United States Patent

Wilson

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[54] BALL BAT CONSTRUCTION

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[73] Assignee: **Aluminum Company of America,** Pittsburgh, Pa.

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[52] **U.S. Cl.** .....**273/72 A,** 273/DIG. 2, 273/DIG. 5

[51] **Int. Cl.** **A63b 59/06**

[58] **Field of Search**....273/72, 81 R, 82 B; 220/24 A, 220/59, 60, DIG. 19, 67

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Assistant Examiner—Richard J. Apley
Attorney—Arnold B. Silverman

[57] **ABSTRACT**

An end plug for a hollow ball bat. The end plug has a substantially rigid inner plug member and a resiliently compressible outer plug member secured to the inner member. The outer plug member has a periphery provided with a generally cylindrical lower portion and an upper portion separated from the lower portion by an outwardly open annular recess. The inner plug member has a generally radially outwardly directed stabilizer portion which extends radially outwardly at least to a position adjacent to the periphery of the outer plug member. The outwardly directed stabilizer portion of the inner plug member may be divided into a plurality of individual stabilizer segments and may be provided with underlying reinforcing members.

A hollow ball bat having a generally cylindrical barrel portion and a generally cylindrical handle portion. At least one of the barrel and handle portions terminating in an open end provided with a transversely inwardly directed flange which is engaged within the annular recess of the end plug to provide an effective mechanical joint between the bat and the end plug. The composite end plug serves to provide both sound and vibration deadening means and integral structural reinforcing means resisting relative axial movement between the end plug and the ball bat.

7 Claims, 8 Drawing Figures

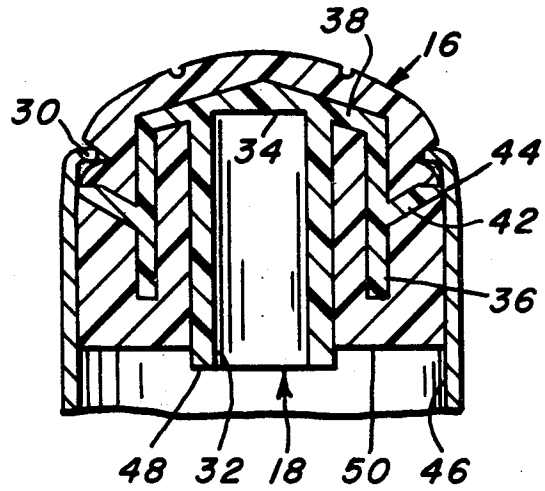


FIG. 1.

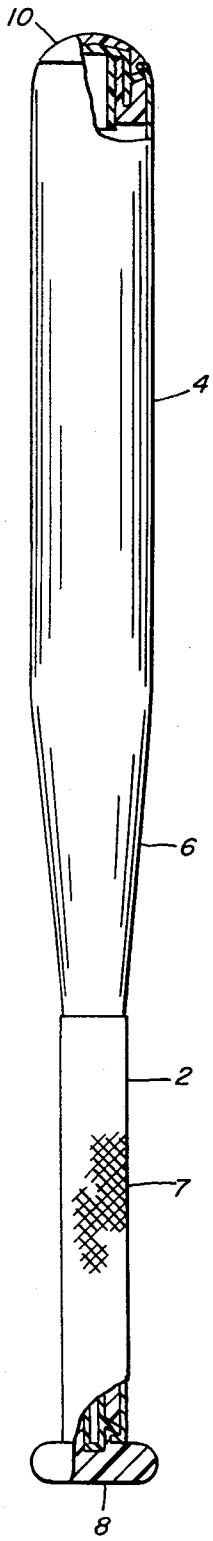


FIG. 2.

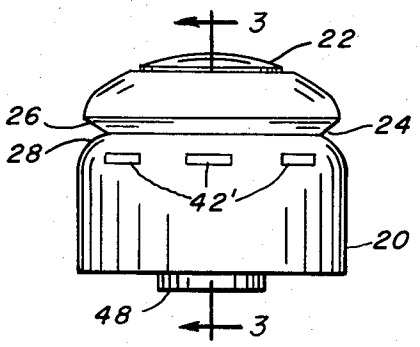


FIG. 3.

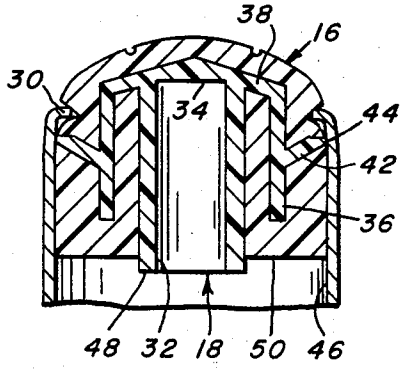


FIG. 4.

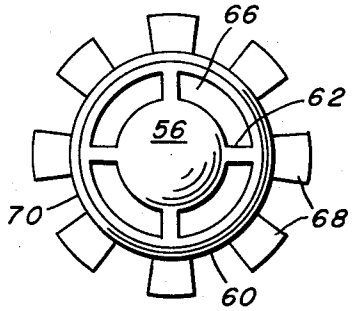


FIG. 3A

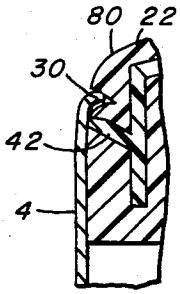


FIG. 5.

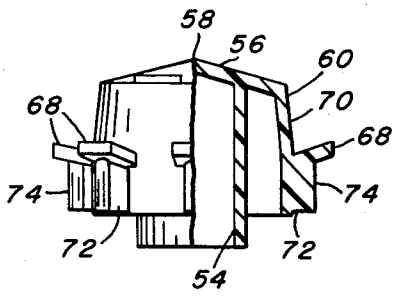


FIG. 3B.

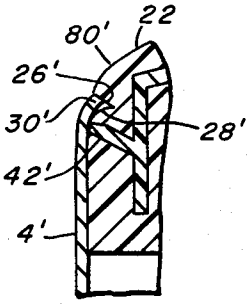
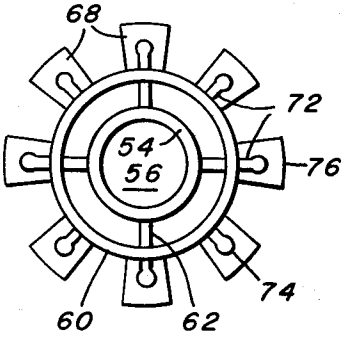


FIG. 6.



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BALL BAT CONSTRUCTION

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an aluminum ball bat construction and more specifically to a composite end plug which is adapted to be mechanically joined to a ball bat to establish a stable joint and to provide a bat with sound and vibration dampening properties.

2. Description of the Prior Art

It has been known to provide hollow metal bat structures having various configurations and composed of a wide range of materials. In general, the bat bodies have been formed from metal tube stock which has been worked, as by swaging, to establish a relatively small diameter handle portion, a relatively large diameter barrel or impact portion and a tapered intermediate portion. It has been known to employ metal end caps to close the opposed open ends of the bat body. See U. S. Pat. No. 1,499,128. These structures not only failed to provide the desired sound and vibration dampening in order to reduce both undesirable noise and bat vibration, but also cumbersome and expensive fabricating techniques were required in order to effect the joint.

It has also been known to provide such a hollow metal bat structure wherein an end plug composed of a homogeneous rubberous material has been provided. See U. S. Pat. No. 3,479,030. Such plugs have been secured to the bat body by the use of a separate adhesive material such as an epoxy. One of the difficulties with such a construction is the need to rely on the adhesive as the primary or sole plug retaining means on a product which is subjected to substantial mechanical shock in ordinary use. In addition, the circumferential uniformity of such a joint cannot be readily assured. Finally, the economic aspects of the production cycle are distorted somewhat as a result of the need to provide and apply the adhesive and subsequently insert the adhesive carrying plug into the bat opening without spillage.

There remains, therefore, the problem of providing a ball bat plug and bat assembly construction which facilitates providing a permanent effective joint between the bat and plug. In addition, there is lacking such a joint which provides sound and vibration dampening while also providing for maximum resistance to mechanical shock. The exposed materials must be such as to provide resistance to mechanical wear and also to tolerate the repeated exposure to all sorts of weather and soil conditions which the ball bat would encounter during normal usage, without loss of these desirable properties.

SUMMARY OF THE INVENTION

The above-described problems have been solved by the bat plug and bat construction of this invention.

This invention provides a composite end plug adapted for insertion into and joinder to either the barrel end, the handle end or both ends of a ball bat. The composite plug has a substantially rigid inner plug member and a resiliently compressible outer plug member secured to the inner plug member. The outer plug has a lower portion and an upper portion separated from the lower portion by an annular recess which is adapted to receive and be interengaged with a transversely inwardly directed flange which defines an opening in the end of the bat. The lower portion preferably has a generally cylindrical outer periphery. The inner plug member has a generally radially outwardly directed stabilizer portion which extends to or closely adjacent to the periphery of the outer plug member. This outwardly directed portion may be segmented and is preferably angularly upwardly and radially outwardly directed.

Among the preferred materials for use in the inner plug member are impact styrene, brass, steel and aluminum. Among the preferred materials for use in the outer plug member are polyvinyl chloride, polyethylene and rubber. The end plug may conveniently be formed by first providing a unitary molded inner plug member and subsequently molding the outer plug member therearound.

The inner plug member preferably has a tubular inner core having a closed upper end and a cylindrical body portion spaced radially outwardly from the tubular core. Connecting means secure the tubular core to the body portion and the radially outwardly directed stabilizer portion extends outwardly from the cylindrical body portion. Reinforcing means may be provided for the radially outwardly directed stabilizer portion. Also, the radially outwardly directed stabilizer portions preferably approach the periphery of the outer plug member at a position not higher than the lower of the two annular surfaces which cooperate to define the annular end plug recess.

The hollow bat has an enlarged hollow passageway at the barrel end which terminates in an end opening defined by a generally radially inwardly directed flange. The handle end may be provided with a similar opening. The flange is received within the annular recess of the plug member in order to provide an interlocking joint which resists relative axial separation of the plug from the bat. The diameter of the radially outwardly directed stabilizer portion of the plug member approximates the diameter of the inner surface of the bat at that location of the bat which is adjacent the outer extremity of the stabilizer element. In a preferred form, the outwardly directed stabilizer element is in physical contact with the inner surface of the bat and resists relative axial movement of the plug with respect to the bat. In addition, the diameter of the inner plug member is preferably greater than the diameter of the opening defined by the flange in the end of the bat in which the end plug is secured.

It is an object of this invention to provide an end plug for a hollow ball bat adapted to provide an effective mechanical joint between the hollow ball bat and the plug, which joint is of sufficient strength to withstand the severe mechanical shock encountered in ordinary use of a ball bat, while resisting undesired relative axial movement of the end plug with respect to the bat body.

It is another object of this invention to provide an end plug member for joinder to a hollow ball bat which plug has a substantially rigid inner member and a compressible outer member secured thereto in order to provide effective mechanical retention of the end plug and effective sound and vibration dampening for the bat assembly.

It is another object of this invention to provide a composite bat plug structure which may effectively be fabricated by initial unitary molding of the inner plug

member followed by subsequent molding of a unitary outer plug member therearound.

It is another object of this invention to provide a bat structure which has an effective mechanical joint between a bat plug element and a bat element such that the plug will effectively be mechanically retained in position during normal bat usage and that all exposed portions of the bat assembly are adapted to withstand both physical wear and exposure to the various outdoor climates and soil conditions in which the bat will normally be used.

These and other objects of this invention will be more fully understood from the following description of the invention on reference to the illustrations appended hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view, partially broken away, of a form of ball bat construction contemplated by this invention.

FIG. 2 is an elevational view of one form of composite end plug contemplated by this invention.

FIG. 3 is a sectional view taken through 3—3 of FIG. 2.

FIG. 3A is an enlarged detailed illustration of a portion of a joint of this invention.

FIG. 3B illustrates a modified form of mechanical joint of this invention.

FIG. 4 illustrates a top plan view of a modified form of inner plug member contemplated by this invention.

FIG. 5 is an elevational view, partially broken away, of the inner plug member shown in FIG. 4.

FIG. 6 is a bottom plan view of the inner element shown in FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now more specifically to FIG. 1, there is shown a hollow ball bat construction of a type contemplated by this invention. In the particular form shown, the ball bat is metal and has a handle portion 2, a barrel portion 4 and a connecting tapered portion 6. The handle portion 2 terminates in a knob 8 and is preferably covered by an appropriate grip portion 7. In the form shown, the knob 8 is a separate plug element which extends into the open end of hollow handle 2 and is mechanically secured thereto. The barrel portion 4 terminates in an open end which is closed by a plug 10.

For convenience of description, the discussion of the novel plug assembly of this invention will center around plug 10 which is secured to barrel portion 4. It will be appreciated, however, that a composite plug having the same or substantially identical features may be employed for knob 8 which is inserted within and secured to hollow handle 2.

Referring now to FIGS. 2 and 3, one preferred form of plug construction will be considered. The plug of this invention has an outer plug element 16 and an inner plug element 18. The outer plug element 16, in this form, has a lower portion 20 and an upper portion 22 which is separated from lower portion 20 by annular recess 24. The lower portion 20 has a generally cylindrical peripheral configuration. The annular recess is defined by upper annular surface 26 and lower annular surface 28. Flange 30, in this figure, has a generally perpendicular orientation with respect to the adjacent bat body portion.

In the form illustrated, the outer plug element 16 is preferably composed of a resiliently compressible material such as a plastic or rubber material with a polyvinyl chloride being preferred. As the hardness of the outer plug element material selected is increased, the wear resistance of exposed surface 22 is improved. As the compressibility of the outer plug element material selected is increased, improved dampening characteristics are produced. The inner plug element 18 is preferably composed of a substantially rigid material such as impact styrene which is preferred. In the alternative, an appropriate metal such as steel, aluminum and brass may be employed. An effective form of impact styrene employed for this usage has a tensile strength of about 65,000 lb/in^2 and a compressive strength of about 9,300 lb/in^2. An effective polyvinyl chloride material for this use has been found to have a tensile strength of about 2,400 lb/in^2. The inner plug member 18 serves as a reinforcing member which resists undesired relative axial movement between plug 10 and barrel 4 after the joint between the two has been established. The outer plug member 16 serves to deaden sound and vibrations. In addition, the upper portion 22, which in the form shown is upwardly domed, serves as a shock adsorbing end cap which prevents damage to the bat structure when that portion is subjected to physical contact with the earth or other objects during normal usage and handling.

The word "flange" as used herein shall refer to any generally radially inwardly deformed portion of a hollow bat adjacent or at an end of the bat body which defines a restricted opening therein and includes portions which are integrally reinforced as by providing a hollow bead or reentrant fold.

A form of joint between barrel portion 4 and outer plug member 16 is shown in detail in FIG. 3A. The barrel portion 4 terminates in a curved radially inwardly directed circumferential flange 30 which is received within outwardly open annular recess 24. Overlying recess defining surface 26 is in overlying surface to surface contact with flange 30. This joint provides a mechanical interlock which resists relative axial separation of the plug 10 and the bat. In the form of joint shown in FIG. 3B curved flange 30′ has its undersurface in surface to surface contact with lower annular surface 28′ and has its free end in engagement with upper annular surface 26′. This is a preferred form of joint which provides the desired mechanical interlock and joint stability.

Referring once again to FIGS. 2 and 3, it is seen that the inner plug member 18 has a tubular inner core 32 which has a closed upper end 34. A generally cylindrical body portion 36 is spaced radially outwardly from inner core 32 and is preferably coaxial therewith. Connecting means 38 secure the cylindrical body portion 36 to the tubular inner core 32. The inner plug member 18 has a generally radially outwardly directed stabilizer portion 42 which, in the form shown, extends from cylindrical body portion 36 radially outwardly and angularly upwardly. Stabilizer portion 42 preferably emerges from cylindrical body portion 36 at a position spaced upwardly from the bottom thereof and extends circumferentially around body portion 36. Stabilizer

portion 42 terminates at or closely adjacent the periphery of outer plug member 16 preferably at a position within the cylindrical lower portion 20. While it is preferred that the outwardly directed stabilizer portion 42 terminate at or closely adjacent the surface of outer plug member 16, if desired it may terminate at or closely adjacent the lower annular surface 28. It should, however, not emerge at any higher level of the outer plug member 16.

Contact between the outer extremity 44 of outwardly directed stabilizer portion 42 and the inner surface 46 of barrel 4 establishes frictional engagement which resists undesired relative movement between end plug 10 and barrel 4. The maximum diameter of inner plug member 18 is preferably greater than the diameter of the bat end opening defined by flange 30. As has been stated above, while the stabilizer portion 42 preferably extends to the surface of outer plug member 16, if desired it may be terminated at a position radially inwardly of the surface of outer plug member 16, but closely adjacent thereto. While close adjacency does not provide direct frictional engagement between outer extremity 44 and inner surface 46, the quantity of outer plug member 16 material interposed is sufficiently small that the rigidifying effect of the stabilizer portion 42 is obtained and frictional resistance to movement is effected.

The circumference of lower portion 20 of outer plug member 16 is preferably in surface to surface contact with bat inner surface 46. This not only increases the frictional engagement but also serves to effect a seal of the bat end to resist entry of moisture and foreign matter into the bat interior.

As is seen in FIG. 2, in the form of plug shown in this form of the invention the outwardly directed stabilizer portion 42 is circumferentially discontinuous to provide a plurality of outwardly directed stabilizer segments 42'. It is preferable in the interest of uniform plug securance to provide a minimum of four symmetrically positioned stabilizer segments 42'. Also, this segmented approach results in an economic advantage as it reduces the amount of material employed in the inner plug member 18. Alternatively, the stabilizer portion 42 may be circumferentially substantially continuous, if increased restraint against undesired plug movement is desired. For example, the stabilizer portion may have a generally continuous ring shape configuration with a circular continuous outer circumference, but openings between the outer circumference and cylindrical body 36 may be provided, or, if desired, it may have no openings.

The outer extremity 44 of stabilizer portion 42 preferably has a substantially uniform thickness. The extremity 44 has a radius of curvature which approximates either that of lower portion 20 or the lower annular surface 28 of outer plug member 16 depending upon which surface the extremity is adjacent.

It will, therefore, be appreciated that the end plug 10 provides desired sound and vibration dampening characteristics through the compressively resilient outer plug member 16 and the effectiveness of the joint between the plug 10 and the ball bat is mechanically insured. Not only is the cooperative interengagement between flange 30 and annular recess 24 effective in preventing separation of the plug from the bat body, but the likelihood of severe mechanical shock, frequently encountered in ball bat usage, compressing the outer plug member 16 with resultant undesired movement of the plug 10 with respect to the bat body is eliminated. The rigidifying structural supporting influence of inner plug member 18 coupled with the increased frictional engagement effected adjacent outer extremity 44 of stabilizer portion 42 serves to effectively resist relative axial displacement of the plug 10 either inwardly or outwardly with respect to the bat body.

The composite plug of this invention is adapted to be economically manufactured. In one preferred form, the inner plug member 18 is first molded to the desired configuration. After this has been accomplished, the outer plug member may be molded around the inner plug member 18 employing the latter as a portion of the mold core. In this connection it will be noted that as is shown in FIG. 3 the lower extremity 48 of tubular inner core 32 extends farther downwardly than the lower surface 50 of outer plug member 16. This serves to provide a lower tubular region of inner core 30 with which the mold portion may be engaged during formation of outer plug member 16. It will also be noted that the thickness of upper portion 22 of outer plug member 16 as well as the depth of annular recess 24 may be controlled by adjusting the dimensions of the inner plug member 18 and mold accordingly. This plug design and method also permit selection of an aesthetically pleasing material color for the outer plug member 16 to permit upper portion 22 to be attractively matched with the exposed decorative and/or protective bat finish.

Another preferred form of inner plug member is shown in FIGS. 4 through 6. In this form of inner plug member, a tubular core element 54 has an upper closed end 56 which is upwardly domed and terminates in a peak 58. The outer cylindrical body portion 60 is rigidly connected to the tubular core 54 by vertical, radially extending wall sections 62. These wall sections, in the form illustrated, originate within the lower half of tubular core element 54 and extend upwardly to a position closely adjacent upper closed end 56. As is shown in FIG. 4, this provides a series of curved elongate passageways 66 between tubular core element 54 and outer body portion 60 separated by wall sections 62.

This form of inner plug member also has a radially outwardly directed stabilizer portion which is divided into stabilizer segments 68. Stabilizer segments 68 are connected to the outer surface 70 of cylindrical body portion 60. These segments 68, in the form shown, increase in width as they extend outwardly from the body portion 60. The segments 68 extend radially outwardly and angularly upwardly. While it is preferred to provide an upward angular orientation to segments 68, they may be disposed substantially horizontally if desired. The segments 68 are all preferably of substantially the same size. As is shown in FIGS. 5 and 6, reinforcing walls 72 extend radially outwardly from the outer surface 70 of cylindrical body portion 60 and are in underlying supporting contact with segments 68. As is shown in the bottom plan view of FIG. 6, the reinforcing walls have free ends terminating in an enlarged circular column 74 which has a diameter slightly greater than the thickness of the remaining portion of the supporting wall 72. Reinforcing walls 72 terminate at a position spaced radially inwardly from the outer extremity 76 of segments 68.

In effecting the manufacture of an end plug employing the type of inner plug member shown in FIGS. 4 through 6, the same procedure as has been described with respect to the composite plug shown in FIGS. 2 and 3 may be employed. The resultant composite plug will have a reinforcing inner plug member which serves in essentially the same capacity as that described in connection with FIGS. 2 and 3.

It is noted that, as is shown in FIG. 3A, the outer periphery 80, which is that section of the upper portion 22 of the end plug in overlying surface to surface contact with flange 30, preferably has a thickness greater than the flange 30 of the barrel 4. This portion serves to provide added resistance to undesired axial movement of the end plug farther into the barrel 4. Such movement could readily occur through physical impact applied axially directly to the end plug 10. Where a resiliently compressive material which possesses a substantial degree of rigidity is employed in outer plug member 16, portion 80 may be provided in the form of a relatively thin overlying lip which will serve the same purpose of resisting inward displacement of the plug. It may be desired in some instances to have the flange substantially completely covered by outer peripheral portion 80 for both aesthetic reasons as well as mechanical reasons. It will be appreciated that outwardly directed stabilizer portion 42 also provides frictional resistance to such movement.

The hollow bat of this invention may be made of any suitable tubular material which possesses sufficient strength to function effectively under the mechanical loads which will be encountered in normal use. The material must also provide durability to avoid potentially deleterious effects of exposure to environmental conditions, such as weather and soil variations. In addition, it should be capable of withstanding the mechanical abuse to which such products are frequently subjected. It is preferred that the bat be manufactured from metal, such as aluminum or steel (including alloys thereof) which may be decoratively and/or protectively finished, if desired. A particularly effective series of appropriate aluminum alloys are the aluminum-zinc alloys such as the alloys designated 7075 and 7005, with a T6 or T53 temper being preferred.

It will, therefore, be appreciated that the end plug and bat structure of this invention provide a hollow bat which is adapted to receive one or two composite plugs of this invention in effective mechanical joinder which may be economically provided without the need for use of metal to metal joining techniques, such as welding. Also, the need for separate adhesives is eliminated. The composite plug has a substantially rigid inner reinforcing member which is adapted to provide improved frictional engagement between the surface of the bat body and the plug member to resist undesired relative axial movement between the two. The outer plug member is composed of a compressively resilient material which is adapted to dampen noise and vibrations. An outwardly open annular recess is provided in the outer plug member and a radially inwardly directed flange is formed in the hollow bat end. The flange portions extend into the annular recess to provide an effective mechanical interlocking joint which resists relative axial movement between the end plug and the bat portion. The inner plug member is uniquely configurated to facilitate molding the same as a unitary part and subsequently molding the outer plug member as a unitary part therearound. The plug structure of this invention may be employed in the barrel end of the bat and, if desired, may be provided with a modified knob configuration or other suitable configuration and be provided in the handle portion of the bat with the plug structure and joint structure otherwise being identical.

For purposes of illustration, a bat of the "bottle" variety having cylindrical barrel and handle portions separated by a tapered portion has been shown. It will be appreciated that other forms of hollow bat configurations may effectively be employed with the plug of this invention. The term "generally cylindrical" as used herein to refer to barrel or handle portions of bats shall include hollow bat portions provided with a taper such as might be found in bats which are continuously or partially tapered within these portions.

Whereas particular embodiments of the invention have been described above for purposes of illustration, it will be evident to those skilled in the art that numerous variations of the details may be made without departing from the invention as defined in the appended claims.

I claim:

1. A hollow metal bat body comprising
a hollow metal bat body having a generally cylindrical barrel portion and a generally cylindrical handle portion,
at least one of said barrel and handle portions terminating in an open end,
at least one said open end having a generally radially inwardly directed flange,
a plug element extending into said open end,
said plug element having an outer periphery provided with a lower portion and an upper portion separated from said lower portion by an annular recess,
said transversely inwardly directed flange of said open end extending into said annular recess to establish a joint between said plug element and said bat body,
said plug element having an inner plug member and an outer plug member secured thereto,
said outer plug member being composed of a material which is resiliently compressible,
said inner plug member composed of a substantially rigid material, and
said inner plug member having a radially outwardly directed stabilizer portion extending at least to a position adjacent the outer periphery of said outer plug member.

2. The hollow ball bat of claim 1, including
the maximum diameter of said inner plug member is greater than the diameter of said end opening defined by said radially inwardly directed flange.

3. The hollow ball bat of claim 2, including
said outwardly directed stabilizer portion of said inner plug member having an outer extremity terminating in contact with the inner surface of said barrel portion of said ball bat.

4. The hollow ball bat of claim 2, including
said plug element secured within said barrel portion of said bat,
said lower portion of said outer plug member having a generally cylindrical peripheral configuration,

said upper portion of said outer plug member being upwardly domed,

said annular recess defined by an upper annular surface and a lower annular surface, and

said upper annular surface in overlying surface to surface contact with said inwardly directed flange of said barrel.

5. The hollow ball bat of claim **2**, including

said inner plug member composed of a material selected from the group consisting of impact styrene, brass, steel and aluminum, and

said outer plug member composed of a material selected from the group consisting of plastic and rubber.

6. The hollow ball bat of claim **2**, including

said annular recess defined by an upper annular surface and a lower annular surface, and

said lower annular surface in underlying surface to surface contact with a portion of said inwardly directed flange of said cylindrical barrel.

7. The hollow ball bat of claim **6**, including

the free end of said inwardly directed flange in contact with said upper annular surface.

* * * * *