Jan. 21, 1947. C. H. SAUER 2,414,672

BOWLING BALL CONSTRUCTION

Filed Nov. 8, 1943

Fig. 1.

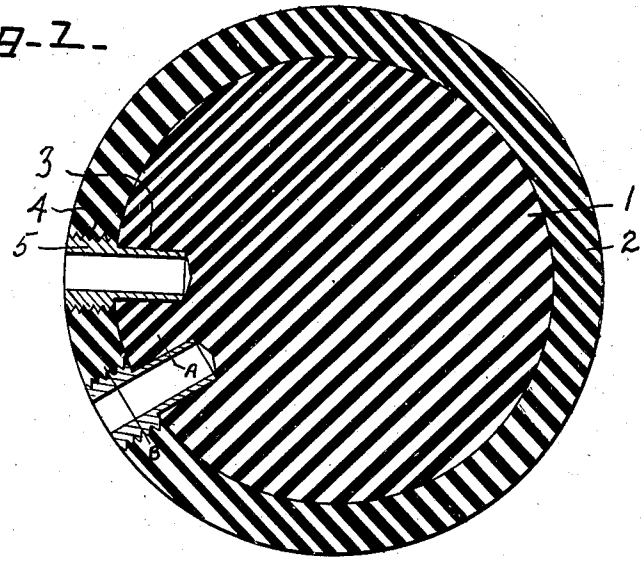


Fig. 2.

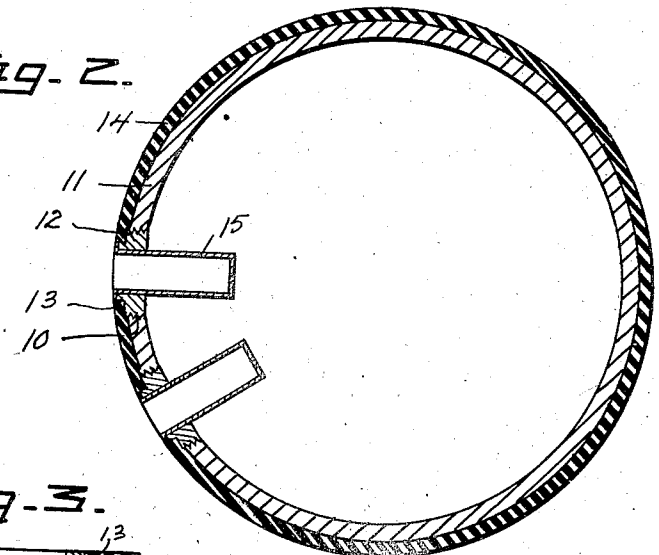


Fig. 3.

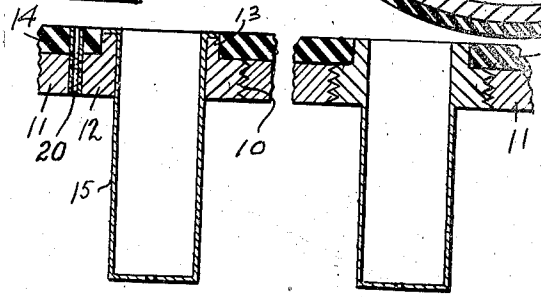
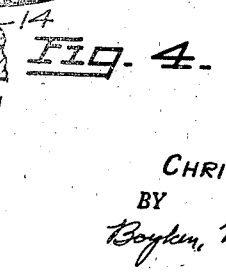


Fig. 4.



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BOWLING BALL CONSTRUCTION

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1 Claim. (Cl. 273—63)

1

This invention relates to bowling balls, and has for its principal object the provision of a bowling ball, including finger and thumb sockets, that is more perfectly balanced than heretofore.

At the present time most bowling balls have a core and an outer shell, the former being less dense than the latter since the shell takes the initial impact upon striking the pins. Either or both the core and shell may be of rubber or of composition material, but the shell in any instance is relatively hard. The drilling or forming of the finger and thumb sockets creates an unbalanced condition. In an attempt to compensate for this condition the present makers of balls merely insert a block of hard rubber of greater density than the core within said core and off-center during molding of the core and before the shell is molded in place. The general location of this block in the finished ball is readily detected and the finger and thumb holes are then formed in the side adjacent the block. Since the heavier, off-center mass is fully enclosed in the shell, it is manifest that the accurate uniform positioning of the finger holes in the balls is impossible. All that is expected is a slight compensation and the variations in the balance of the balls is quite wide. However, with this method and structure it is impossible to produce a very close balance, no matter how accurately the holes are formed in the heavy side of the ball. This fact is readily perceived when it is considered that the weight of the heavier, off-center material is radially inwardly of the outer shell and, therefore, there is no compensation in the outer shell for material removed therefrom. Also the off-center material is spread over an appreciable area both radially inwardly from the finger holes and laterally of said holes.

In other instances hollow balls have been made of metal with an outer coating, an example of which is the United States patent to Hyatt, No. 1,111,022, of September 22, 1914. Of course, in these balls tubular thimbles or grip-sockets must be provided for the fingers. In hollow balls of this type the thimbles have been many times heavier than the metal that is removed, and the major weight of the same has been offset radially relative to the holes formed in the metal ball and coating therefor.

With my invention the balls are as accurately balanced as is possible where holes must be formed in a ball, as is the case in bowling balls. This accuracy is far greater than in any conventional structure heretofore employed, insofar as I am aware.

2

In the drawing,

Fig. 1 is a sectional view through a solid ball and through several of the grip sockets.

Fig. 2 is a sectional view through a hollow metal ball having a coating of hard rubber or of composition material.

Fig. 3 is an enlarged fragmentary sectional view through one of the holes and thimble of Fig. 2, and Fig. 4 is an enlarged fragmentary section of a slightly different structure than that of Fig. 3.

In detail, the ball of Fig. 1 comprises a spherical core 1 and a spherical outer shell 2 integrally united thereto. The core and shell may be formed absolutely true insofar as their balance is concerned, a step that is readily accomplished. After the ball is so formed, it may be drilled for the finger grips. These drill holes ordinarily extend through the shell and into the core 1, which core is less dense or heavy per cubic inch than the shell 2.

In view of the difference in density, hole 3 that extends into core 1 is of less diameter than the portion 4 of the hole that extends through the shell, which latter portion may be a counter-bore and threaded. Into each hole 3, 4 is inserted a tubular thimble 5 preferably of metal. This thimble is of the same weight at any point thereabout as the weight of the material of the core or of the shell at such point or in a plane transversely of the thimble and hole at said point. Thus a section at line A is equal in weight to the portion of the core removed at said line, and a section at line B is equal in weight to the portion of the shell removed from said shell at said line. The metal of the thimble may be an alloy of a light and a heavy metal, such as ferro-aluminum, in which the weight can be materially varied without change in size of the thimble. Aluminum-copper alloy is satisfactory where the ball is of composition material, such as a thermo-setting plastic, rather than of hard rubber. The specific gravity of hard rubber and plastics is between about 1.1 and 1.5 and the specific gravity of aluminum, iron and copper are about 2.58, 7.5 and 8.9, respectively. As aluminum will combine with copper in an amount anywhere from about 1% to 95%, and also as aluminum will combine with iron in almost any proportion, although from 5% to 20% aluminum is most practical, it will be seen that the weight of the thimbles may be very accurately determined and they may be suitably proportioned. These examples of alloys are not intended to be restrictive, since it is obvious that any of the various metals substantially heavier than the weight of the material removed from

the hole may be used, such as steel, and the amount calculated with respect to the size of the hole and the specific gravity of the material of the ball to compensate for the latter material that is removed. Hole sizes and the material of the ball may vary according to the requirements of the user or the specifications of the manufacturer.

In the ball of Fig. 1 the thimble **5** is thinner where it extends into the restricted diameter bore **3** in the core, while that portion extending through the denser layer **2** of the ball is thicker. This variation corresponds to the difference in the specific gravity of the core and of the outer layer. The thicker portion may be threaded to engage the threads in counterbore **4** or may be secured in the ball in any other suitable manner.

Referring to the hollow metal ball of Fig. 2, it is obvious that the ball cannot be quite as accurately balanced as with the solid ball since the thimbles that form the finger grips will protrude into the ball. However, an extremely close balance can be had by threading the opening **10** in the metal ball **11** (Fig. 3) and by threadedly securing an annular member **12** of lead or a lead alloy in said opening. This member **12** in the plane of the metal ball **11** is practically the weight of the material, such as steel, that is removed to make the opening and it carries a neck **13** that is the weight of the outer shell **14** that is bonded to the steel.

Secured in the opening in each member **12** is a relatively thin tube **15** of magnesium alloy or aluminum, that provides the finger grip. The weight of member **12** is preferably slightly less than that of the material removed from the opening in the steel ball so that the weight of tube **14** plus that of member **12** will equal the weight of the material removed for the opening in the steel ball **11** and in the shell **14**, although the latter is preferably molded in place after the member **12** is fitted in opening **10** so that the material of the shell will cover the outer surface of member **12** and will tightly embrace neck **13**. The tube **15** may be a tight press fit in member **12** or it may be secured rigidly thereto by any other suitable means.

The specific gravity of steel being about 7.8 and that of lead over 11, it will be seen that the member **12** will readily compensate for the steel removed from the opening in which it is fitted. The specific gravity of the tube **15** may be about 2 which is about the same as hard rubber, the latter being about 1.5.

A hollow pin **20** may be tightly fitted into an opening drilled through the threaded portion of ball **11** (Fig. 3) to function both as a lock for the member **12** and as a vent opening to relieve an objectionable suction that might be created in the tube **15**, the latter also being formed with

an opening to provide for a communication between the interior of the tube and the passageway through pin **20** by way of the inside of the ball. Any suitable vents may be provided to break possible objectionable vacuum.

In any event, the important points are that (1) the specific gravity of the material surrounding the insert or thimble forming the finger grip at any one point along the latter must be less than the specific gravity of the finger grip and (2) the material of the thimble or combined thimble and holder (Fig. 3) in any plane at right angles to the axis of the opening in the ball must substantially equal the weight of the material of the ball that was removed in that same plane for said thimble.

I am aware that thimbles have been previously disclosed, as in the Hyatt patent already mentioned. Also in solid balls they have been shown, as in United States patent to Dokkenwadel, No. 531,103, December 18, 1894, but there was no concept of how to balance the balls by the material of the thimbles. Instead, the old practice of using extra counterweights at points spaced from the holes has been used, or else the thimbles have so overbalanced the balls by actually adding objectionable weight at the holes.

It is manifest that the thimbles may have their walls tapered longitudinally thereof on their outer sides where two layers of material of different specific gravity are drilled for the holes.

Where the ball is solid, as in Fig. 1, it is relatively important that the inner end of the thimble or liner **5** be open, or if it is closed, then the material thereof should be quite thin so as to not seriously overbalance the ball at the points where said ends are positioned.

Various modifications may be made in the actual structure used without departing from the scope of the invention intended to be covered by the claim, and the method described herein may be used to balance balls having different sized holes, or at different angles, or of different shapes.

Having described my invention, I claim:

In a bowling ball formed with a plurality of radially extending, outwardly opening holes therein for the fingers of a hand; a tubular liner for each of said holes extending the full length of each adapted to receive therein one of such fingers; the specific gravity of the material of each liner in any plane transversely of its axis and at any point along said axis being greater than the specific gravity of the material of the ball surrounding said liner in such plane at any such point; and the weight of a section of such liner in any such plane and at any such point being substantially equal to the weight of the volume of said material that would be required to fill said hole at such point.

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