June 5, 1934. A. C. MUNRO 1,961,239

BALL FORMING MACHINE

Filed Sept. 24, 1932 2 Sheets-Sheet 1

Fig. 1.

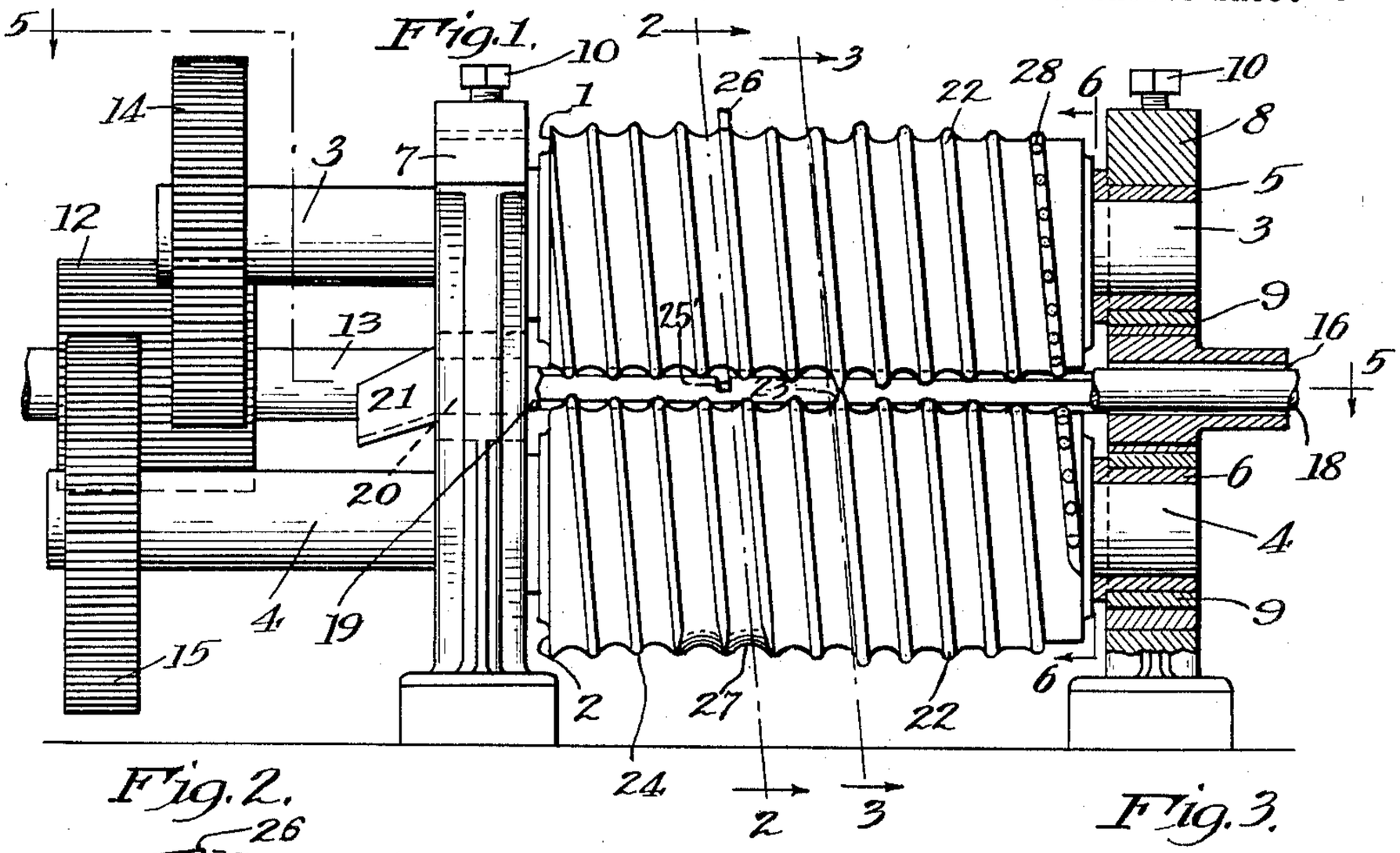


Fig. 2.

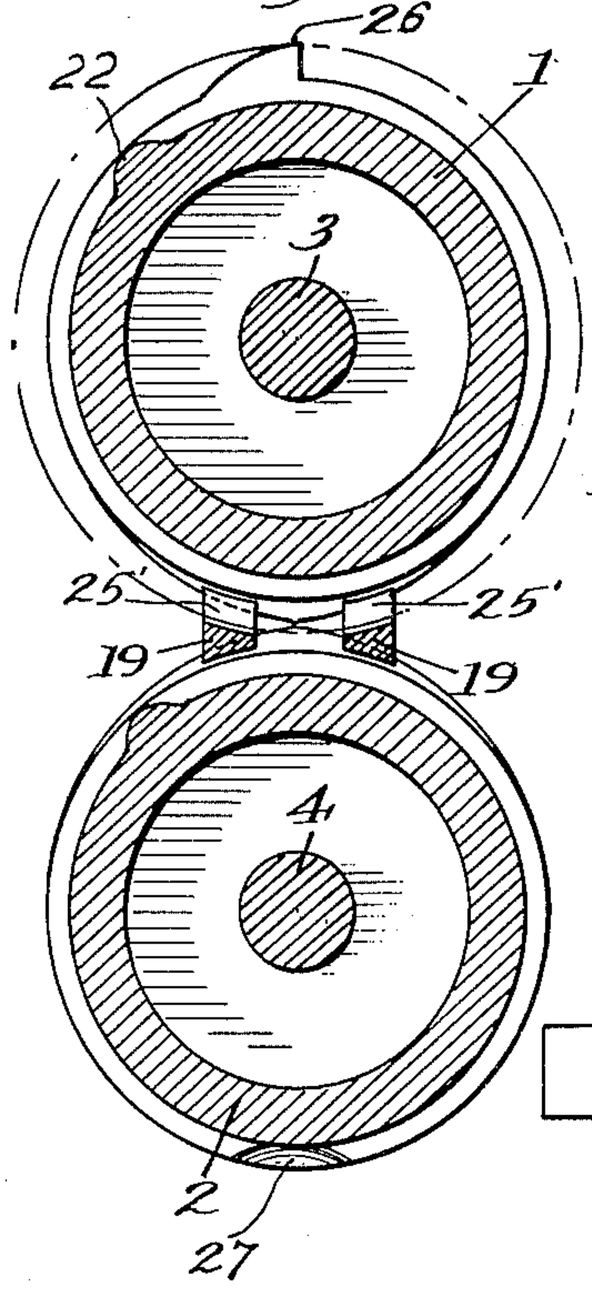


Fig. 3.

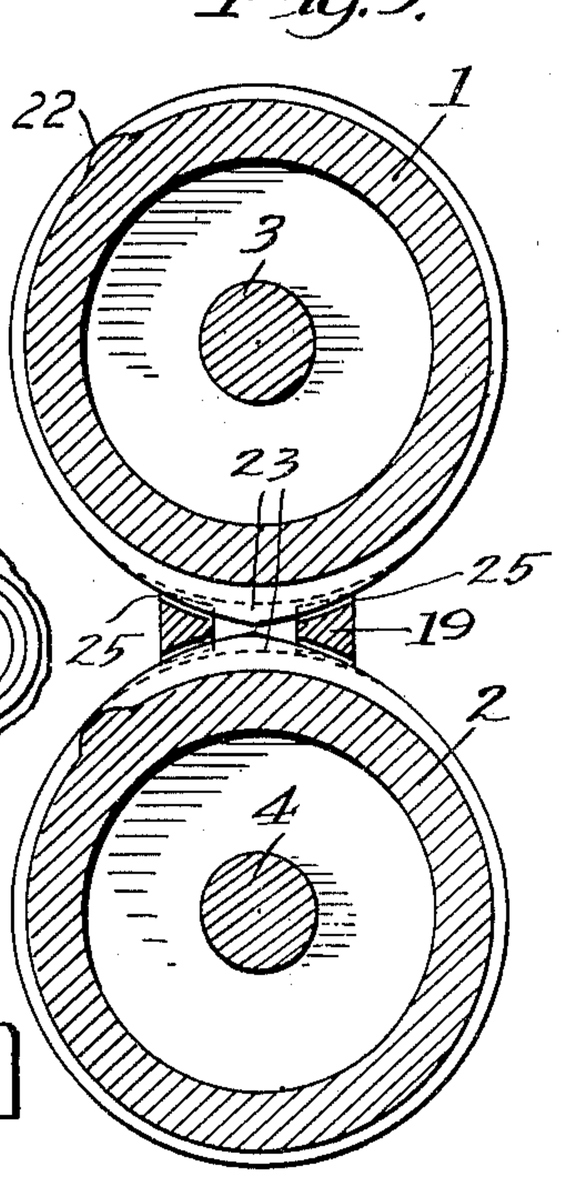
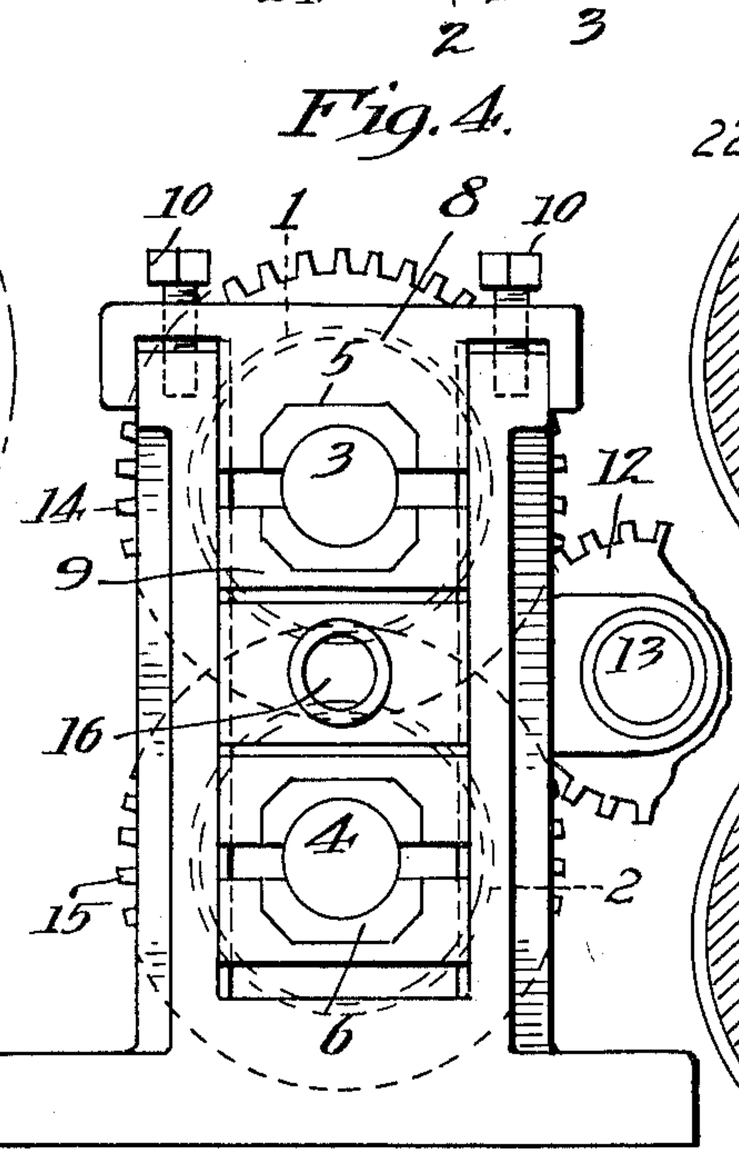


Fig. 4.



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2 Sheets-Sheet 2

Fig. 5.

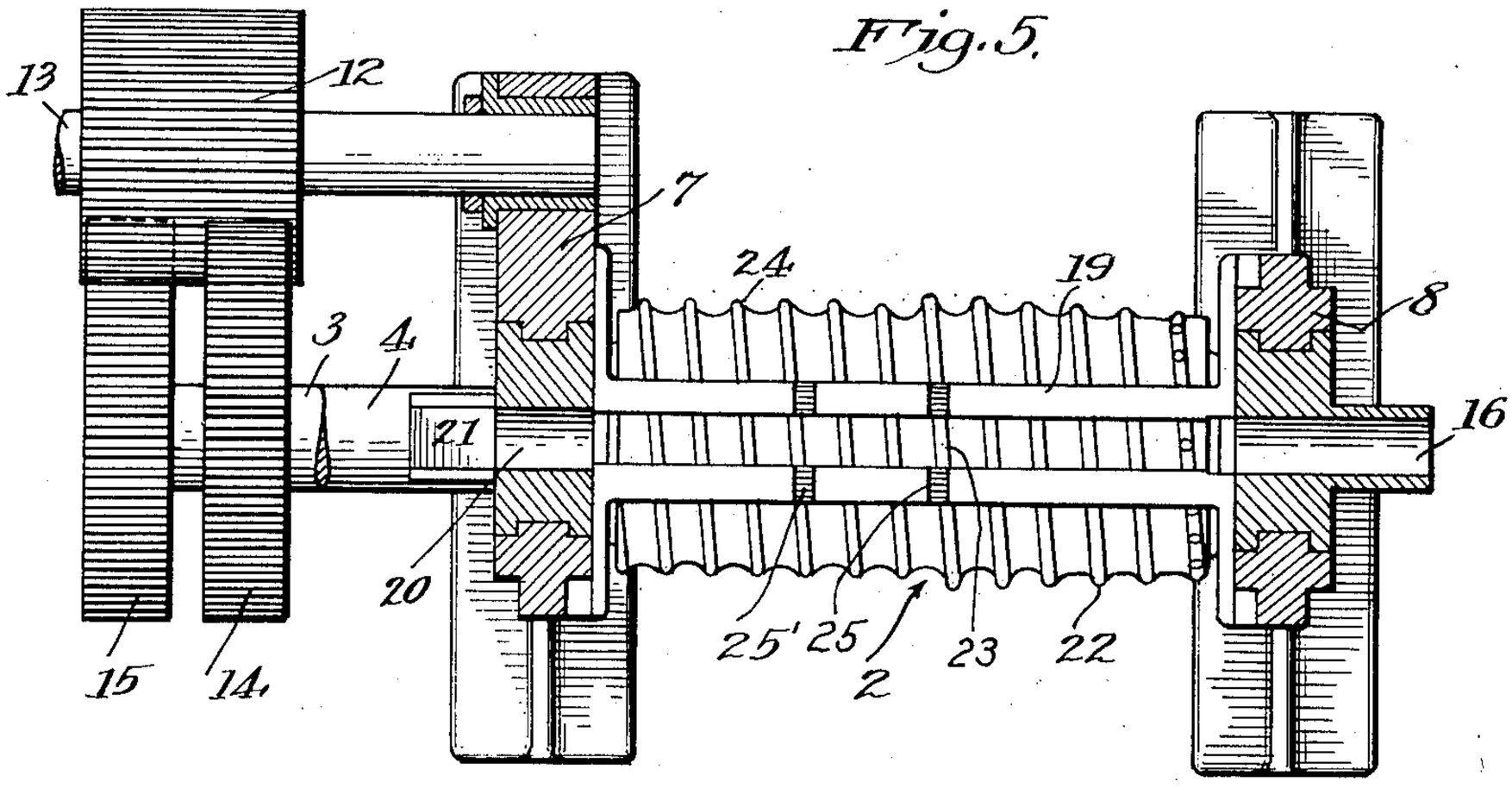
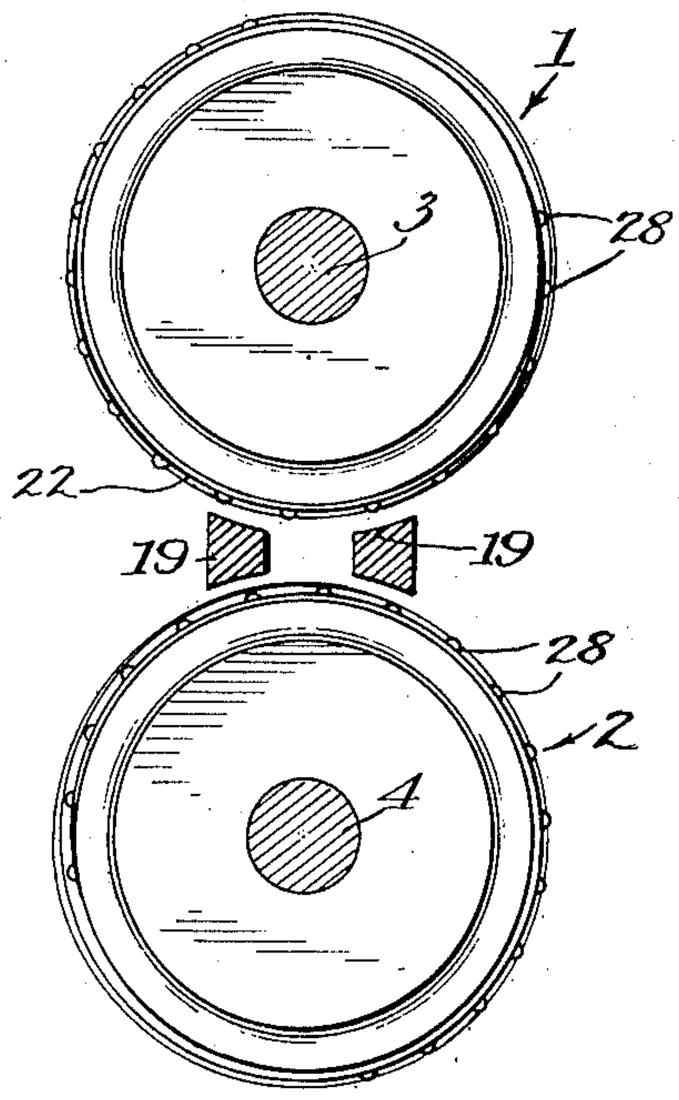


Fig. 6.



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UNITED STATES PATENT OFFICE

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BALL FORMING MACHINE

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Application September 24, 1932, Serial No. 634,739

3 Claims. (Cl. 80—23)

This invention relates to a machine for forming balls or approximately spherical bodies from suitable material such as bars or rails. The invention is particularly intended for forming balls intended for use in tube or ball mills or similar apparatus and for utilization for such purpose of discarded or worn railroad rails which have been brought to suitable shape by rolling or otherwise, but the invention is applicable to the production of balls from metal bars or rails produced in any suitable manner.

The main object of the present invention is to provide an improved ball forming machine with means for insuring approximately spherical smooth shape of the finished balls. In ball forming machines operating by the action of rolls on a bar in such manner that the bar is transversely scored to gradually increasing depth and is finally cut off, an objection arises that in the final cutting off operation there is generally left a rough spot or projection on each side of the ball and the tendency is for the ball to revolve in the finishing grooves of the rolls without rolling out these rough spots. My present invention provides means for insuring rolling out of such rough spots to produce an approximately smooth finished ball.

A further object of the invention is to provide for positive turning of the bar stock entering the rolls so as to insure proper operation of the rolls thereon.

The accompanying drawings illustrate the embodiments of my invention, and referring thereto:

Fig. 1 is a side elevation of a ball forming machine provided with my improvements; the bearings at the feed end of the machine being shown in section and the ball guide at the front side of the rolls being broken away;

Fig. 2 is a section on line 2—2 in Fig. 1;

Fig. 3 is a section on line 3—3 in Fig. 1;

Fig. 4 is an end elevation taken from the right hand end of Fig. 1;

Fig. 5 is a section on line 5—5 in Fig. 1;

Fig. 6 is a section on line 6—6 in Fig. 1.

The machine comprises a pair of rolls, namely, an upper roll 1 and a lower roll 2 mounted respectively on shafts 3 and 4 journalled in suitable bearings 5 and 6 on standards 7 and 8 in the usual manner of machines of this kind, the bearings being mounted, for example, in guideways in said standards and adjusted by shims 9 and screws 10 so as to provide for adjustment of the distance apart of the rolls and for firm support of the rolls during the forming operation.

Suitable means are provided for driving the rolls 1 and 2, for example, a driving gear 12 carried by a driving shaft 13, mounted in a fixed bearing and engaging gear wheels 14 and 15 respectively on the shafts 3 and 4 of the rolls 1 and 2, so as to operate said rolls in the same rotative direction and at substantially the same rotative velocity.

A guide passage or feed opening 16 is provided in standard 8 for guiding the stock indicated at 18 into position between the rolls, and guide means 19 are provided extending between the standards 5 and 6 and secured thereto so as to guide the stock or work in its passage between the rolls, these guide means 19 extending in the re-entrant angle between the roll surfaces at each side of the axis of the machine, which is also the axis of the feed passage 16. A delivery passage 20 is formed in the standard 7 leading to a discharge chute 21 for delivering the formed balls to any suitable receiving means.

Each roll, 1 and 2, is formed with a helical rib or flange extending from end to end thereof, said rib forming a series of spaced convolutions about the body of the roll. In the initial portion of each roll, this rib, as indicated at 22, is of gradually increasing height, so as to provide a gradual intrusion of the rib into the material of the stock for progressive formation of the balls. At a certain portion thereof, for example, at about midlength of the roll this rib is provided on one of said convolutions with an enlarged portion 23 or projection extending around the roll through a minor portion of its circumference acting as a cut-off or knife for suddenly severing the formed ball. This knife portion may be formed on or secured to the flange or rib in any suitable manner, for example, by welding it onto the flange. The flange or rib portion 24 succeeding the knife portion 23 may be of uniform height as shown, or if desired, may be varied in height in any suitable manner, the function of these flange portions being to finish and smooth the ball and deliver it to the delivery means 20. The flange or rib portions 24 are shown as increasing in pitch toward the delivery end, but the said flange or rib portions 24 may, if desired, be of uniform pitch.

The lateral guides 19 are preferably provided with notches indicated at 25 at a portion thereof which is opposite the knife portions on the ribs so that as the rolls rotate the said knife portions will traverse said notches in the guide means 19.

My present invention provides in addition to the above described construction, means for insuring turning or twisting of the balls after they

have been cut off, said means comprising a projection 26 on one of the rolls, for example on roll 1, which is adapted to engage one side of the ball to flip or turn the ball in a manner hereinafter described. The portion of the opposing roll which comes opposite this projection 26 at the moment of engagement with the ball is preferably cut away or depressed as shown at 27 so as to momentarily free the ball from tight engagement with the roll and facilitate the flipping or turning of the ball by the means 26. The guides 19 are shown as provided with notches 25' on the side disposed toward roll 1, in position to permit projection 26 to pass through said notches.

My present invention further comprises projections 28 on the first turn of each roll 1 and 2 which are suitably formed and spaced to positively engage the work or bar stock as the same enters between the rolls so as to positively rotate such bar stock and insure proper operation of the rolls thereon. The initial portions of the rolls are spaced sufficiently far apart to enable the stock to enter between the rolls and to be engaged by said projections.

In the operation of the machine the stock, indicated at 18 is fed forwardly through the passage 16 into the space between the rolls and is then subjected to a forming operation between the adjacent faces of the rolls. As the stock enters between the rolls the projections 28 on the rolls engage the same to positively rotate the stock and insure more effective grip of the rolls thereon, it being understood that as soon as the rolls have begun to score or groove the stock the grip of the rolls on the stock will be sufficient to complete the operation. By reason of the rotation of the rolls in the same rotative direction these adjacent faces of the roll move in opposite linear directions with the result that there is relatively little, if any, lateral force exerted on the stock; but the flanges or ribs tend to score or groove the stock on opposite sides and to rotate the stock so as to cause circumferential grooves to be formed in the stock, the spacing of the grooves corresponding to the spacing of the ribs on the rolls and the grooves being progressively deepened as the stock is fed forwardly by the rolls, this feeding operation being also effected by the helical flanges or ribs. When the work reaches the portion of the rolls occupied by the knife means 23, it is suddenly and completely severed by the operation of said knife means. I have found that when it is attempted to twist and cut off the balls without the use of such knife means, the wear on the ribs is excessive apparently by reason of the increasingly greater peripheral diameter of the ribs which causes the ball-stock to be twisted unduly before being severed, and the provision of the knife means avoids this difficulty. After leaving the knife means the balls are finished in the groove portions of the rolls at the delivery end thereof, so as to smooth and finish the ball, the ball being finally delivered to the delivery means 20.

The severing of the ball as above described generally leaves a rough spot or projection at each side of the ball where the final severance takes place but by the operation of the flipper or projection 26, the ball is given a partial rotation or twist shortly after the severing operation by impact of said projection 26 with one side of the ball, thereby bringing the said rough spots into position for operation of the rolls thereon to smooth out such rough spots and to form an approximately smooth finished ball.

I claim:

1. A ball forming machine comprising bearing means, a pair of rolls mounted to rotate on said bearing means and having parallel axes, means for driving each roll in the same rotative direction, each roll having a helical rib formed thereon and increasing gradually in depth from one end of the respective roll towards the other end thereof, and adapted to form and sever balls from stock fed between the rolls, and a projection on one of the rolls adapted to engage the formed ball when severed to turn the ball so as to cause different portions of the ball to come into engagement with the respective rolls.

2. A ball forming machine comprising bearing means, a pair of rolls mounted to rotate on said bearing means and having parallel axes, said rolls being spaced apart sufficiently to permit entrance between the rolls of the stock to be formed into balls, means for driving each roll in the same rotative direction, each roll having a helical rib formed thereon and increasing gradually in depth from one end of the respective roll toward the other end thereof and adapted to form and sever balls from suitable stock fed between the rolls and said rolls being provided with projections on the initial portions of each of the helical ribs on each roll to positively engage and rotate the stock.

3. A ball forming machine comprising bearing means, a pair of rolls mounted to rotate on said bearing means and having parallel axes, means for driving both rolls in the same direction, each roll having a helical rib formed thereon and increasing gradually in depth from one end of the respective roll toward the other end thereof, and provided with a knife portion for severing the balls, and a projection on one of the rolls adapted to engage the formed and severed balls to turn the ball so as to cause different portions of the balls to come into engagement with the respective rolls.

ALEXANDER C. MUNRO.