CAST HOLLOW BALLS

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The present invention relates to hollow pulverizer grinding balls. More particularly, the pulverizer balls of the present invention are cast of ferrous alloy with a selected wall thickness commensurate with the type of service for which the grinding ball is intended.

Hollow metallic balls for pulverizer use have heretofore been known where a cored hole has been provided in the wall of the ball. Heretofore, the opening or cored hole in the wall of the cast ball has generally been closed by means of a plug or the like, but whether the cored hole has been plugged or not, the metal surface of the ball adjacent the edge of the hole has progressively spalled, leading to an early failure.

In the present invention, the hollow ball is formed by casting a wear metal shell of alloy steel, iron or the like about a core of the desired size and shape which is mounted on an arbor or spider where the radial pipe-like spools or arms of the spider may be constructed of the same material as that used in the casting of the shell. The spools or arms of the spider are advantageously hollow with both ends open so that the gases evolved during solidifying of the metal will discharge through the hollow arms of the spider. Moreover, the disintegrated core materials may also be removed through the hollow arms after the ball has been formed. Thereafter, the projecting ends of the hollow arms are removed so as to be flush with the exterior surface of the ball. The open ends of the arms may be plugged or left open, as desired. With this method of manufacturing, the opening in the wall of the ball does not spall or adversely affect the structural characteristics of the hollow ball. This is particularly true since the arms of the spider form a part of the cast ball.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed and in forming a part of this specification.

For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

Of the drawings:

FIG. 1 is an exterior view of a hollow ball cast in accordance with the present invention;
FIG. 2 is a cross-section of a hollow ball after the shell has been cast and before the projecting ends of the core supporting spider have been removed; and
FIG. 3 is a cross-section, taken at line 3—3, of the core used in casting the ball shown in FIG. 2.

The hollow metallic balls of the present invention have been successfully used in the operation of a pulverizer of the general type shown in U.S. Patent 2,275,595. In the illustrated embodiment of the invention, the hollow ball has an exterior diameter of 12" with a wall thickness of 23 1/4". Hollow balls of the type described have been successfully cast having exterior diameters ranging from 8 1/4" to 22 1/4", with metal wall thicknesses from 1 1/4" to 3".

Larger or smaller diameter balls having a greater or lesser thickness than that here indicated may also be cast; the size being determined by the use to which they are applied or adapted and the balls may be used in other types of pulverizers. Advantageously, the hollow cast ball of the present invention may be formed from a metal having a high resistance to abrasion and may be heat treated to obtain desired physical and metallurgical characteristics.

Experience has shown that hollow balls of the type described, when heat treated for service in a pulverizer, resist impact stresses and heat effects better than solid balls formed from the same material and similarly heat treated. Such improved results are attributed to the absence of the usual stresses which in the case of a solid ball normally concentrate at its center. The hollow ball also has a superior ability to dissipate localized heating which may occur in a portion of the ball during operation.

In manufacturing the hollow ball shown in the drawings, a spider 10 is constructed with four hollow arms 11 joined by a plate 12, or the like, with the ends of each arm maintained open for subsequent passage of granular materials therethrough. It is preferred that the spider, with its hollow arms, should be fabricated from metal of the same general composition as that contemplated for the finished ball so as to minimize thermal expansion and contraction differences within the wall of the ball. The arms 11 are radially disposed in a common plane and of sufficient thickness to extend outwardly beyond the exterior surface of the cast ball.

As shown in FIG. 3, the four arms 11 are located with the arms all lying in a common plane. It will be understood that a greater or lesser number of arms 11 can be used in the same plane or otherwise, if necessary to support the core 13, to facilitate the venting of gases, or for removal of the core materials after completion of the ball casting operation.

In the casting of larger hollow balls, for example 18" in diameter, it may be desirable to fasten a framework of rods or wires or the like (not shown), to the arms 11 of the spider 10, with the framework generally following the configuration of the spherical core 13. Such a structure serves to both support and reinforce the core material and aids in the formation of a core member of sufficient strength to maintain its shape during the casting operation. The framework wires or rods may also be of metal having the same general composition as that of the cast ball.

Generally, the core material will consist of the usual foundry sand composition having a binder such as oil or a plastic which is consumable at metal casting temperatures. The core 13 will be fabricated about the spider by usual foundry procedures and may be heat treated or baked to provide a core body having sufficient strength to withstand the metal casting process.

Following the formation of the core 13 on its supporting spider 10 the core will be mounted in the mold, maintained in the desired position by the arms of the spider which extend beyond the mold shape formed in the drag and the cope.

With the mold formed for the desired exterior ball dimension and the core in place, the molten metal is poured from above through a proper riser to form the hollow metallic sphere 15. After cooling, the casting is withdrawn from the mold, the feed head removed and the portion 16 of the arms 11 (see FIG. 2) extending beyond the exterior surface 17 is removed to form the finished ball 18 shown in FIG. 1.

Gases evolved during the solidification of the metal within the mold escape from the interior of the ball through the openings of the arms 11. At the same time, the binder used in the construction of the core 13 will be consumed by heat given off by the hot metal and the core will disintegrate into a granular form. Such disintegration will occur after the metal has solidified sufficiently to be self-sustaining, and gases evolved during consumpition of the core binder will also escape through the hollow arms 11. After the removal of the casting from the mold, the granular core material may be re-
moved from the ball through the hollow arms 11 by flushing the ball with either air or water.

While the invention has been illustrated by the use of a fabricated spider 10, it will be understood the spider may be of cast construction with cored hollow arms where such arms may be of any desired number.

While in accordance with the provisions of the statutes I have illustrated and described herein the best form and mode of operation of the invention now known to me, those skilled in the art will understand that changes may be made in the form of the apparatus disclosed without departing from the spirit of the invention covered by my claims, and that certain features of my invention may sometimes be used to advantage without a corresponding use of other features.

What is claimed is:

1. An article of manufacture comprising a metallic hollow cast ball having a plurality of hollow members forming a part of and each having a length greater than the thickness of and extending outwardly through the wall of said hollow ball to an outer end substantially flush with the exterior surface of the hollow ball, said members being formed of the same composition as said metallic ball.

2. An article of manufacture comprising a hollow cast ball having a plurality of hollow arms extending outwardly through the wall of said hollow ball to an outer end substantially flush with the exterior surface of the hollow ball, each of said hollow arms being formed from substantially the same material as the wall of the ball and being interconnected in the central hollow portion of said ball.

References Cited by the Examiner

UNITED STATES PATENTS
1,043,855 11/1912 Main --------------- 241—184
1,215,662 2/1917 Kittle --------------- 241—184
1,247,545 11/1917 Kittle --------------- 22—204
1,483,932 2/1924 Ellis --------------- 241—184
1,746,236 2/1930 Barton --------------- 22—200
2,440,952 5/1948 Hurley --------------- 22—204

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