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THERMAL-RESPONSIVE BULB

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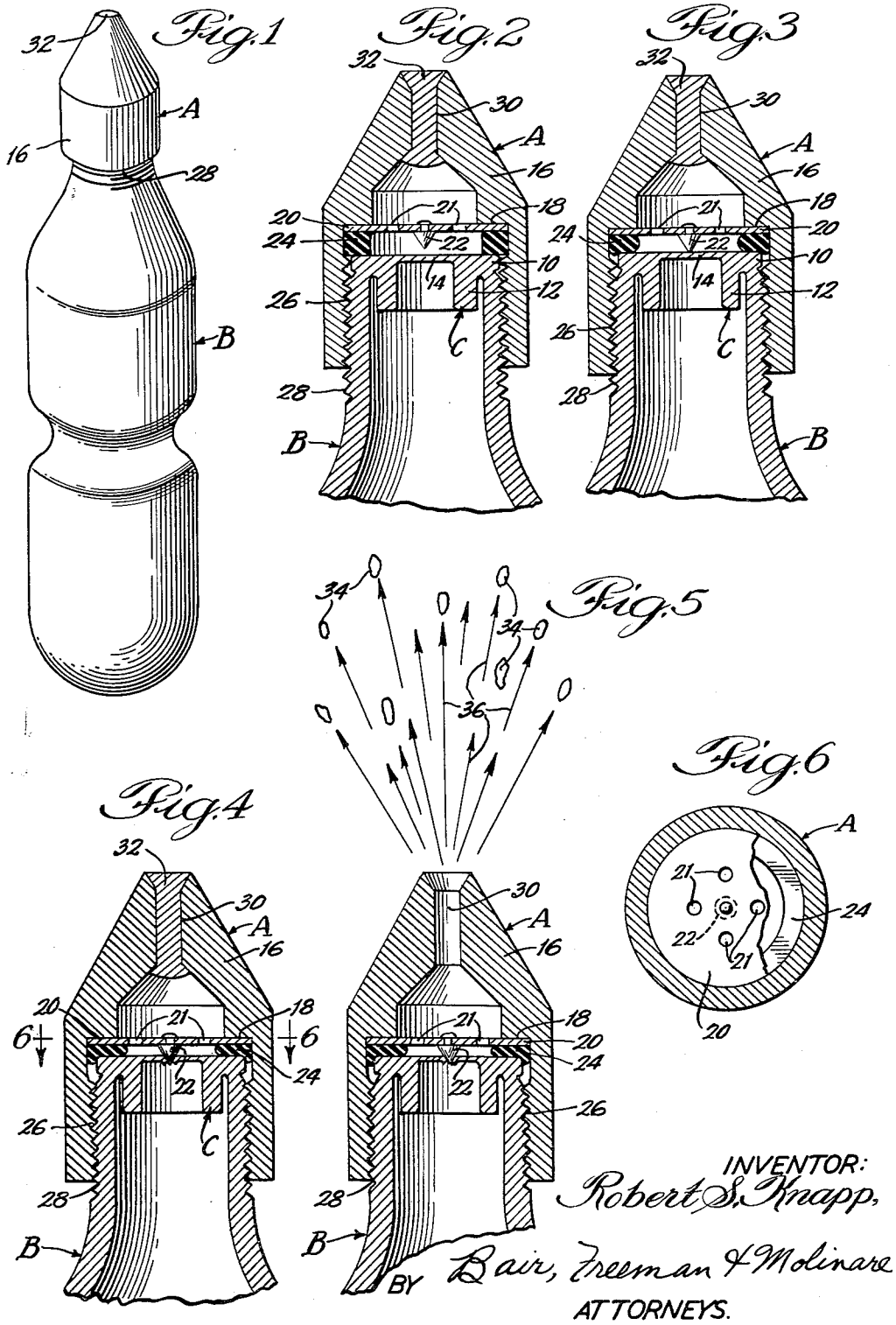

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THERMAL-RESPONSIVE BULB

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This invention relates to a thermal-responsive bulb which automatically discharges its contents upon attainment of a predetermined temperature ambient to the bulb.

One object of the invention is to provide a relatively simple and inexpensive means to release compressed coolant gas from a bulb upon a predetermined temperature being attained in a compartment containing the bulb so that such gas will then cool the compartment.

Another object is to provide light-weight cooling means for ballistic missiles, space rockets and similar devices which contain delicate instruments, in order to prevent dangerous temperature increases which would destroy the operation of such instruments.

Still another object is to provide an effective means for instantaneously cooling a compartment by the release of carbon dioxide gas or the like under pressure thereinto from a bulb, such as for the protection of electronic instruments and the like when a missile or rocket re-enters atmosphere dense enough to attain therewithin a temperature which would be detrimental to the instruments, the device being of value for critical uses in modern military as well as in civilian practice.

A further object is to provide thermal-responsive means for application to a compressed gas bulb as in the form of a thermal-responsive cap to be screwed thereon.

Still a further object is to provide the thermal-responsive cap with piercing means for the bulb and a gas discharge opening, the opening being sealed by a fusible plug which melts at a predetermined temperature.

An additional object is to provide means to convert a welded bulb into a thermal-responsive bulb by using an auxiliary cap which contains a piercing pin that automatically pierces the welded bulb as it is screwed down tight thereon, the gas pressure forcing its own release when the thermal-responsive means operates, and to permit the use of a standard threaded welded bulb utilizing a simple screw machine part which includes an appropriate gas-tight sealing washer, a piercing pin and a fusible plug.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my thermal-responsive bulb, whereby the objects above contemplated are attained, as hereinafter more fully set forth, pointed out in my claim and illustrated in detail on the accompanying drawings, wherein:

FIG. 1 is a full size perspective view of a thermal-responsive bulb embodying my invention;

FIG. 2 is an enlarged vertical sectional view through the neck of the bulb and the thermal-responsive cap, the cap being only partially associated with the bulb;

FIG. 3 is a similar view showing a further degree of association;

FIG. 4 is a similar view showing the final position of the cap on the bulb;

FIG. 5 is a similar sectional view showing the thermal-responsive operation of the assembly; and

FIG. 6 is a sectional view on the line 6—6 of FIG. 4.

On the accompanying drawing, I have used the reference character B to indicate a compressed gas containing bulb, and C a cap therefor. An auxiliary cap A is also provided having means for piercing the cap C,

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means for sealing the cap A to the bulb B and a thermal-responsive fuse as will be described in detail.

The bulb B may be of the usual metal type such as a "Sparklet" bulb having preferably a metal cap C welded thereto as disclosed in Kochner Patent No. 2,685,-383. The cap C comprises a flange **10** having a positioning neck **12** and a thinned down portion **14**, the flange **10** being mounted to the bulb B as disclosed in the Kochner patent. A welded construction of this type insures a bulb and cap combination which eliminates all possibility of leakage as might be experienced with a gasketed bulb closure, and this, of course is a very important consideration when the device is used in ballistic missiles, rockets and the like, as the failure of any one component usually results in an unsuccessful operation at great expense.

The auxiliary cap A consists of a body **16** having a shoulder **18** against which a disc **20** is positioned. The disc **20** is provided with perforations **21** and a piercing pin **22**. A resilient compressible gasket **24** is in turn positioned against the disc **20**, and beyond the disc the cap A is threaded at **26** to coact with threads **28** on the neck of the bulb B.

The cap A is provided with a gas discharge bore **30** in which there is a fusible plug **32**. The plug may be made of metal or the like melted into the bore **30** after the bore has been "tinned" so that the fusible plug thereby forms a perfect hermetic seal with respect to the cap A.

The cap A and the parts **20**, **22**, **24** and **32** assembled therein forms a light-weight inexpensive thermal-responsive cap that can be applied to any bulb B and cap C such as a bulb containing compressed CO_2. These "welded" bulbs are at present in military use as a standard practice and have proved entirely reliable. Such a bulb, when the thermal-responsive cap A is applied thereto, becomes a thermal-responsive coolant gas discharging bulb that operates automatically in response to ambient temperature rise to a predetermined degree, depending on the composition of the fusible metal **32** which can be nicely controlled by the alloying of the proper percentages of different metals.

In associating the cap A with the bulb B, the gasket **24** is first brought into contact with the cap C as shown in FIG. 2 by screwing the threads **26** of the cap A onto the threads **28** of the bulb B. Further threading results in the gasket washer **24** being squeezed as in FIG. 3 to effect a seal between the cap A and the cap C before the diaphragm portion **14** of the cap C is pierced by the piercing pin **22** as in FIG. 3. Further movement of the cap A onto the bulb B results in piercing the diaphragm **14** as in FIG. 4 so that the gas is then released into the cap A but of course cannot escape therefrom because the bore **30** is sealed by the fusible plug **32**. However, when the temperature ambient to the cap A rises sufficiently to soften the fusible plug **32**, the pressure within the bulb B will be released as in FIG. 5 as shown by the arrows **36**, globules **34** of the fusible plug **32** being also illustrated as being discharged from the bore **30**.

From the foregoing description it will be obvious that a thermal responsive bulb or coolant gas containing bulb with a thermal-responsive cap A as I have disclosed, when included in the compartment of a ballistic missile or the like having delicate instruments therein, will automatically have its contents discharged into the compartment for cooling it in the event the compartment reaches a temperature that is dangerous for the instruments. Such temperature, of course, is determined by the softening or melting point of the fusible plug **32**. Once the fusible plug is softened sufficiently that it can no longer contain the pressure of the gas in the bulb B, the gas will automatically discharge and effect the desired cooling of the

compartment in which the bulb and instruments are located in an obvious manner.

Some changes may be made in the construction and arrangement of the parts of my thermal-responsive bulb without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claim any modified forms of structure or use of mechanical equivalents which may reasonably be included within its scope.

I claim as my invention:

A unitary thermal-responsive device for connection with a compressed gas-containing bulb having a puncturable cap comprising an auxiliary cap body adapted to be screw threaded onto said bulb, said cap body having a shoulder therein, a piercing pin carrying disc in said cap body against said shoulder, a piercing pin carried by said disc, a gasket against said disc for sealing said cap body to the compressed gas-containing bulb, said cap body, when screwed onto the bulb, effecting said seal and actuating said disc and its piercing pin to pierce the cap of said bulb for discharge of gas therefrom into said auxiliary cap, a gas discharge bore in said auxiliary cap, an opening through said disc to permit gas to flow from the bulb

to said bore, and a fusible plug sealed in said bore and adapted to soften at a predetermined temperature to permit gas flow from said cap body.

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