US 20030192446A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2003/0192446 A1

Berg et al. (43) Pub. Date: Oct. 16, 2003

(54) HEADER WITH OVERLYING EYELET

(76) Inventors: **Paul Berg**, Northridge, CA (US); **Vahan Avetisian**, Newbury Park, CA (US); **Robert Renz**, Phoenix, AZ (US)

Correspondence Address:
THOMAS J. BRINDISI
20 28TH PLACE
SUITE B
VENICE, CA 90291 (US)

(21) Appl. No.: **10/124,470**

(22) Filed: **Apr. 16, 2002**

Publication Classification

(51) **Int. Cl.**[7] **F42C 1/00**

(52) **U.S. Cl.** **102/202.9**

(57) ABSTRACT

Disclosed is a pyrotechnic initiator header having an eyelet overlying a recessed primary glass insulator. The recessed region can be filled with a secondary glass insulator and/or a pyrotechnic ignition charge.

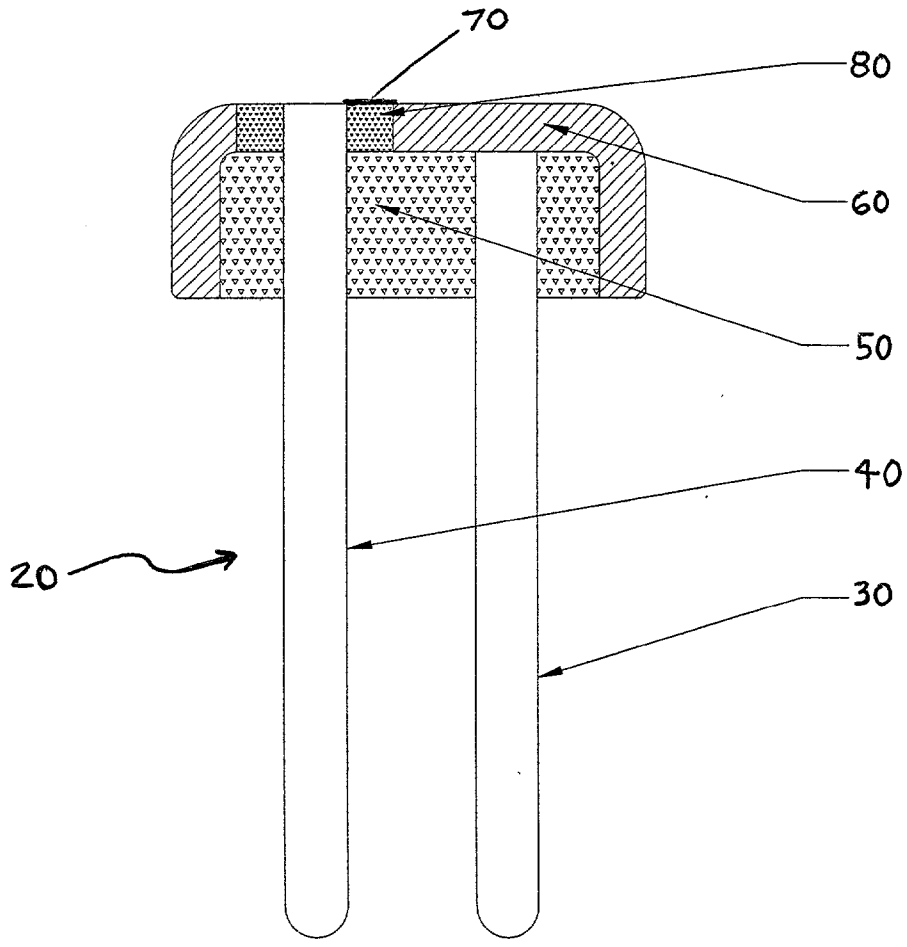
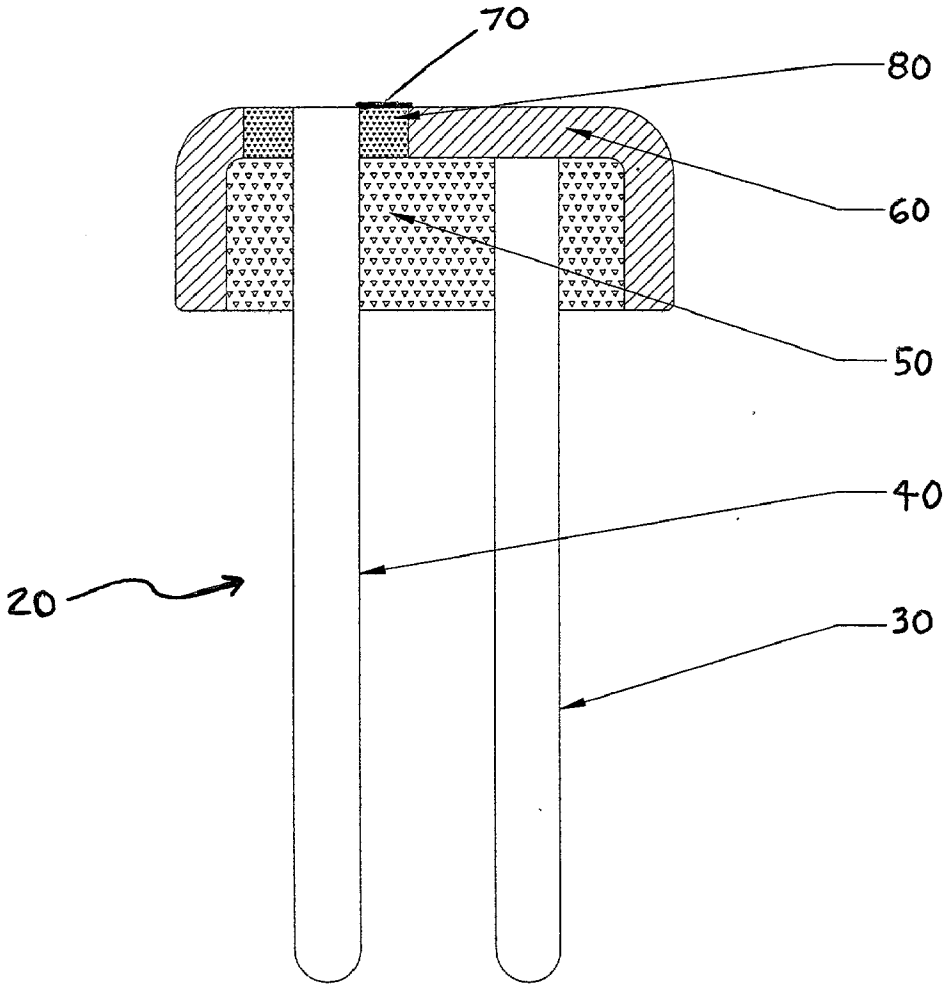


Fig.



HEADER WITH OVERLYING EYELET

BACKGROUND OF THE INVENTION

[0001] The present invention relates to the field of pyrotechnic initiators, and more particularly to a pyrotechnic initiator having an eyelet that overlies the glass insulator.

[0002] Pyrotechnic initiators have many uses in industrial and consumer applications. One important use is the inflation of airbags in motor vehicles. As airbag production has steadily increased, significant efforts have been made to reduce the cost of reliable airbag initiators. Nevertheless, there remains a substantial need in the automotive airbag industry in particular as well as in other applications, for further reduction in the costs of manufacturing reliable initiators.

SUMMARY OF THE INVENTION

[0003] In accordance with the present invention, a header for an initiator is provided that includes an eyelet overlying the glass insulator. A smaller second glass insulator aspect can also be provided, or the bridgewire can be suspended and encapsulated in an ignition droplet.

BRIEF DESCRIPTION OF THE FIGURE

[0004] The FIGURE is a side sectional view of an embodiment of the present invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

[0005] In conventional sealed-glass headers, there is a single insulator that is flush with the top surface of a generally cylindrical eyelet. As shown in the FIGURE, however, a preferred embodiment of a header **20** according to the present invention includes a ground pin **30**, a central isolated pin **40**, a primary glass insulator **50**, an overlying eyelet **60**, and a bridgewire **70**, with the primary glass insulator **50** being recessed below and substantially covered over by the eyelet **60**. Consequently, the top of the pin **70** is flush with the top surface of the eyelet **60**, and separated therefrom by an annular region that is filled with a secondary glass insulator **80**, or, alternately (not shown), with an ignition pyrotechnic charge.

[0006] Although eyelets in conventional sealed-glass headers are typically machined from stainless steel, the eyelet of the present invention may desirably be fabricated of nickel-plated 1010 carbon steel. Further, the eyelet can be stamped or cold-formed (preferably into a cup-like shape as shown), and then plated with nickel using a standard plating process. The eyelet should have a wall thickness that is sufficient to sustain a compression seal and to sustain ballistic firing forces without creating undue stress in the glass. However, it should be thin enough that the header can fit within the allotted space for the initiator assembly, and thin enough to facilitate any desired stamping or cold-forming. The hole in eyelet **60** (which includes the upper portion of the isolated pin **40** and the annular region around it) may also simply be punched, preferably after the stamping or cold-forming of the eyelet **60**, and may even be done on the same press.

[0007] The primary glass insulator **50**, pins **30** and **40**, and eyelet **60** are preferably of materials that are selected to result in a compression seal, or less preferably, a matched seal. For example, a suitable compression seal would result with a 1010 carbon steel eyelet, a sodasilicate (e.g., TM9) primary glass insulator, and pins of a 52 alloy (or less preferably 42-6 alloy). The primary glass insulator can be made of drawn or pressed glass. The ground pin **30** may be press fit into a corresponding hole (not shown) in the eyelet **60**, or it can be welded on, or it can be brazed with a solder ring during the sealing process. Both pins are preferably gold-plated, either individually, or as part of the header in "barrel" plating process.

[0008] If the annular region between the isolated pin **40** and the eyelet **60** is filled with a secondary glass insulator **80**, it may made be flush (either by a non-grinding flush-glassing process, or by grinding), or it can have a meniscus. The material of a secondary glass insulator **80** is also preferably selected for a compression seal, or less preferably for a matched seal, but in either case, is preferably the same material as the primary glass insulator. The secondary glass insulator also may be drawn or pressed, and if pressed, the primary and secondary glass insulators could be made of a single integral pressed piece. If a flush secondary glass insulator is not used, grinding of the top surface of the header may be eliminated since the bridgewire will be suspended above, rather than lying flat against, a glass surface.

[0009] There are a number of ways to seal a header according to the present invention wherein the eyelet overlies a primary glass insulator. For example, the header can be fixtured upside-down, using a fixture that includes a carbon or other suitable projection (not shown) to displace the primary glass insulator **50** (but not the isolated pin **40**) away from the top surface of the eyelet **60** during heating and sealing. Alternately, the header might be fixtured right-side-up, using a fixture that includes means positioned below the primary glass insulator **50** to support it at the appropriate height during heating and sealing. While steps can also be taken to ensure that the top surface of the primary glass insulator **50** is flat (as shown in the FIGURE), a meniscus (not shown) on the top surface of the primary glass insulator **50** may also be acceptable.

[0010] If an ignition charge is placed in the annular region between the isolated pin **40** and the eyelet **60** rather than a secondary glass insulator **80**, or if a secondary glass insulator **80** is formed with a meniscus and an ignition charge is placed in the sunken region of an insulator **80** below the plane of the top surface of the eyelet **60**, such an ignition charge is preferably dispensed as a droplet. Such a droplet can be dispensed in a liquid or slurry using formulas and techniques known to those of ordinary skill in the art, such as those described in U.S. Pat. No. 5,939,660 to Fogle, Jr., which patent is incorporated herein by reference as if set forth in full. Such a droplet can preferably be sprayed or dispensed with volumetric dispensing syringe-type equipment, and if there is no secondary glass insulator, the retention of the droplet in place can be enhanced by the provision of a circumferential notch (not shown) or other irregular surface near the top of isolated pin **40**.

[0011] Assignee's co-pending U.S. patent application Ser. No. 09/733,548, filed Dec. 7, 2000, the disclosure of which is incorporated herein by reference as if set forth in full, teaches another recessed header wherein a substantial part of

the bridgewire is suspended a distance away from the glass. As with the invention of that application, in the present invention, if a secondary glass insulator is not used, the annular cavity between the isolated pin and the eyelet beneficially helps to maintain the ignition charge in contact with the bridgewire so that it does not move during environmental testing or other physical shocks.

[0012] As evident to one of ordinary skill in the art, the header of the present invention can be pressed into a suitable can (not shown) that is loaded with a suitable output pyrotechnic charge (such as one provided using a conventional slurry loading process). The header can then be hermetically sealed (for example, with a through-weld) to the can to form an initiator sub-assembly, which can in turn be completed by, for example, a suitable method of insert-molding a nylon body to provide electrical insulation and structural support.

[0013] A preferred header with recessed glass insulator, and many of its attendant advantages, has thus been disclosed. It will be apparent, however, that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention, the form hereinbefore described being merely a preferred or exemplary embodiment thereof. Therefore, the invention is not to be restricted or limited except in accordance with the following claims and their legal equivalents.

We claim:

1. A header for use in a pyrotechnic initiator, comprising:

a) an electrically conductive eyelet having an upper eyelet surface and an eyelet bore defining an inner eyelet surface;

b) a primary glass insulator having an outer glass surface and an upper glass surface, and having an insulator bore defining an inner glass surface, wherein said outer glass surface is sealed to said inner eyelet surface, and said upper glass surface is disposed below said upper surface of said eyelet;

c) an electrically conductive center pin having an upper end, said center pin being disposed within said insulator bore and sealed to said inner glass surface; and,

d) a bridgewire attached between said upper eyelet surface and said upper end of said center pin.

2. The header of claim 1, wherein said upper glass surface is flat.

3. The header of claim 1, wherein said upper glass surface includes a meniscus.

4. The header of claim 1, further including an ignition charge droplet that includes a portion that is disposed between said center pin and said inner eyelet surface and extends below the plane of said upper eyelet surface.

5. The header of claim 4, wherein said droplet further includes a portion that extends above the plane of said upper eyelet surface.

6. The header of claim 4, wherein said ignition charge droplet extends down to said upper glass surface.

7. The header of claim 6, wherein said center pin includes a circumferential notch above said upper glass surface and below said upper end of said center pin.

8. The header of claim 1, further comprising a secondary glass insulator disposed between said center pin and inner eyelet surface, said secondary glass insulator having an upper surface that does not protrude above the plane of said upper eyelet surface.

9. The header of claim 8, wherein said primary glass insulator and said secondary glass insulator are made from pressed parts.

10. The header of claim 8, wherein said upper surface of said secondary glass insulator is substantially flat.

11. The header of claim 8, wherein said upper surface of said secondary glass insulator includes a meniscus.

12. The header of claim 11, further including an ignition charge droplet that includes a portion that is disposed between said center pin and said inner eyelet surface and extends below the plane of said upper eyelet surface.

13. The header of claim 1, further including an electrically conductive ground pin that is welded, soldered, or press-fit onto said eyelet.

14. The header of claim 1, wherein said eyelet is cold-formed.

15. The header of claim 1, wherein said eyelet is formed by stamping.

16. The header of claim 1, wherein said eyelet includes at least one punched hole.

17. The header of claim 15, wherein said eyelet primarily consists of 1010 carbon steel.

18. The header of claim 1, wherein said eyelet, primary glass insulator, and center pin are selected of materials to result in a compression seal when subjected to a suitable glass sealing process.

19. The header of claim 1, wherein said header is formed to be attached to a can loaded with an output pyrotechnic charge.

20. The header of claim 19, wherein said header is further formed to be incorporated into an initiator assembly for use in an automotive airbag inflator.

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