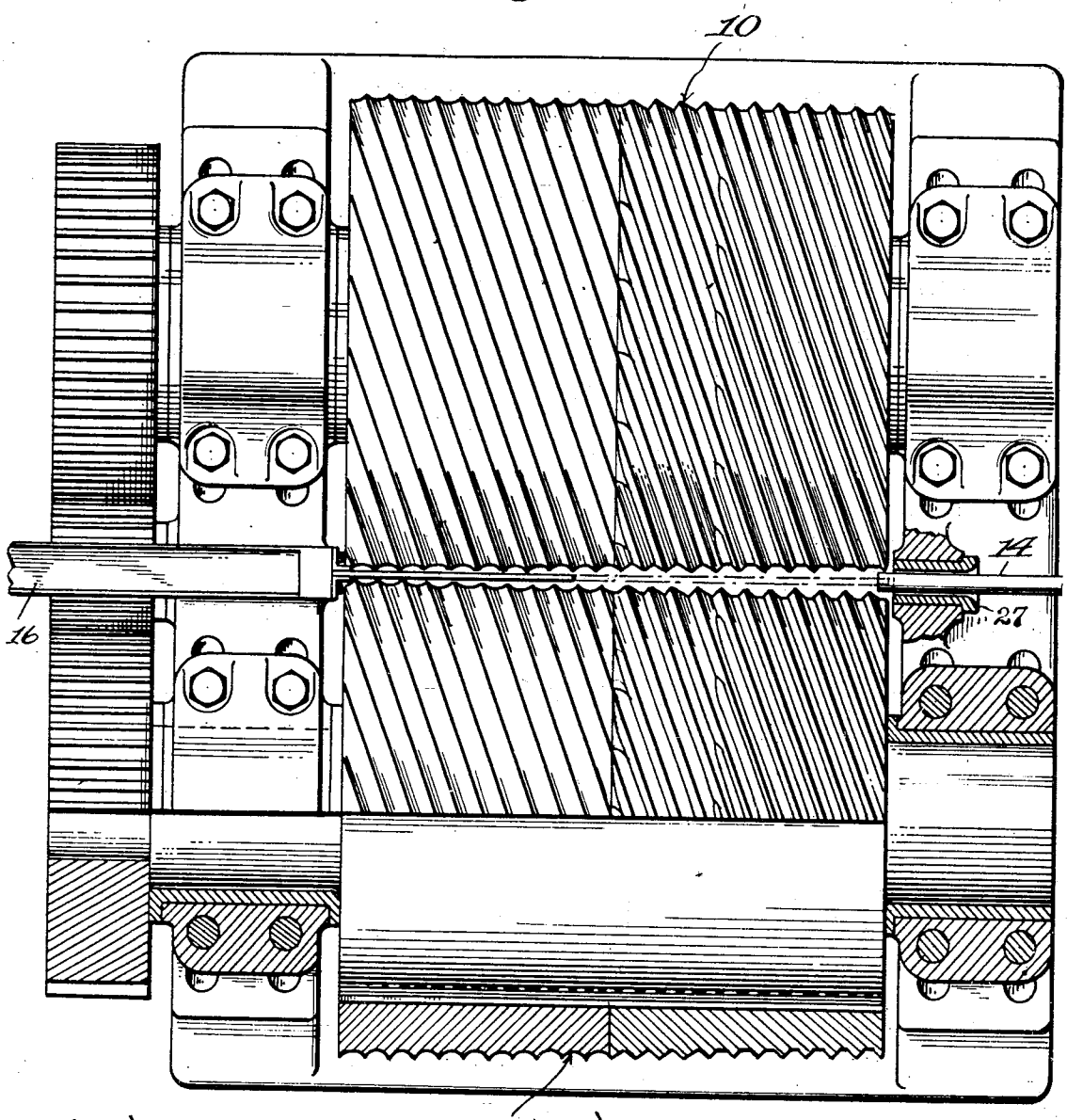
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A. CANDA

FORGING BALLS FROM LONG BARS

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Fig. 1.



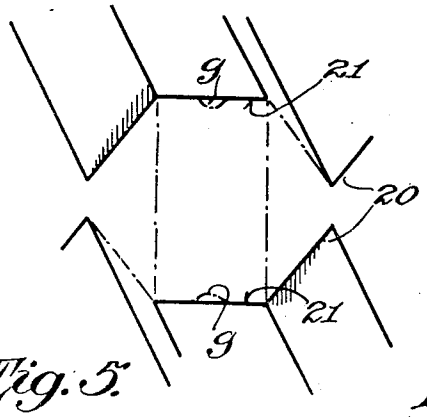


Fig. 5.

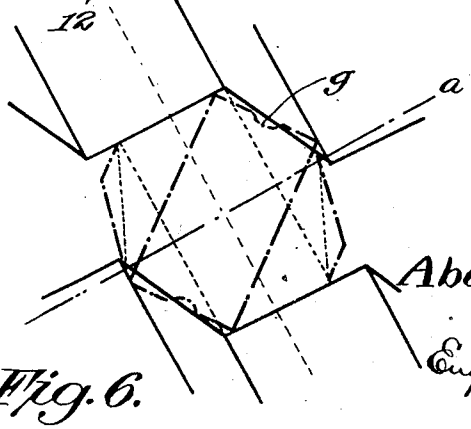


Fig. 6.

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Fig. 2.

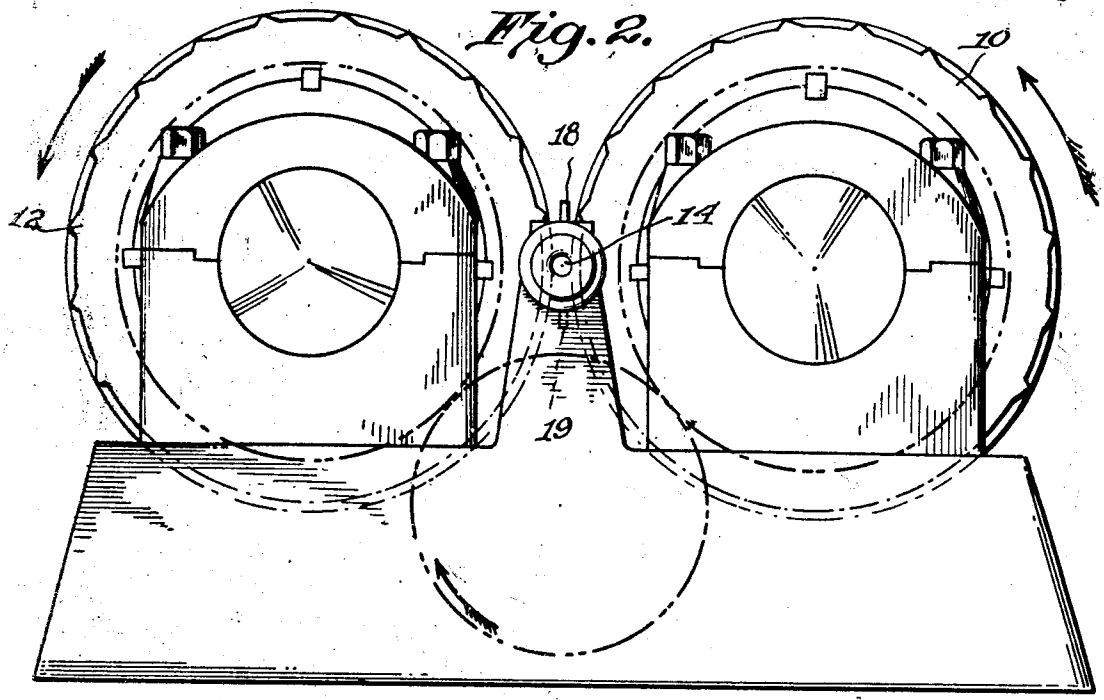


Fig. 3.

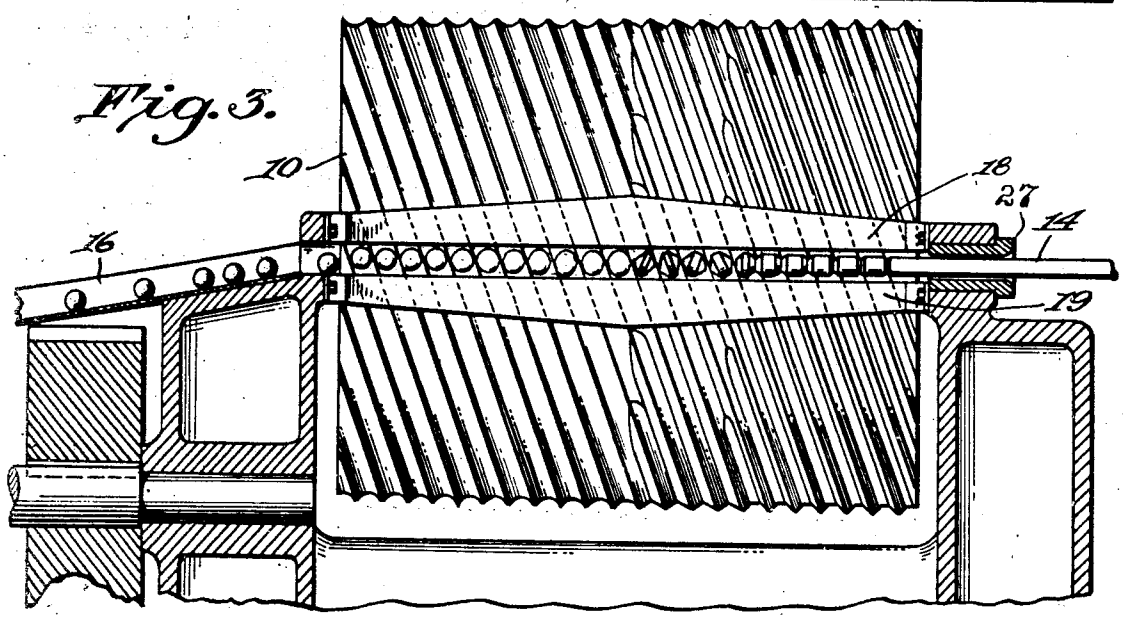
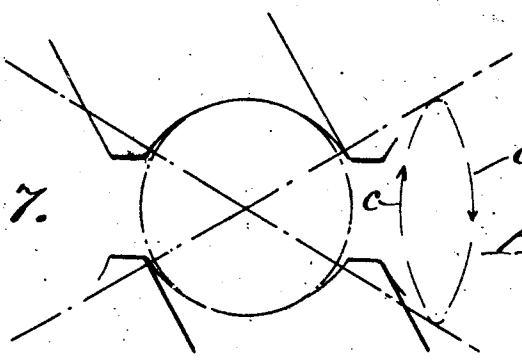


Fig. 7.



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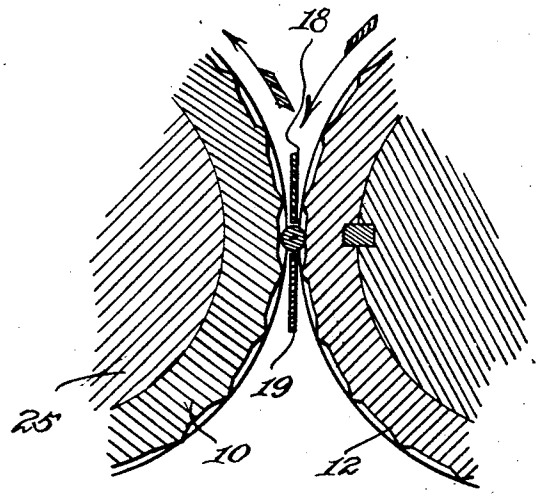


Fig.4.

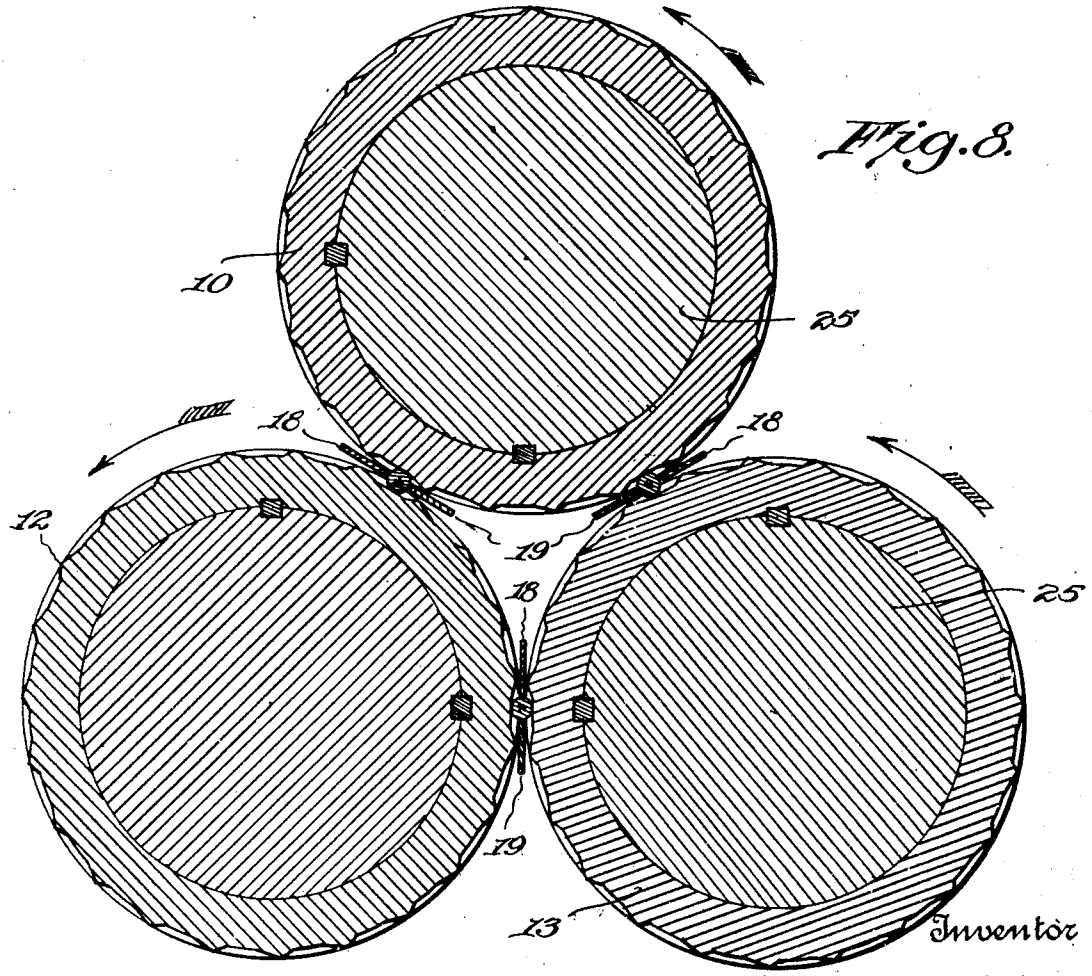


Fig.8.

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UNITED STATES PATENT OFFICE.

ABEEL CANDA, OF CRANFORD, NEW JERSEY.

FORGING BALLS FROM LONG BARS.

Application filed May 12, 1924. Serial No. 712,859.

My invention relates to a method of forging balls from long bars or rods and to apparatus for carrying out this method.

In forging balls from long bars, the finished balls are necessarily of greater diameter than the bars and consequently the metal must flow from the ends of the ball element toward the center and must be subjected to the proper pressures during the shaping process in order to prevent flaws in the finished product. When the balls are formed in substantially circular grooves extending around the circumference of a cylindrical drum, the grooves must have the same uniform contour throughout their extent, the shaping of the balls being effected by gradually narrowing the width of the pass. I have found that it is practically impossible to form perfect balls free from creases and other flaws by this method. Accordingly I have devised a method by which the metal progresses continuously through grooved channels of varying shapes in which the metal is subjected to a kneading action which causes the metal to more readily flow into the deeper parts of the grooves and prevents the formation of internal flaws, producing a compact homogeneous mass. During the first stage of the process the bar is gradually sheared along its length into billets, the metal being caused to flow toward the ball centers while the bar is rotated upon its axis. When the bar is nearly severed the ball elements pass into grooves which are slightly flattened so that the stock may take a spiral movement sufficient to break the connecting necks after which the separate ball elements are operated upon by the flattened groove in a manner to forge out the central peripheral ring left between the metal which has moved up into the groove from opposite ends. At this stage the billet or ball element has been shaped to form a double cone with their bases together. From this point the elements are subjected to the action of round grooves which shape them into true spherical form.

The object of my invention, therefore, is to provide a method of forming spherical balls free from flaws by subjecting the stock to forming grooves having a spiral path and varying in shape from one portion of the groove to another portion.

In the following description of an apparatus for carrying out this method I shall refer to the accompanying drawings, in which—

Figure 1 is a top plan view partly in section, of a machine embodying the features of my invention; Fig. 2 is an end elevation of the same; Fig. 3 is a central vertical longitudinal sectional view of the same; Fig. 4 is a fragmentary sectional view showing the arrangement of the guides for directing the stock between the rolls; Figs. 5, 6 and 7 are diagrammatic views showing the shapes of the passes at various stages through the machine; and Fig. 8 is a transverse sectional view showing the manner of applying this invention to a plurality of grooved rolls operating simultaneously upon a plurality of stock bars.

For the purpose of carrying out the method above outlined, I provide a machine having coacting rolls 10 and 12, provided with helical grooves into which the stock bars 14 are fed endwise, the completed balls being delivered at the opposite end of the rolls into the chute 16. The stock is fed on the center line of the coacting rolls and the metal is worked upon this center line, thereby eliminating pressure upon the guide members 18 and 19.

During the first stage of the process it is necessary that the metal bar should be sheared progressively by the ribs of the rolls, which cut deeper and deeper until the bar is nearly severed into billets to form the ball elements. I have found that the cutting or shearing action takes place more efficiently when the ribs 20 are sharp and V-shape as shown in Fig. 5. I flatten the inner part of the wall of the grooves, as at 21, for the purpose of exerting a pressure upon the metal as it flows into the groove from the ends to prevent any tendency to spin a cavity in the center of the billet. The shape of the V-shaped shearing ribs togther with the fact that the billets are still connected by narrow necks causes them to rotate on the axis of the bar and the spiral grooves exert a kneading action upon opposite sides, indicated by the shaded edges, and this assists in causing the metal to flow toward the center of the billet.

I have indicated in Fig. 3 the action of the rolls on the stock as it progresses through the machine. By the time it has moved from one quarter to one third of the distance through the machine, the billets or ball ele-

ments have been severed and they then partake of a spiral movement. At this stage the stock has not entirely filled the grooves but has left a central ring or groove *g*, which has not filled up. To eliminate this ring the V-shape of the groove at this point is changed and slightly flattened. The shape of the groove shown in Fig. 5 then merges into the shape shown in Fig. 6. The billets being now independent of each other, partake of a spiral movement and rotate on the axis *a*—*a*. I have indicated in dotted lines the shape and position assumed by the billet at this point of the spiral pass, and in broken lines the shape at the previous point.

By the time the billets reach the central point in the machine, the groove or ring has been eliminated and they then enter the round grooves forming the latter half of the spiral path. The width of the pass is gradually narrowed until it is the diameter of the finished ball. Each ball partakes of a spiral movement, its axis rotating about an orbit indicated at *c*—*c* in Fig. 7. As the ball elements traverse this finishing portion of the pass they are rolled into perfect spheres.

The grooved shells are fitted over and keyed to solid cores 25. The shells may be made in sections having respectively V-shape and round grooves and to facilitate machining. As indicated in Fig. 2, the rolls are geared to rotate at the same speed. The bearings, of course, are movable so that proper adjustment can be made for the size of the pass and also to compensate for the wear of the grooves.

In prior machines employing spirally grooved rolls, each roll is formed with a single continuous spiral groove, while in my machine I provide the rolls with a plurality of spiral grooves. Thus in a machine having rolls 26 inches in diameter, and with a lead angle of about 30 degrees in the spiral, there are 22 grooves. Hence there are 22 different channels, which pass the inlet bushing 27 through which the rod is fed during each revolution of the drum into any one of which the rod may be inserted. This of course greatly increases the life of the roll and furthermore enables me to combine a number of such rolls in a machine, as indicated in Figure 8, so that a plurality of rods may be operated upon simultaneously.

I claim:—

1. The method of forging balls, which consists in axially rolling a heated metal bar and grooving it progressively from one end into a connected series of elements of cylindrical frustro-conical configuration, subjecting the metal to a kneading action and simultaneously causing the displaced metal to flow oppositely from the grooves, severing the metal at the grooves into separate elements, subjecting the elements to a spiral rolling motion and simultaneously compacting and shaping them into true spherical bodies.

2. A machine for forming balls from a rod or bar, comprising a pair of oppositely rotatable rolls having cooperating spiral grooves, said grooves being substantially V-shape at the feed end of the machine and merging into substantially semi-circular grooves at the finishing end of the machine.

3. A machine for forming balls from a rod or bar, comprising a pair of cooperating spirally grooved rolls, the grooves in one section being provided with angularly arranged walls varying in cross-sectional configuration in different parts thereof, and in another section the grooves being substantially semi-circular in cross-section, the ribs separating adjacent grooves being adapted to cut successively deeper into the rod or bar.

In testimony whereof I affix my signature.

ABEEL CANDA.