

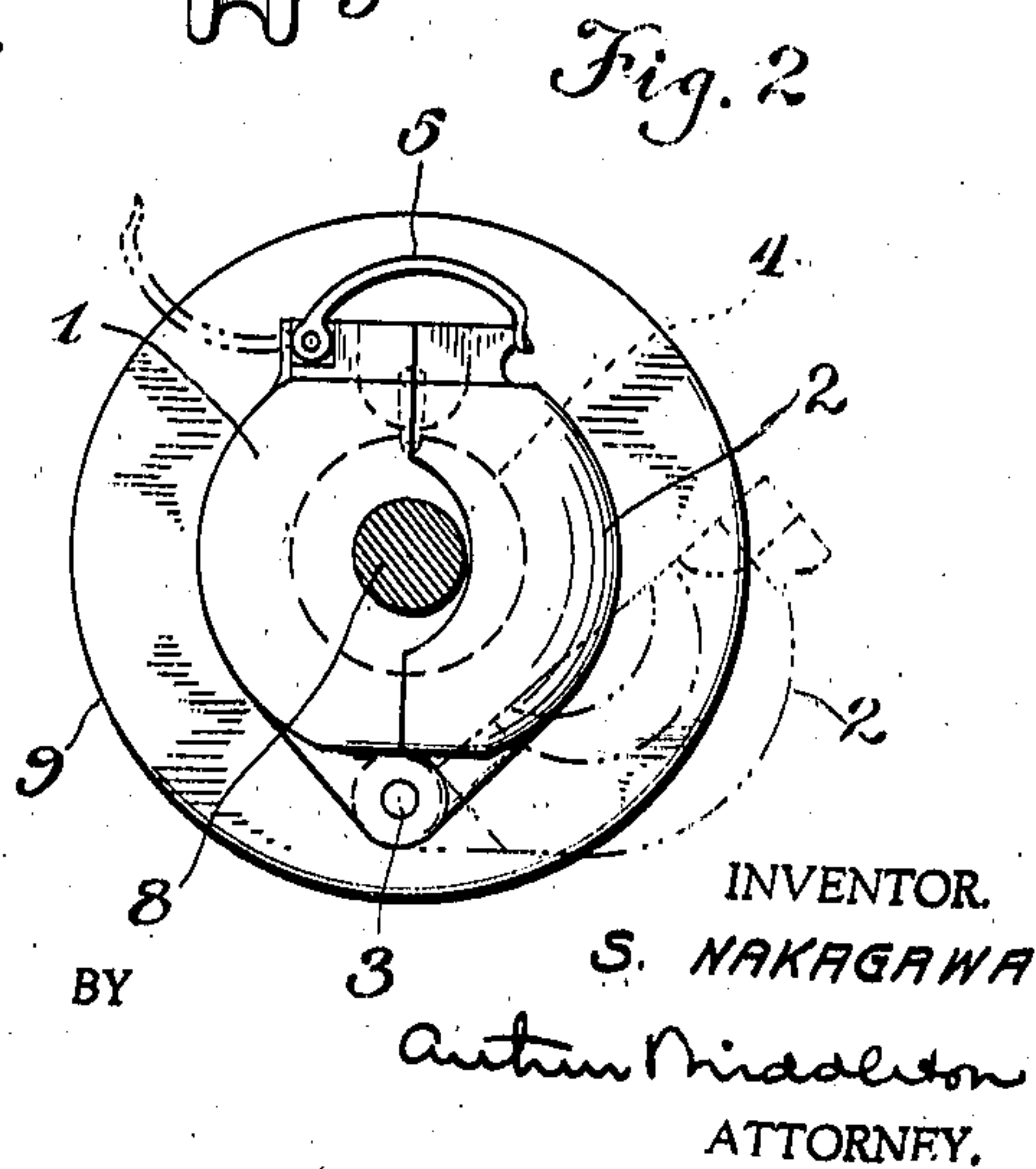
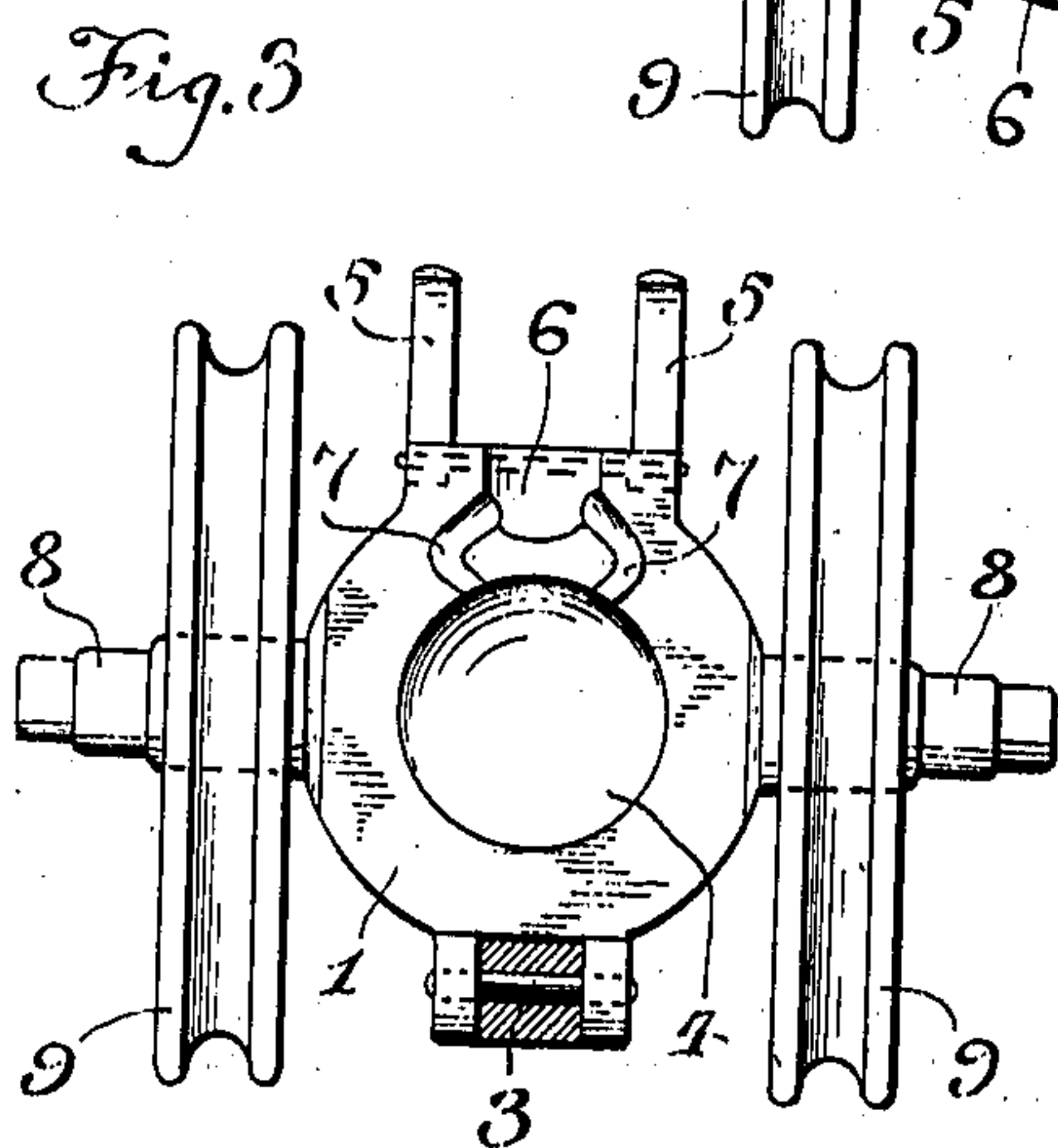
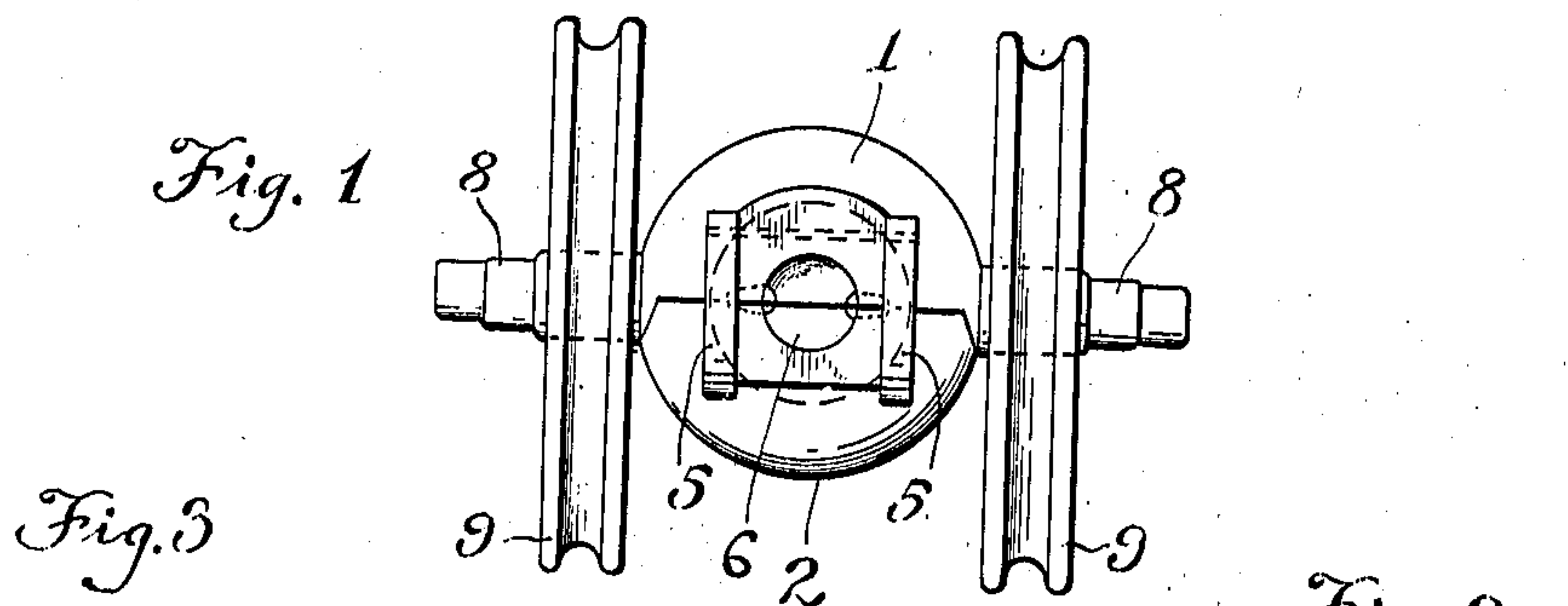
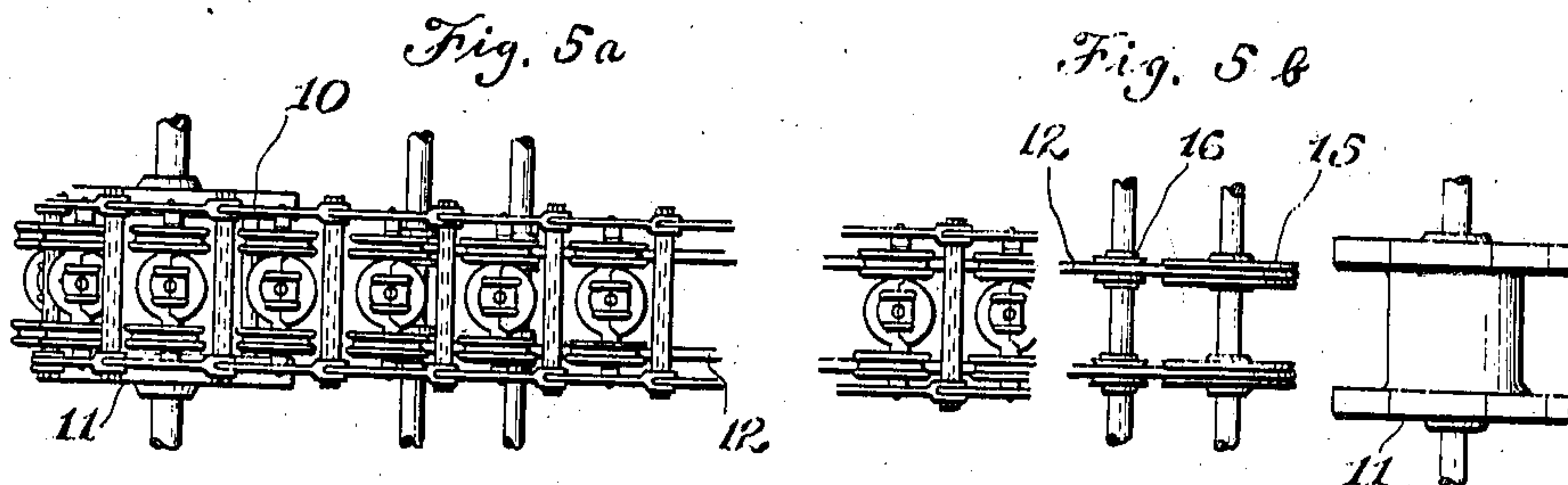
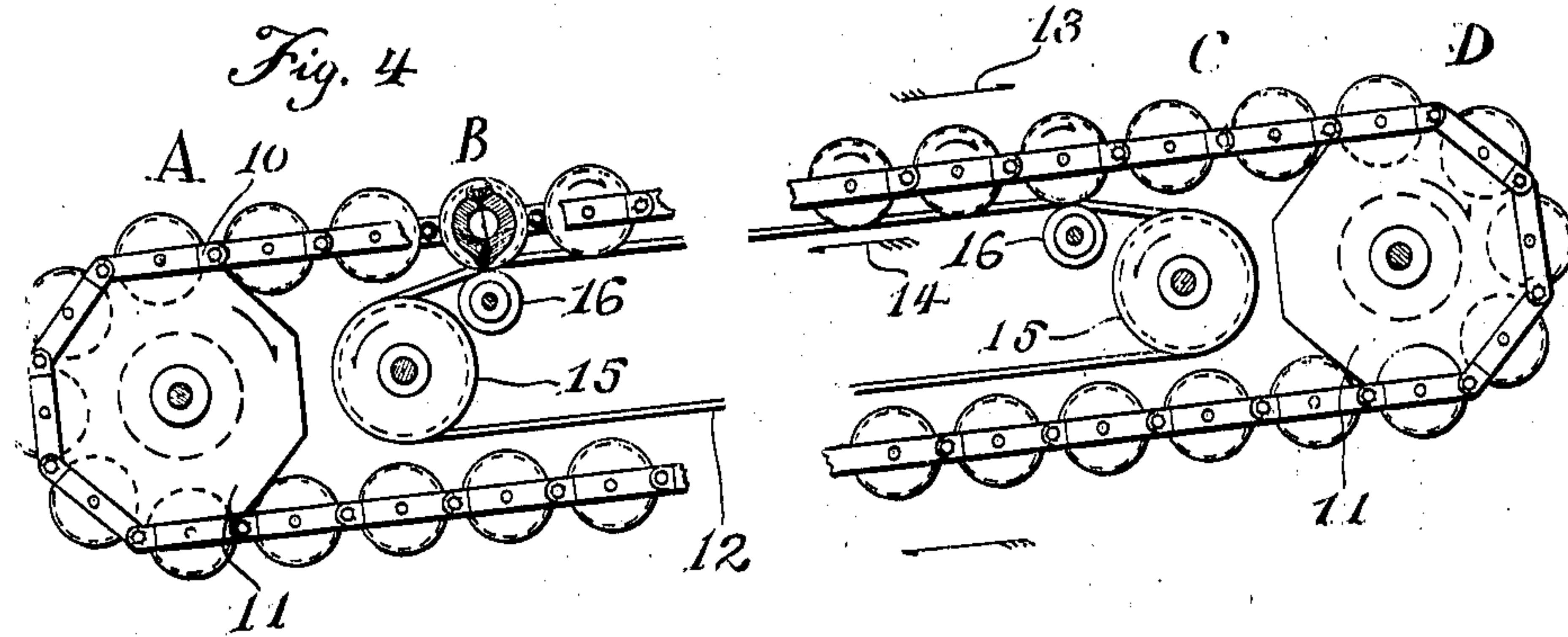
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2,184,257

PROCESS FOR MANUFACTURING CHILLED HOLLOW BALLS

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PROCESS FOR MANUFACTURING CHILLED HOLLOW BALLS

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1 Claim. (Cl. 22—200)

The present invention relates to a process for manufacturing chilled hollow balls by centrifugal force and more particularly to a process by which molten metal charged in the spherical room of a mould is cast into a chilled hollow ball by cen-

trifugal force due to the rotation of said mould. In manufacturing a metal ball, especially a steel ball, it has been usual to manufacture at first a metal lump of irregular form by forging means and then grind it into a spherical form. This process requires, consequently, much trouble and time.

After finishing by grinding and polishing the chilled ball produced by this process it can be used as a bearing-ball or similar ball of uniform quality and high hardness.

According to the present process, the molten metal charged in the mould is distributed over the spherical inside face of said mould by the centrifugal force, with the result that a hollow portion of spherical form is produced naturally in the molten metal so that the ball chilled from said metal becomes a hollow hard ball of smaller weight having its center of gravity not positioned excentrically. Consequently, the product by the present process is very suitable for use as a ball for bearing and other various purposes. Especially when this ball is used for a ball mill, as the hardness of the surface portion of the ball is very uniform, it is worn equally all around its surface and when it is worn out to a certain length of the radius, i. e., to the unchilled portion, it may disintegrate naturally into pieces, so that it can be then removed conveniently from the drum of the ball-mill.

Another object of the present invention is to provide an apparatus carrying out the foregoing process conveniently and simply, that is, an apparatus, in which endless chain belts carrying many moulds rotatably thereby and other endless belts cooperating with the above belts to rotate said moulds are so arranged that on the way of travelling from the molten-metal-supplying position to the ball-taking-out position the moulds are so rotated rapidly about their axes that the molten metal in each mould is subjected to the centrifugal force.

The invention possesses other objects and features of advantages, some of which with the foregoing will be set forth in the following description. In the following description and in the claim, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit. In the accom-

panying drawing, the best embodiments of the invention known to the inventor have been illustrated, but such embodiments are to be regarded as typical only of many possible embodiments, and the invention is not limited thereto.

The novel features considered characteristics of the present invention are set forth with particularity in the appended claim. The invention itself, however, together with additional objects and advantages thereof will best be understood from the following description of specific embodiments when read in connection with the accompanying drawing, in which:

Fig. 1 is a plan view of an embodiment of the mould such as may be used in the present invention;

Fig. 2 is a sectional side elevation of the same;

Fig. 3 is a sectional front elevation of the same, the one half thereof being cut away;

Fig. 4 is a partly sectional side elevation of an embodiment of the apparatus due to the invention, the intermediate portion thereof being cut away, and

Fig. 5a is a partial plan view of the apparatus, and

Fig. 5b is also a partial plan view of the same, chain belts thereof being partly cut away.

Now, referring more particularly to the accompanying drawing, a metal mould consisting of two halves 1 and 2 which are jointed with each other by a pin 3 at their lower parts, and which form a regular spherical cavity or room 4 when they are clamped together by hooks 5 of elastic metal shown as pivoted to the one half 1 of the mould is provided at its upper end with a tap 6 and tap holes 7 and also provided with trunnions 8 to which are fixed grooved wheels 9.

When the molten metal is poured into the cavity 4 of the mould through the tap holes 7 the portion of said metal remaining in the narrow tap holes solidifies soon to blockade said holes. When the mould thus charged with the molten metal is rotated rapidly about its axis, i. e., its trunnions 8, then the molten metal is dispersed toward and solidified closely upon the surface of the cavity of the mould under the influence of the centrifugal force as well as the chilling action, and at the same time produces a hollow portion therein to form a hollow chilled ball. This ball is then taken out from the mould by disengaging the hooks 5 and swinging away the half 2 into the opening position as shown by the imaginary lines in Fig. 2. By grinding and polishing this ball it becomes a finished product suitable for various using purposes.

One embodiment of an apparatus which can put into practice the foregoing process conveniently is illustrated in Figs. 4 and 5, wherein many moulds are carried rotatably by two parallel endless chain belts 10 embracing two octagonal or other polygonal wheels 11, within the loop of which belts 10 two parallel endless belts 12 are arranged so as to drive the grooved wheels 9 of the moulds just travelling above said belts 12. The cycling directions of the belts 10 and 12 are made opposite to each other, that is, determined in such a manner that when the belts 10 transport slowly the moulds, for example, in the direction of the arrow 13, then the belts 12 travel in the direction of the arrow 14, so that the moulds above the belts 10 are rotated rapidly about their trunnions 8. It will be noted that the belts 12 embrace the grooved wheels 15 and are pressed against the grooves of the wheels 9 by small pulleys 16 when travelling above and between said pulleys.

Now, when the endless chain belts 10 and the endless belts 12 are cycled in the directions shown by the arrows 13 and 14, respectively, and each of the moulds is charged with the molten metal in the place A, then the molten metal remaining in the narrow holes 7 is cooled down and solidified to blockade said holes before the mould reaches the place B, and during travelling from the place B to the place C the mould is rotated rapidly by the endless belts 12, so that the molten metal therein is slung and distributed closely upon the inside surface of the cavity 4 by the centrifugal force to form a hollow ball. The mould, when reaching the place D, is opened and the ball is taken out therefrom. The opened mould travels thereafter around the wheel 11 to the slack (lower) side of the belt 10, where it

is again closed tightly, and the closed mould, travelling around the wheel 10, is charged repeatedly with the molten metal in the place A. Thus, the operation of the apparatus is repeated.

In the foregoing embodiments, although the mould is adapted to rotate about a horizontal axis only, the viscosity of the molten metal and the diffusibility of air enable the molten metal under the influence of the centrifugal force to form a chilled ball with an approximately regular spherical hollow portion. However, if the mould is rotated simultaneously about the horizontal axis as well as about the vertical axis, the spherical hollow portion would have a still more regular form.

Although I have described two specific embodiments of the invention, it will be apparent that various changes, additions, modifications and substitutions can be made therein without departing from the spirit of the invention or the scope of the appended claim.

What I claim as new and desire to secure by Letters Patent is:

A process for manufacturing chilled hollow balls by centrifugal force, comprising pouring molten metal into a spherical inner room of a metal mould which consists of two halves pivotally jointed with each other and provided with cavities to form said room, tap and tap hole or holes, blockading the tap hole or holes of said mould with the portion of said molten metal cooled down therein, and solidifying the molten metal in the mould while rotating said mould rapidly about an axis, so that the content in the mould is changed into a surface-chilled ball having a hollow portion therein.

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