall 14 to ensure that the base portion 12 is urged against the inner surface of the wall 14 while the peripheral edge of the head portion 10 is urged against the outer surface of the wall 14. From Figure 3 it can be seen that the corners of the triangular aperture 13 are unobstructed by the base portion 12 and define passages 15 through which gas can flow from within the casing to the region 16 below the head portion 10. When the pressure within the casing is sufficiently greater than the ambient pressure outside the casing, a part of the peripheral edge of the head portion 10 will be

lifted from the outer surface of the wall 14 and the gas can escape. In order to reduce the pressure difference necessary across the plug 9 which will cause outward gas leakage from the casing, the under surface of the head portion is made of concave shape so that the peripheral region of the head portion defines a very flexible "feather edge".

- 10 In one embodiment, the overall diameter of the head portion 10 was 5/16th of an inch, the maximum diameter of the base portion 12 was 3/16th of an inch, the diameter of the stem 11 was 1/8th of an inch and the length of the sides of the triangular aperture 13 was 7/32nd of an inch.

A pyrotechnic store of the kind specified when provided with a non-return valve as illustrated in Figures 2 and 3 permits "gassing" of pyrotechnic compositions within the casing without any risk of premature removal of the end portions 3 or 4 (and without any risk of buckling or distortion of the casing 1 by excess pressure build-up). Further, the store can safely be taken to high altitudes without risk of the generation of a dangerous pressure-difference across the casing.

30 WHAT WE CLAIM IS:—

1. A pyrotechnic store of the kind specified comprising a plug of flexible resilient air-impermeable material located in an aperture in the casing, the plug cooperating with the casing to define a non-return valve whose flow direction is outwardly of the casing, the casing, apart from the unidirectional flow path provided by the plug being gas-tight.

40 2. A store as claimed in claim 1 in which the plug comprises a head portion designed to overlies the aperture in the casing on the outer surface thereof, a base portion designed to retain the plug within the aperture and to be located within the casing and an integrally formed stem interconnecting the head and base portions.

50 3. A store as claimed in claim 2, in which, when viewed in the axial direction of the stem, the head portion is of larger cross-sectional area than the base portion.

4. A store as claimed in claim 3, in

which, both head and base portions (again when viewed in the axial direction of the stem) are of circular cross-section. 55

5. A store as claimed in claims 2, 3 or 4, in which the head portion is in the form of a cap of a sphere.

6. A store as claimed in any of claims 2 to 5, in which the peripheral region of the head portion defines a feather edge. 60

7. A store as claimed in claim 6, in which the head portion is of concavo-convex shape.

8. A store as claimed in any of claims 2 to 7, in which the base portion is of frusto-conical shape. 65

9. A store as claimed in any of claims 2 to 8, in which the base portion is of frusto-conical shape and the length of the stem (measured in the axial direction thereof) is dimensioned with respect to the wall thickness of the casing so that when the plug is located in the aperture, the base portion is urged against the inner surface of the casing as the head portion is urged against the outer surface of the casing. 70 75

10. A store as claimed in any of claims 2 to 9 in which, the plug is located in a non-circular aperture so that if the aperture (with the plug located therein) were to be viewed from the interior of the casing there would be at least one part of the aperture which was unobstructed by the base portion and through which one could view the side of the head portion confronting the casing. 80 85

11. A store as claimed in claim 10 in which the aperture is triangular.

12. A store as claimed in any preceding claim, in which the casing also encloses an igniting mechanism. 90

13. A pyrotechnic store of the kind specified substantially as hereinbefore described with reference to, and as illustrated in the drawing accompanying the provisional specification. 95

J. Y. & G. W. JOHNSON,
Furnival House,
14-18 High Holborn
London W.C.1.
Chartered Patent Agents,
Agents for the Applicants.

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7. A store as claimed in claim 6, in which the head portion is of concavo-convex shape.

65 8. A store as claimed in any of claims 2 to 7, in which the base portion is of frusto-conical shape.

70 9. A store as claimed in any of claims 2 to 8, in which the base portion is of frusto-conical shape and the length of the stem (measured in the axial direction thereof) is dimensioned with respect to the wall thickness of the casing so that when the plug is located in the aperture, the base portion is urged against the inner surface of the casing as the head portion is urged against the outer surface of the casing.

80 10. A store as claimed in any of claims 2 to 9 in which, the plug is located in a non-circular aperture so that if the aperture (with the plug located therein) were to be viewed from the interior of the casing there would be at least one part of the aperture which was unobstructed by the base portion and through which one could view the side of the head portion confronting the casing.

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