

[54] **BALL BAT**

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[52] U.S. Cl. **273/72 A**, 215/47, 220/24 R, 72/343

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

[58] Field of Search 273/72 A, 82 R, 82 B, 81 R; 220/24 A, 59, 42 R, 42 B, 42 D, 42 E, 42 F, 60 R, 66, 67, DIG. 19; 215/47

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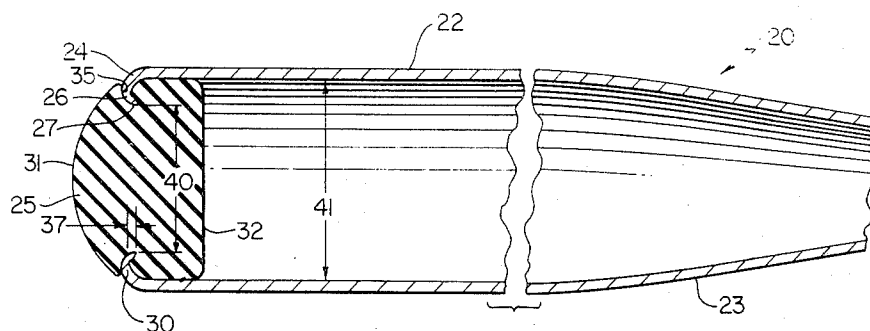
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[57]

ABSTRACT

A ball bat is provided wherein the bat comprises a tubular metallic body having a handle end portion and a hitting end portion. The hitting end portion has an annular flange defining its terminal end and the flange has a radially inwardly directed portion and an integral hooking end which hooks toward the handle end portion with the radially inwardly directed portion and hooking end each having a thickness which decreases substantially gradually from the hitting end portion to the terminal edge of the hooking end. The bat is provided with an end plug which has an annular groove therein corresponding in configuration to the flange and has such flange received therewithin. The plug has a flange-engaging surface which defines one wall of the groove and engages the inside surface of the flange to thereby hold the end plug in position even after extended use of the bat.

3 Claims, 12 Drawing Figures



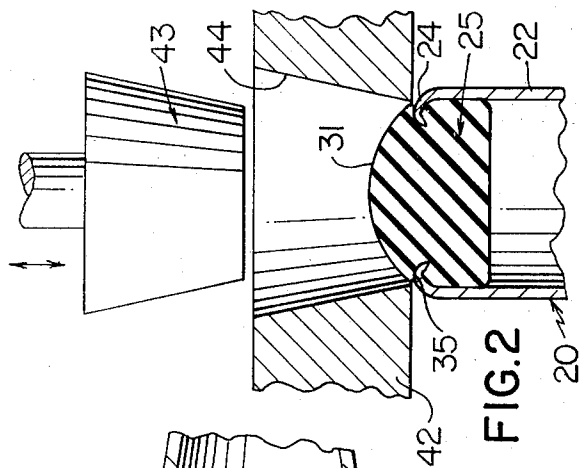


FIG. 2

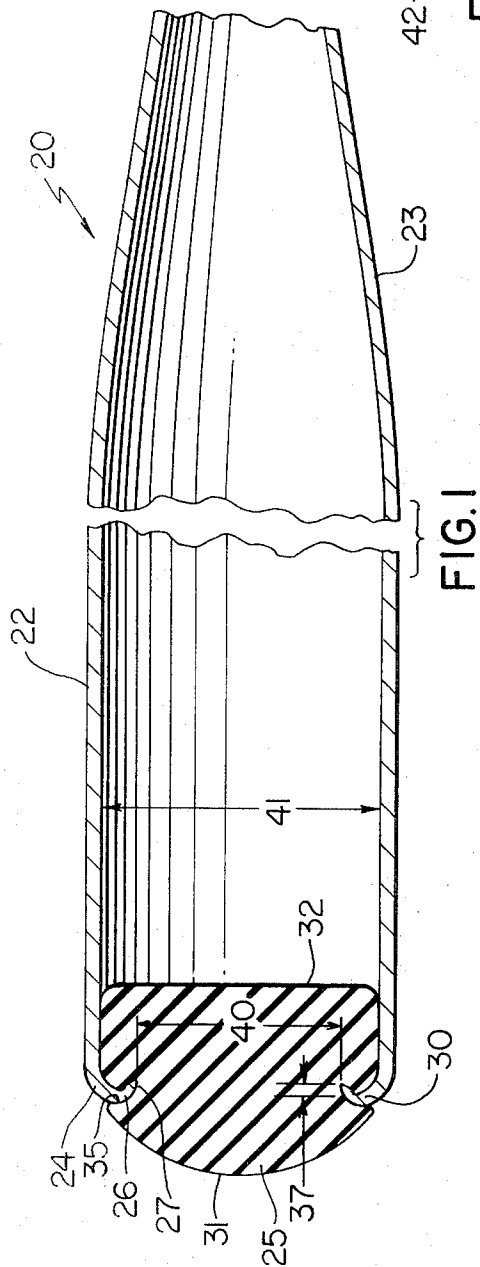


FIG. 1

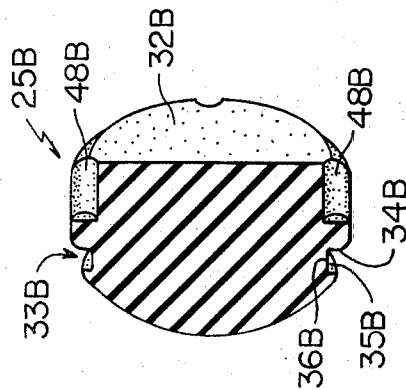


FIG. 5

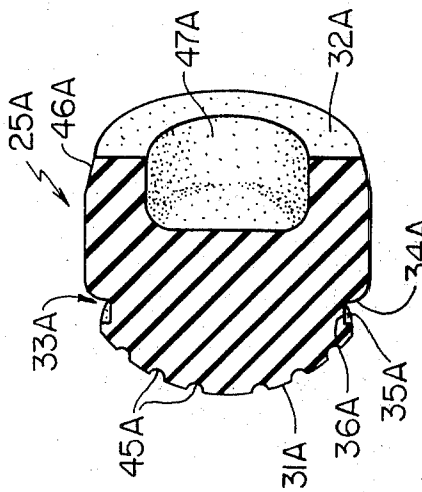


FIG. 4

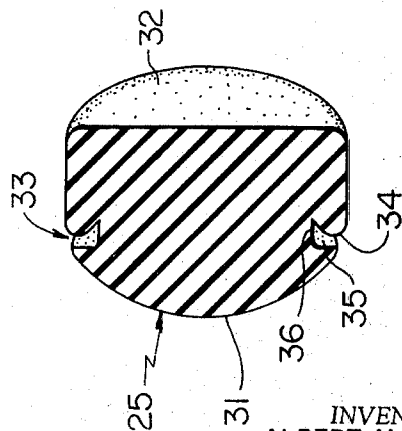


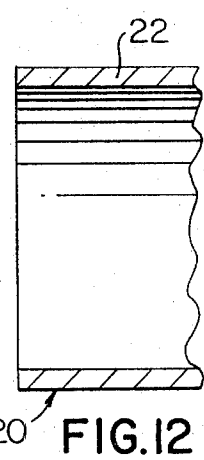
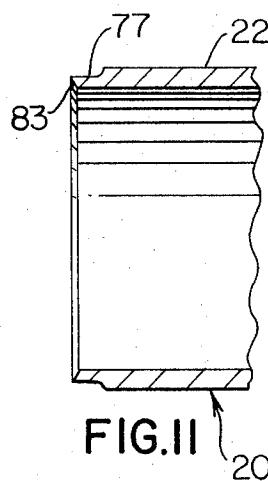
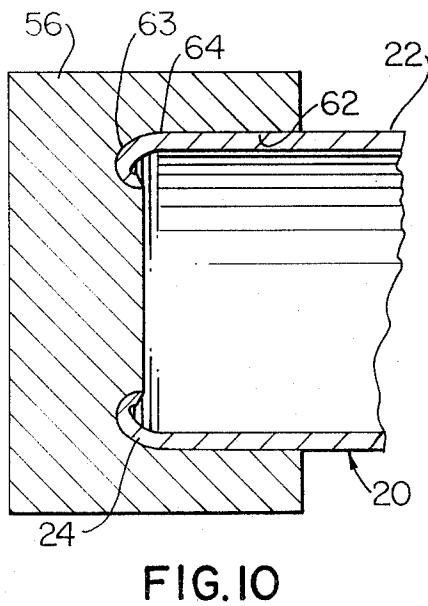
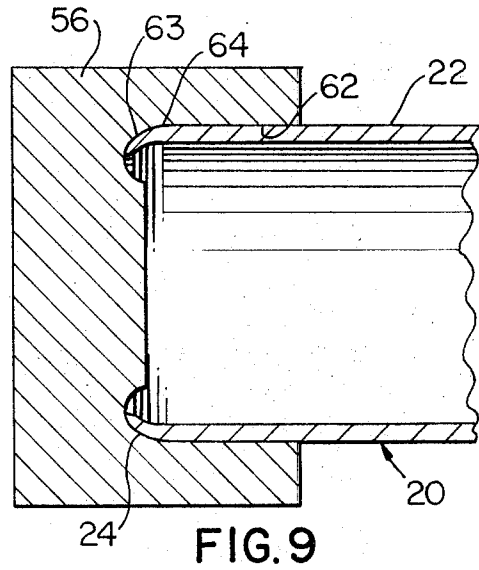
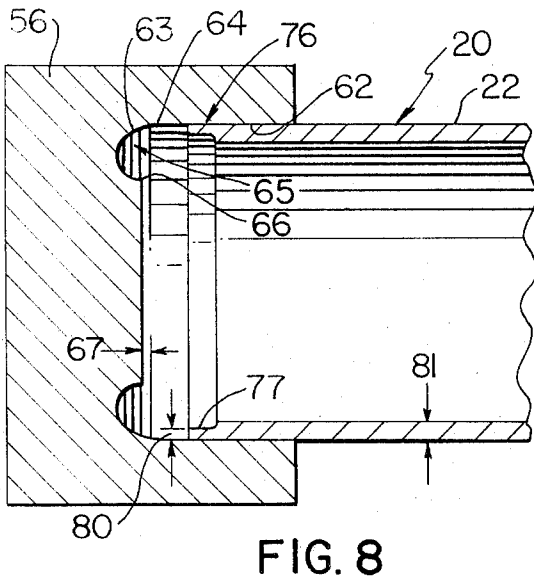
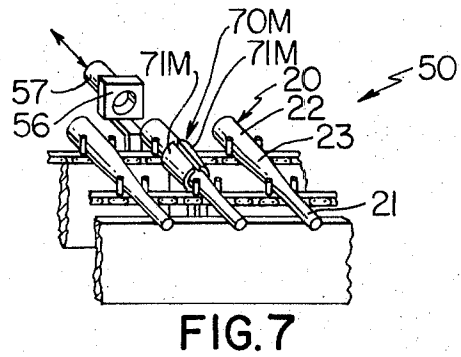
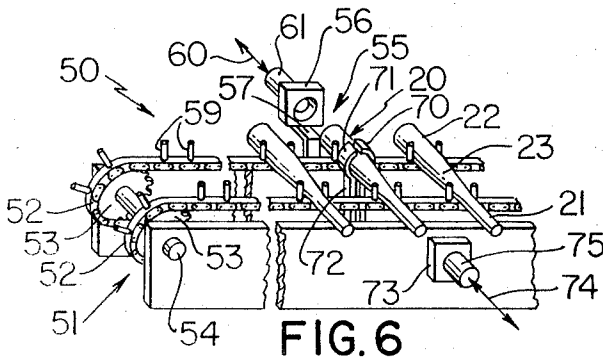
FIG. 3

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BALL BAT

BACKGROUND OF THE INVENTION

It has become increasingly popular to replace wooden ball bats in the games of softball, baseball and the like, with metallic bats of substantially tubular construction. Each of these tubular bats usually employs an end plug in the terminal end of its hitting end portion.

It is generally very difficult to retain these end plugs in position and numerous techniques using mechanical devices, adhesives, etc., have been proposed heretofore to hold the plugs in position. However, certain of these previously proposed techniques are not completely satisfactory, especially after extended use of the bat.

SUMMARY

This invention provides an improved ball bat, and an improved apparatus for and method of making same, wherein the bat has a tubular metallic body provided with a handle end portion, a hitting end portion, and a substantially frustoconical transition portion therebetween. The hitting end portion has an improved integral annular flange provided in its terminal end which retains a cooperating end plug made of an elastomeric material.

Other details, uses, and advantages of this invention will become apparent as the following description of the exemplary embodiments thereof presented in the accompanying drawings proceeds.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings show present exemplary embodiments of this invention, in which

FIG. 1 is a cross-sectional view with parts broken away illustrating one exemplary embodiment of the bat of this invention which has a rubber plug fixed in the terminal end of its hitting end portion and such plug is held firmly in position by a unique integral annular flange;

FIG. 2 is a view with parts in cross section and parts broken away illustrating an apparatus and method which may be used to install the end plug in the bat of FIG. 1;

FIG. 3 is a fragmentary perspective view partially sectioned of the plug of FIG. 1;

FIG. 4 is a view similar to FIG. 3 illustrating another embodiment of a plug which may be used in the bat of FIG. 1;

FIG. 5 is a view similar to FIG. 3 illustrating still another embodiment of a plug which may be used in the bat of FIG. 1;

FIG. 6 is a perspective view with parts broken away and parts shown schematically illustrating an exemplary apparatus and method which may be used in forming the integral flange in the bat of FIG. 1;

FIG. 7 is a fragmentary perspective view of a portion of the apparatus and method of FIG. 6 which uses a modified form of holding device to hold the bat during the forming of its flange;

FIGS. 8-10 are fragmentary cross-sectional views of an improved die comprising the apparatus of FIGS. 6 and 7 and a series of three successive steps are shown in the process of making the bat of FIG. 1 using such die;

FIG. 11 is a fragmentary cross-sectional view of the terminal end of the hitting end portion of a bat which may be formed using the die of FIGS. 8-10 and illustrating the manner in which a thickness of material may be removed from the outside surface of the hitting end portion to facilitate forming the improved flange in its terminal end; and

FIG. 12 is a view similar to FIG. 11 illustrating the terminal end of the hitting end portion of a bat construction prior to removing material to define either the construction shown in FIG. 8 or 11.

DESCRIPTION OF ILLUSTRATED EMBODIMENTS

Reference is now made to FIGS. 1 and 6 of the drawings which illustrate one exemplary embodiment of the ball bat of this invention which is designated generally by the reference numeral 20. The bat 20 comprises a substantially tubular metallic body having a handle end portion 21 and a hitting end portion 22 which are interconnected by an integral substantially frustoconical interconnecting portion 23. The bat 20 has an annular flange 24 defining the terminal end of the hitting end portion 22 and the flange has what has been popularly referred to as a J-hooked cross-sectional configuration which holds a compressible end plug 25 comprising the bat in position without requiring mechanical fasteners or other retaining means. The plug 25 may be made of any suitable elastomeric material, such as natural rubber, synthetic rubber, or any suitable plastic having properties substantially similar to rubber.

The annular flange 24 has a radially inwardly directed portion 26 (see FIG. 1) and an intergral hooking end 27 which hooks toward the handle end portion 21 of the bat 20. The radially inwardly directed portion 26 and the hooking end 27 each has a thickness which decreases gradually as the distance from the main body of the hitting end portion to the terminal edge of the hooking end 27 increases and as will be readily apparent at 30. The radially inwardly directed portion 26 and hooking end 27 of flange 24 define a substantially semitoroidal outside surface which appreciably increases the structural rigidity of the hitting end portion 22 of the bat thereby preventing it from collapsing or flattening. Further, the annular flange 24 holds the plug 25 in position in a fixed non-rattling manner throughout the entire life of the bat.

As seen particularly in FIGS. 1 and 3, the end plug 25 has a substantially outwardly convex outside surface 31 and an oppositely arranged planar inside surface 32 which, with the plug 25 fixed in position in the hitting end portion 22, is arranged substantially perpendicular to the longitudinal axis of the bat 20. The plug 25 has an annular groove 33 provided therein which corresponds in configuration to the configuration of the flange 24 and once the plug is installed in the bat 20 the flange is received within groove 33.

The plug 25 has a flange-engaging surface 34 which defines one wall of the groove 33 and engages the inside surface of the flange 24 and such inside surface is defined by the cooperating inside surfaces of the radially inwardly directed portion 26 and hooking end 27. The plug 25 also has a substantially planar annular surface portion 35 which defines the outer portion of a wall 36 which is arranged opposite wall 34 and cooperates therewith to define the groove 33. The annular portion 35 engages a part of the substantially semitoroi-

dal outside surface of the flange 24, and the annular surface 35 serves to control the amount that the plug 25 is positioned within the bat 20 either during initial installation thereof or through abuse of the bat by striking the end of the plug 25 against the ground or an object.

The hooking end 27 defines an annular substantially tubular portion of limited height, indicated at 37 in FIG. 1, and such annular tubular surface portion is arranged concentrically within the hitting end portion 22 and has a diameter 40 which is substantially less than the inside diameter 41 of the tubular hitting end portion 22 whereby the inside surface of the inwardly directed portion 26 provides a comparatively large area for engagement by the flange-engaging surface 34. It will also be seen that the annular planar surface portion 35 of plug 25 has an area which is roughly equal to the area of the annulus defined by diameters 40 and 41. Thus, once the plug 25 is installed in position, it is fixed against either inward or outward movement.

The plug 25 may be installed in the end of the bat 20 using any suitable apparatus and method and one technique which may be employed is to hold the bat firmly in position and place a plug-receiving holder 42 having a frustoconical opening therein with its lower surface against the end of the bat, see FIG. 2, whereupon a co-operating frustoconical plunger 43 is urged against the plug 25 to force it into position. As the plug 25 is moved axially into the bat it is first compressed radially inwardly by the frustoconical surface 44 defining the corresponding opening in the holder 42 and then is further compressed radially inwardly by the inner portion of the semitoroidal outside surface of flange 24. Once annular surface 35 engages the end of the bat, the plug 25 has moved axially a sufficient distance that flange 24 is received within groove 33.

Other exemplary embodiments of end plugs are illustrated in FIGS. 4 and 5 and such plugs are very similar to the plug 25; therefore, these plugs will be designated generally by the reference numerals 25A and 25B respectively for the plugs of FIGS. 4 and 5 and parts of each plug which are similar to corresponding parts of the plug 25 will be designated by the same reference numeral as in the plug 25 also followed by an associated letter designation and not described again. Only those component parts which are substantially different from corresponding parts of the plug 25 will be designated by a new reference numeral also followed by an associated letter designation and described in detail.

The plug 25A, see FIG. 4, has an outwardly convex outside surface 31A provided with concentric annular grooves each designated by the reference numeral 45A which may be provided in plug 25A to help control the weight of its associated ball bat within precise limits. The annular groove 33A is also defined by walls 34A and 36A and, in this example, the planar annular wall portion 35A of wall 36A has a smaller area than the annular wall 35 of plug 25.

The plug 25A has a tapered surface 46A which enables easier installation thereof and also has a cutout or blind hole 47A therein which extends inwardly from its inside surface 32A. The hole 47A has a substantially right circular cylindrical configuration and serves to eliminate material from the center portion of plug 25A which serves the dual purpose of allowing the plug to be more easily compressed radially inwardly to facilitate its installation in an associated bat as well as serv-

ing to reduce the weight of its bat for weight and balance control.

The plug 25B, see FIG. 5, has walls 34B and 36B including a planar annular surface portion 35B in wall 36B, and walls 34B and 36B define a groove 33B which is similar to the groove 33. The plug 25B has a plurality of equally angularly spaced cutouts or blind holes 48B which extend inwardly from its planar inside surface 32B. The holes 48B serve the same dual purpose as the central hole 47A of plug 25A. The cutouts 48B may have substantially right circular cylindrical configurations as shown and one or more of these holes may be defined by pins in an associated mold used to make the plug 25B.

The end plugs 25A and 25B may be used interchangeably with the plug 25 in the bat 20 of FIG. 1. In addition, these plugs may be installed utilizing the apparatus and method shown in FIG. 2 or any other suitable apparatus and method.

The bat 20 may be formed utilizing the apparatus and method 50 shown in FIG. 6 of the drawings. The apparatus 50 comprises a chain conveyor assembly 51 which has a pair of endless chains 52 which are mounted on associated pairs of chain sprocket wheels 53 and each pair of wheels 53 is fixed on and rotatably supported by an associated shaft 54. One of the shafts 54 is suitably driven by a conventional drive (not shown). Each chain 52 has pairs of upstanding pins fixed thereto and the assembly 51 with pins 59 carry the main bodies of tubular metallic bats 20 with the bats supported horizontally to a forming station, indicated at 55, to define a J-hooked flange or annular flange 24 therein. The flange 24 is formed by the action of a die 56 which is suitably slidably supported on a support 57 at the forming station 55 and the die 56 is moved in a reciprocating rectilinear manner toward and away from an associated bat to be formed by a ram or actuator 60, indicated schematically by a double arrow, and the ram 60 has a rod end 61 fixed to the die 56.

As seen particularly in FIGS. 8-10, the die 56 has a substantially right circular cylindrical inside surface 62 defining an entrance opening thereto which is adapted to receive the terminal end of the hitting end portion 22 of a bat to be formed. The die 56 has an annular arcuate surface 63 which has a circular edge indicated at 64 adjoining the inner edge of the cylindrical surface 62 and the arcuate surface 63 extends within the die 56 and away from its edge 64 through an approximately circular arc of roughly 180°, as indicated at 65 in FIG. 8. The arcuate surface 63 is substantially semitoroidal and terminates in another circular edge 66 which has its center arranged coaxially with the center of the circular edge 64. In this example, the circular edge 66 is arranged in a plane perpendicular to the longitudinal axis of the die 56 and is spaced from a similar perpendicularly arranged plane containing the circular edge 64 by a distance indicated at 67.

The apparatus 50 also has means for holding each bat in its forming position at the forming station 55 and, in this example, such means comprises a clamping device or clamp 70 having substantially semicylindrical clamping members 71 which engage diametrically opposed outside surface portions of the hitting end portion 22 and hold the bat steady on the conveyor assembly 51 whereby the clamp holds the bat against both horizontal and vertical lateral movement. The device 70 may

be supported between chains 52 by an associated supporting mechanism 72 which is suitably moved vertically upwardly and downwardly into an out of engagement with each bat at station 55.

The apparatus 50 also uses another holding device in the form of a stop 73 which holds each bat against axial movement and the stop 73 may be either supported in a fixed position at the handle end of the bat or such stop may be suitably rectilinearly moved against the terminal end of the handle end portion 21 by a suitable actuator designated by a double arrow 74 and having a rod end 75 fixed to the stop 73.

Each bat to be formed is moved into the forming station 55 in an indexing manner whereby with the conveyor assembly 51 stopped, the mechanism 72 extends the clamping device 70 vertically upwardly and its members 71 into clamping engagement against opposite surfaces of the bat to be formed. The stop 73 is then urged tightly against the end of the bat whereupon the bat and forming die 56 are relatively moved together. Because the bat is held stationary in this example by clamping device 70 and stop 73, only the forming die 56 is moved against the terminal end, indicated at 76 in FIG. 8, of the hitting end portion 22 to form the substantially semitoroidal flange 24 with its unique advantages. The manner in which flange 24 is formed may be viewed in FIG. 9 which shows the flange 24 partially formed and in FIG. 10 the flange is shown in its completed form. Once the bat has been formed, the device 70 is retracted by mechanism 72 allowing the formed bat to be carried by assembly 51 and pins 59 out of station 55 and another bat to be formed into position at such station whereupon the process is repeated.

To facilitate the integral forming of the flange 24, the terminal end of the bat has a cutout indicated at 77 provided therein and such cutout defines a reduced thickness in the terminal end of the bat body, indicated at 80, which is less than the thickness 81 of the tubular wall of the hitting end portion. Also, the end edge of the hitting end portion 22 is in the form of an annular planar edge which is arranged in a plane perpendicular to the longitudinal axis of the die 56. The cutout 77 enables the flange 24 to be formed with the application of comparatively little force and simply by moving the die 56 in a rectilinear manner without relative rotation between the die 56 and bat 20.

The apparatus 50 may be modified to eliminate the stop 73 by employing a clamping device 70M, see FIG. 7, which has two clamping members 71M which cooperate to define a substantially frustoconical inside surface when such members are moved into clamping engagement. The clamping members operate in a similar manner as the clamping members 71; however, such members 71 engage the tapered or frustoconical portion 23 of an associated bat to be formed. The device 70M holds the bat against both lateral and axial movement during movement of the forming die 56 against the end portion of the bat to enable forming thereof in a similar manner as described previously in connection with the device 70 and stop 73.

The flange 24 in the bat 20 has been shown as being formed with a cutout 77 in its tubular wall and such cutout extends inwardly from its inside surface. However, it will be appreciated that such bat may be made by providing a cutout 77 extending into the tubular wall from the outside surface of the hitting end portion as

shown in FIG. 11. With this type of cutout, a tapered edge 83 is preferably provided in the end of the bat body.

However, regardless of whether the hitting end portion 22 of a bat body is provided as shown in FIG. 8, the resulting annular flange 24 is easily defined by the unique forming die 56 so as to have a radially inwardly directed portion 26 and a hooking end 27 which hooks toward the handle end portion 21 of the associated bat.

Any suitable metallic material having the proper physical properties may be utilized in forming ball bats capable of being used for either softball or baseball. However, such bats are preferably made utilizing a modified 6061 aluminum alloy having a temper commonly referred to in the trade as a T-8 designation.

It will also be appreciated that rubber used to define either end plug 25, 25A, or 25B may have any suitable hardness. However, such rubber preferably has a Shore A durometer hardness of roughly 80.

In this example of the invention each bat body is formed by relatively axially moving the bat body and die 56 together in a substantially rectilinear manner and without relative rotation therebetween; however, it is to be understood that the die 56 and bat body may also be relatively rotated about the longitudinal axis of the bat during axial movement of these components into forming engagement.

In the above description reference is made to the various end plugs being held in position by an annular flange such as the flange 24 for plug 25, for example; however, it is to be understood that suitable adhesive means may be used between the hitting end portion of the bat and the elastomeric plug to help hold such plug in position.

While present exemplary embodiments of this invention, and methods of practicing the same, have been illustrated and described, it will be recognized that this invention may be otherwise variously embodied and practiced within the scope of the following claims.

What is claimed is:

1. A ball bat comprising, a tubular metallic body having a handle end portion and a hitting end portion, an annular flange defining the terminal end of said hitting end portion, said flange having a radially inwardly directed portion and an integral hooking end which hooks toward said handle end portion, said hooking end defining a substantially tubular portion of limited axial height with said tubular portion being arranged concentrically within said hitting end portion, said radially inwardly directed portion and said hooking end each having a thickness which decreases substantially gradually from said hitting end portion to the terminal edge of said hooking end, and an end plug having an annular groove therein corresponding in configuration to and having said flange received therewithin, said plug having a peripheral flange-engaging surface which defines one wall of said groove and engages the inside surface of said flange to thereby hold said end plug in position even after extended use of the bat.

2. A ball bat comprising, a tubular metallic body having a handle end portion and a hitting end portion, an annular flange defining the terminal end of said hitting end portion, said flange having a radially inwardly directed portion and an integral hooking end which hooks toward said handle end portion, said hooking end defining a substantially tubular portion of limited

7

axial height with said tubular portion being arranged concentrically within said hitting end portion, said radially inwardly directed portion and said hooking end each having a thickness which decreases substantially gradually from said hitting end portion to the terminal edge of said hooking end, and an end plug having a groove which has said flange received therewithin.

3. A ball bat comprising, a tubular metallic body having a handle end portion and a hitting end portion, and an annular flange defining the terminal end of said hitting end portion, said flange having a radially inwardly directed portion and an integral hooking end which

8

hooks toward said handle end portion, said hooking end defining a substantially tubular portion of limited axial height with said tubular portion being arranged concentrically within said hitting end portion, said radially inwardly directed portion and said hooking end each having a thickness which decreases substantially gradually from said hitting end portion to the terminal edge of said hooking end, said flange with its inwardly directed portion and hooking end being adapted to hold an associated end plug for said bat securely in position therewithin.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,834,698 Dated September 10, 1974

Inventor(s) Albert M. Pouzou

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

1st Page, after Inventor: Albert M. Pouzou, Richmond, Va.,
read -- Assignee: Reynolds Metals Company, Richmond, Va.

Signed and sealed this 22nd day of April 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
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