

1,370,978.

F. R. LONG.
FORGING MACHINE.
APPLICATION FILED SEPT. 22, 1917.

Patented Mar. 8, 1921.

2 SHEETS—SHEET 1.

Fig. 7.

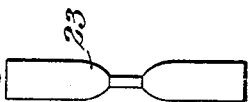


Fig. 6.

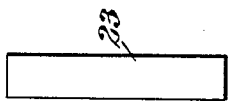
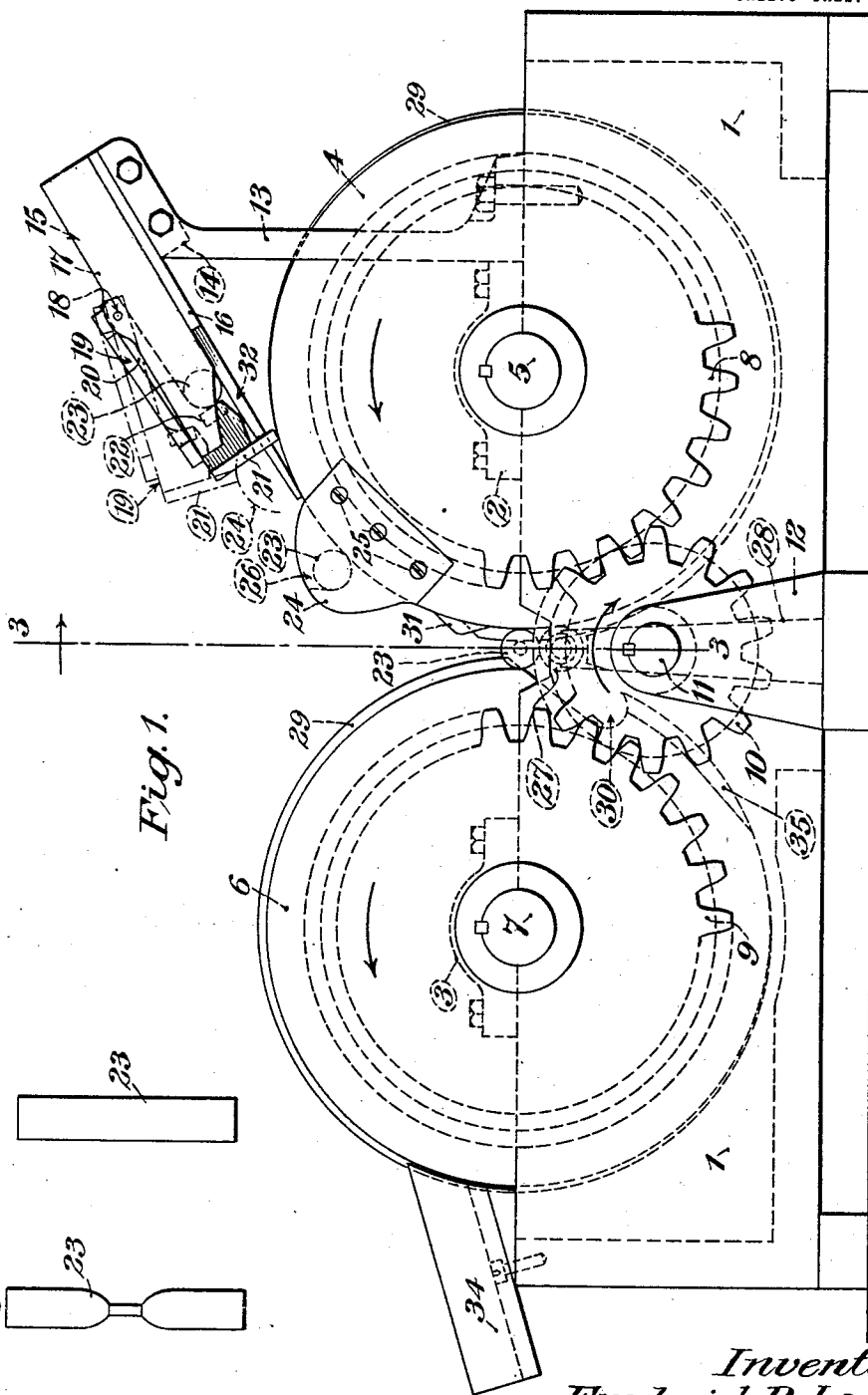


Fig. 1.

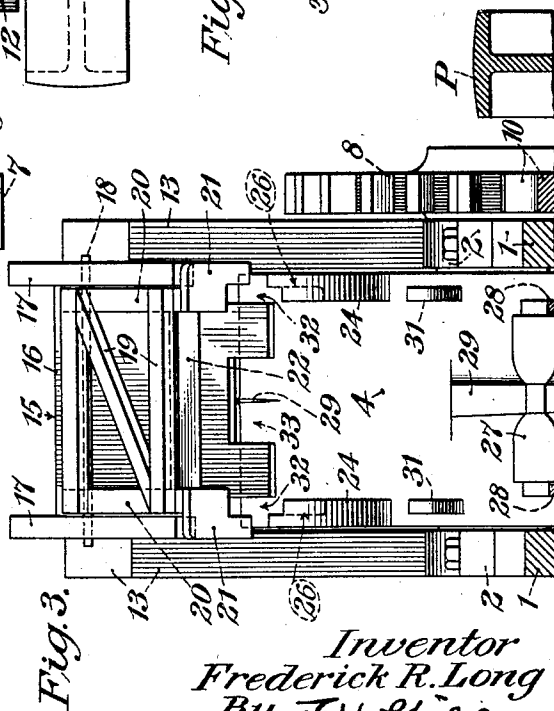
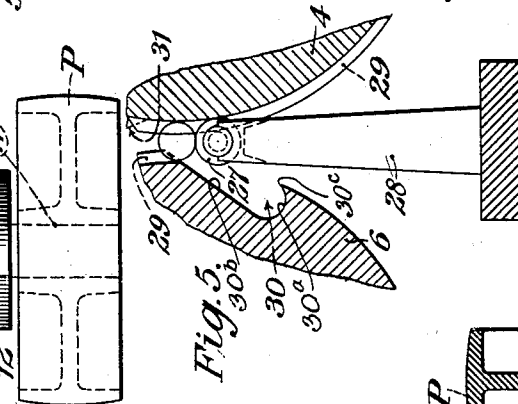
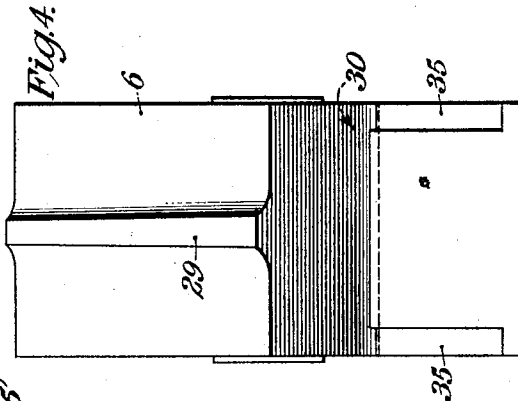
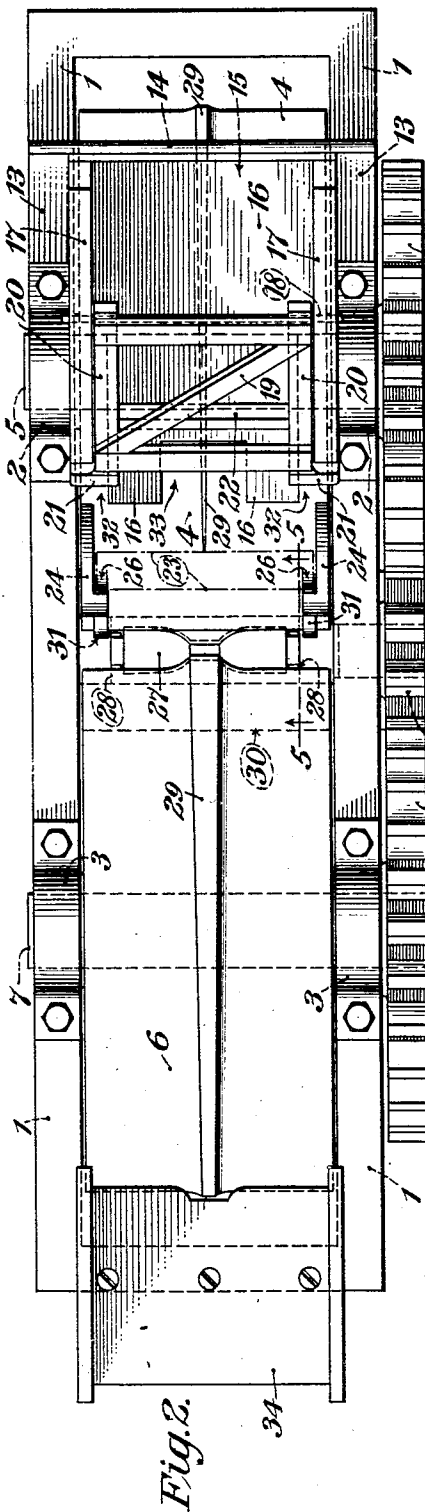


Inventor
Frederick R. Long
By *J. H. Gibbs*
Attorney

Patented Mar. 8, 1921.

2 SHEETS—SHEET 2.

1,370,978.



Inventor
Frederick R. Long
By *J. H. Gibbs*
Attorney

UNITED STATES PATENT OFFICE.

FREDERICK R. LONG, OF BERWICK, PENNSYLVANIA, ASSIGNOR TO AMERICAN CAR AND FOUNDRY COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF NEW JERSEY.

FORGING-MACHINE.

1,370,978.

Specification of Letters Patent.

Patented Mar. 8, 1921.

Application filed September 22, 1917. Serial No. 192,731.

To all whom it may concern:

Be it known that I, FREDERICK R. LONG, residing at Berwick, Columbia county, State of Pennsylvania, and being a citizen of the United States, have invented certain new and useful Improvements in Forging-Machines, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and to use the same, reference being had to the accompanying drawings, which illustrate the preferred form of the invention, though it is to be understood that the invention is not limited to the exact details of construction shown and described, as it is obvious that various modifications thereof within the scope of the claims will occur to persons skilled in the art.

In said drawings:

Figure 1 is a side elevation of my improved forging machine, showing a piece of work between the rolls with the latter having just completed the shaping thereof;

Fig. 2 is a plan view of the same, the work having been omitted except that the position of a piece of work held by the pocketed cams is indicated in dot and dash lines;

Fig. 3 is a vertical section taken on the line 3—3 of Fig. 1 transversely of the machine, showing the upper portion thereof as viewed in the direction of the arrows, the major portion of the view being in elevation;

Fig. 4 is an elevational view of the circumferential face of the discharging roll, showing the work-receiving pocket;

Fig. 5 is a detail sectional view taken on the line 5—5 of Fig. 2, illustrating the anti-friction work support intermediate the work-shaping rolls;

Fig. 6 is an elevation of the cylindrical blank or billet that is fed into the machine; and

Fig. 7 illustrates the same in elevation as it appears after the rolls have shaped it.

The present invention relates to forging machines, and particularly to a type wherein there are associated work-shaping rolls provided with peripheral contours that are co-operative to subdivide a piece of work positioned between them into multiples of an intended product, said rolls also shaping each multiple.

Convenient means for mounting the work-

shaping rolls may consist of an appropriate frame supplied with bearings therefor. Such frame will preferably have an upward extension advantageously positioned to support a work-feeding device that leads to the upper surface of one of the rolls. Included in the work-feeding device is suitable means to prevent the feeding of work to the shaping rolls, as a gate normally closed by gravity or other suitable means.

Secured to or formed integral with the roll to which the work-feeding device leads are cams adapted to periodically open the gate of the feeding device to release a piece of work. Obviously, where desirable, the gate may be operated in other manner. Arrangement is made for the referred to roll to receive and hold on its periphery a piece of work as it is released from the feeding device, whereby such work will be carried during the continued rotation of that roll to a work-support upon which it is deposited. This work-support may be of an anti-friction type adapted to hold the work so that it may be rotated by companion rolls between which it is positioned and which co-operate to shape it.

Another of these coöperating rolls is provided with work-removing means, which may be in the form of a pocket in its periphery. The correlation of the rolls and their respective parts is such that the second specified roll presents its pocket to receive the work after the latter has been fully formed. Usually the work will automatically leave its anti-friction support and place itself in the pocket of the second roll. That there may be no failure of the work to do so, the roll that deposited it on the work-support is provided with dislodging means adapted to drive the work into the pocket of said second or companion roll.

Continued rotation of this second roll carries the formed work in proximity to its periphery to a discharge chute, which receives the formed work and discharges it from the machine. The work between the multiples of the intended product will have been so thinned by the rolls that, upon the work falling from the discharge chute, the multiples will break into individual units.

Such features as have not already been referred to, but which become manifest hereinafter, are, of course, to be regarded as coming within the scope of the invention,

Referring to the drawings, 1 indicates the spaced longitudinal sides of the frame of the machine, which are provided with suitable bearings 2 and 3. Positioned between said sides 1 of the frame are companion work-shaping rolls, of which 4 is a work-receiving roll having journals 5 seated in bearings 2. A cooperative work-discharging roll 6 is provided with journals 7 mounted in bearings 3, being spaced out of tangential contact with roll 4 sufficiently to establish the desired cross sectional dimension of the work. Journals 5 and 7 may be the end portions of shafts to which the rolls 4 and 6, respectively, are secured for rotation therewith, or they may be trunnions extending from the sides of said rolls.

Gears 8 and 9 are rigidly secured to journals 5 and 7, respectively, being maintained in mutually responsive relation by a pinion 10 in mesh with both said gears. Pinion 10 is mounted on a short shaft 11, one end of which has a bearing in the adjacent frame side 1, the opposite end of said shaft being mounted in a standard 12 outside pinion 10. Shaft 11 extends through and outwardly beyond standard 12 to receive means for driving it, such as driving pulley P. The illustrated gear train comprising gears 8 and 9 and pinion 10, or any other substituted driving connection between gears 8 and 9, is arranged to rotate gears 8 and 9 in the same direction, which, in the present instance, is counterclockwise. Therefore, rolls 4 and 6 rotate simultaneously counterclockwise.

To the right of bearings 2, standards 13 arise from the opposite longitudinal sides 1 of the main portion of the machine frame, the upper end portions of standards 13 being inclined upwardly. The inclined upper portions of standards 13 are connected by an upper cross member 14 having the same inclination, and an inclined chute 15 is secured thereto and with a corresponding inclination leads to the work-receiving roll 4. Chute 15 comprises a bottom wall 16 and spaced side walls 17, through which latter, intermediate their lengths, extends a pivot pin 18 upon which is mounted a chute-closing gate 19. Said gate includes cross-connected side members 20 substantially paralleling the chute side walls 17 and extending beyond the ends thereof, where they are formed into cam followers 21; the lower edges of which rest upon the normal periphery of roll 4. Side members 20 of gate 19 are connected back of the cam follower portions 21 thereof by a cross bar 22 which serves to hold the work from feeding to the rolls 4 and 6.

In practice the billets are fed to the chute 15 from any suitable source, such as a hopper, not shown, the billet coming into contact with the cross bar 22 and thereby being arrested.

During forging operations, appropriate

means are employed to periodically open gate 19 to release a piece of work, said gate automatically closing thereafter to restrain the subsequent billets 23, and such gate may be heavier at its lower end and be pivoted, as shown, to close by gravity.

The gravity-closing gate 19 is shown as being conveniently opened at the proper time by suitable cams 24 arising from or near the opposite sides of work-receiving roll 4, such cams in the illustrated form being effective once during each revolution of roll 4. For convenience in machining the cams and for replacing the same should they become defective, said cams may be formed separately and fastened in recesses in the sides of roll 4, as by screws 25.

As the cylindrical blank or billet 23 is released from the work-feeding chute 15 it rolls down the bottom wall 16 thereof onto the periphery of work-receiving roll 4 to engage work-holding means on that roll. Such means may be independently formed, but are advantageously created by the formation of pockets 26 on the inner sides of cams 24. The metal forming the pockets partakes the shape of hooks protruding from the periphery of work-receiving roll 4, as clearly shown in Fig. 1, which hooks are alined transversely of said roll.

The companion work-shaping rolls 4 and 6 are adapted to rotate continuously, and therefore the cylindrical blank or billet 23 held in pockets 26 of cams 24 will be carried down between such rolls to be deposited upon the roller 27 shown in Figs. 1 and 5. Said roller is intermediate and preferably below the centers of rolls 4 and 6 a sufficient distance to place the center of the cylindrical work in the same horizontal plane as the centers of rolls 4 and 6. Roller 27 has reduced ends or trunnions revolvably mounted in spaced bearings of a standard 28, which with roller 27 constitutes an anti-friction work-support intermediate the companion work-shaping rolls.

Each roll 4 and 6 is provided on its periphery with a circumferential rib 29 which arises from the normal surface of the roll periphery and increases in thickness and width as it progresses around the roll in a direction opposite to that in which said roll rotates.

Thus, after the cylindrical blank or billet 23 has been deposited upon its anti-friction support between the rolls 4 and 6, it is gradually compressed in cross section, ribs 29 developing an annular depression that constantly increases in depth and width to an ultimate extent equal to the maximum thickness and width of the circumferential ribs 29. The work 23 is therefore subdivided into multiples of an intended product, and, as seen by comparing Figs. 2 and 7, the work will be shaped by the rolls in

each multiple on each side of the circumferential ribs 29. Where a greater number of multiples is desired, it is only necessary to increase the width of the rolls and the number of the ribs 29, as will be readily understood.

Fig. 1 shows a cylindrical blank or billet positioned between the companion work-shaping rolls 4 and 6, the latter being in positions wherein they have substantially completed the shaping of the piece of work 23. In said figure and in Fig. 5, the work-discharging roll 6 is shown to have a work-receiving pocket 30 almost in position to receive the formed billet 23. This pocket extends inwardly from the periphery at an acute angle thereto and its innermost wall 30^a is curved to form a socket having approximately the same diameter as the work. The socket is thus a semi-circular groove forming an elongated work-carrying means. As shown, this pocket extends longitudinally or axially of the roll 6, adjacent its periphery, and the side wall 30^b of the pocket is preferably a plane or flat surface extending inwardly at an acute angle relative to the periphery of the roll. This surface merges into the curved wall 30^a of the socket and serves as a guide to pass the work directly into and during the discharge of the work out of the socket and pocket.

Where the curved wall 30^a of the socket contacts or merges into the periphery of the roll 6, a comparatively sharp angle or edge 30^c is produced that forms substantially a work pick-up adapted to engage with the finished work for removing it from between the rolls. This edge overhangs the socket so that the open-side of the groove or socket is tangent to the periphery of the roll.

From Fig. 5, it will be seen that, as the roll 6 revolves, the work is carried with it, and the edge 30^c prevents the work from being thrown outward until it passes beyond the vertical center line, which work, therefore, cannot leave the pocket except at the proper time and in the discharge direction. As the roll 6 and its pocket 30 approach the discharging point, the work will begin to leave the socket or groove, rolling on the side wall 30^b with increasing acceleration, until the pocket opening registers with the discharge chute, whereupon the work will pass thereto without the aid of auxiliary devices to impart an initial movement. This will provide a positive and automatic discharge of the work that is inherent in the formation of the pocket and socket and thus utilizes the weight of the work.

Work-discharging roll 6, rotating counter-clockwise to a slightly greater extent, positions pocket 30 so that the cylindrical blank 23 will automatically roll into it. To guard against a failure of the formed

work 23, doing this, the work-receiving roll 4 is provided with dislodging means, such as a pair of triangularly shaped kickers 31 protruding from the periphery of roll 4 near opposite sides thereof. Kickers 31 will engage the work before pocket 30 in roll 6 has passed beyond a position to receive it, in case said work for any reason has failed to automatically deposit itself in such pocket.

The bottom wall 16 of work-feeding chute 15 is cut away at both of its sides, as indicated at 32, for a sufficient distance inwardly from the lower edge of bottom wall 16 to permit the passage of cams 24 and kickers 31. Said bottom wall 16 of the feed chute is also centrally cut away at 33 for the passage of the circumferential rib 29. Therefore despite the irregularities on the periphery of roll 4, there is no interference of the parts.

The cylindrical billet 23, after being formed by rolls 4 and 6 and having entered pocket 30 of the latter roll, is carried in proximity to the periphery of roll 6 through an ascending and descending arcuate path toward the opposite end of the machine, whereupon roll 6 discharges it upon a discharge chute 34. Discharge chute 34 may be inclined as shown in Fig. 1, and the work deposited thereupon rolls down the same and drops a considerable distance in emerging from the machine. Since the portion of the formed work 23 which was shaped by the circumferential ribs 29 is relatively thin, the shock the work receives upon striking the ground, or whatever it falls upon, is sufficient to break the formed billet 23 into individual units, each corresponding to one of the multiples of said formed work.

In some instances the machine may be used to form the billets 23 while they are cold, but when shaping cylindrical steel billets the same are preferably heated to a proper degree before being placed in the work-feeding chute 15.

It will be noted that, as shown in Figs. 1 and 4, roll 6 is recessed at 35 near its opposite sides, establishing clearance for the passage of cams 24 on roll 4. Rolls 4 and 6 may thus be brought into such proximity that work may be shaped to smaller diameter than in instances where this clearance is not provided. Also, the adjacent portions of the peripheral surfaces of rolls 4 and 6 travel in opposite directions, and, in bearing against the work, revolve it, so that no flat places are produced therein.

What I claim is:

1. In a machine of the character described, a plurality of suitably mounted work-shaping rolls rotatable in the same direction and at like speeds, and means secured upon the ends of one of said rolls to carry work into position to be operated upon

by a plurality of said rolls, the cooperating roll being shaped to permit the passage of the work carrying means.

2. In a machine of the character described, work-shaping rolls rotatable in the same direction and at like speeds and work-holding means on different rolls movable therewith, part of said means being adapted to position work between adjacent rolls and another part thereof to remove the work from said rolls, said latter part being inherent in the formation of one of the rolls and being wholly within the periphery of the roll.

3. In a machine of the character described, a pair of work-shaping rolls, a work-supporting roller mounted therebetween, work-holding means on each roll that on one roll being adapted to deposit work on said roller and that on another roll being formed to automatically remove the work from said roller and to discharge it from said rolls, and means to force the work to the work discharging means.

4. In a machine of the character described, companion rolls having co-acting work-shaping peripheries adapted to produce a fragile place in work, a work-support intermediate said rolls, means movable with one of said rolls to deliver work to said support, and means formed in the other roll to remove the work after said rolls have shaped it.

5. In a machine of the character described, rotatable companion rolls having circumferential ribs adapted to reduce the cross section of work to subdivide the latter into multiples, said rolls being formed to shape each multiple, a support arranged to hold the work rotatively between said rolls, and means movable toward and from said support to deliver the work thereto and means to remove it therefrom after it has been shaped.

6. In a machine of the character described, companion rolls rotatable in the same direction and having circumferential ribs of increasing thickness and width adapted to reduce the cross section of work to subdivide the latter into multiples, said rolls being formed to shape said multiples, means to support the work rotatively between said rolls and work-inserting and extracting means.

7. In a machine of the character described, receiving and discharging work-shaping rolls, a work-feeding device leading to said receiving roll, means to support the work rotatively between said rolls, said receiving roll being provided with means to convey work to said work-supporting means and said discharging roll being formed to receive and discharge the work after said rolls have shaped it.

8. In a machine of the character de-

scribed, rotatable receiving and discharging rolls, means for supporting work therebetween, said receiving roll being provided with means to convey work to said work-supporting means and said discharging roll having a work-receiving pocket, and dislodging means on said receiving roll adapted to drive the work from said supporting means into said pocket, the discharging roll being movable to thereafter convey the work away and discharge it.

9. In a machine of the character described, receiving and discharging work-shaping rolls, a work-feeding device leading to said receiving roll, actuating means therefor effective to operate said device when the latter roll is in predetermined position, the first roll being provided with means to carry work to a position between the rolls, and the second roll being integrally formed to remove and thereafter to carry work from a position between said rolls and means to force the work to the work discharging roll.

10. In a machine of the character described, work-shaping rolls rotatable in the same direction, a support to hold work intermediate said rolls, a work-feeding device leading to one roll, means movable with that roll to which said device is periodically responsive to release a piece of work, means on the same roll to carry work to said support, and work-removing and work-carrying means in and forming part of the periphery of the adjacent roll.

11. In a machine of the character described, rotatably mounted work-shaping rolls and a support to hold work therebetween, one roll being provided with means to hold work in proximity to its periphery and movable with said roll to deposit work on said support and a companion roll formed with means in its periphery to receive and remove the work.

12. In a machine of the character described, receiving and discharging work-shaping rolls rotatable in the same direction and at the same speeds, a work-feeding device leading to said receiving roll, a discharge chute leading from said discharge roll, a work-support intermediate said rolls, means on said receiving roll adapted to periodically operate said device, holding means on the receiving roll and movable therewith to convey work to said support, the discharge roll being formed with means to receive work in its periphery and capable of conveying the work to said discharge chute.

13. In a machine of the character described, a frame with spaced sides, companion rolls mounted to rotate therebetween, each roll being provided with a circumferential rib merging with the normal periphery of the roll and increasing in thickness and width, a work support intermediate said

rolls, one roll being provided with means to convey work to said support and another roll formed to convey it therefrom, and means to rotate said rolls in the same direction at the same speed.

14. In a machine of the character described, a frame with spaced sides, companion rolls therebetween, journals therefor rotatively supported by said frame sides, the peripheries of said rolls having circumferential ribs adapted to subdivide work into multiples, said rolls being adapted to shape each multiple, a work-support, one roll having means to convey work thereto and another roll formed to convey it away therefrom, and gearing to drive said rolls in the same direction.

15. In a machine of the character described, a frame, companion work-shaping rolls mounted therein and geared to rotate in the same direction, said rolls having circumferential ribs adapted to subdivide work into multiples, a stander extending between said rolls, and a roller mounted therein, one roll being adapted to deposit work thereon and the adjacent roll being formed to remove and discharge the work.

16. In a machine of the character described, a frame, companion work-shaping rolls having journals mounted therein, a gear train including gears secured to journals of said rolls and adapted to rotate the rolls in the same direction at the same speed, and an anti-friction work support, one roll being adapted to deposit work thereon and an adjacent roll formed to remove and discharge the work therefrom.

17. In a machine of the character described, a frame, companion work-shaping rolls mounted therein, a support upstanding from said frame, a stationary inclined work-feeding chute supported thereby and leading to the periphery of one roll, a gate normally closing said chute, and a cam on the last mentioned roll adapted to periodically open said gate.

18. In a machine of the character described, a frame, companion work-shaping rolls mounted therein, an inclined work-feeding chute leading to the periphery of one roll and fixedly supported in position with respect thereto, a gate normally closing said chute, and aligned cams on the last mentioned roll adapted to periodically open said gate, said cams being provided with work-receiving pockets and being adapted to convey work between said rolls.

19. In a machine of the character described, appropriately mounted work-shaping rolls, an inclined work-feeding chute, a gate therefor closed by gravity, and cam means on one of said rolls adapted to be carried thereby into periodic engagement with said gate to open the same independently of the chute.

20. In a machine of the character described, a frame, companion work-shaping rolls mounted therein, a support extending higher than one of said rolls, a work-feeding chute secured to said support and leading to the last mentioned roll, a gate pivoted to said chute for operation independently of said chute extending toward its lower end and provided with a stop for work, and cam means on said roll adapted to open said gate.

21. In a machine of the character described, companion work-shaping rolls, an inclined work-feeding chute bearing on one of said rolls, a pivoted chute gate having cam followers normally engaging the last mentioned roll, gate-operating cams adapted to engage said followers and means for conveying work into position between said rolls both on the specified roll, said chute and cam followers being recessed for the passage of said conveying means.

22. In a machine of the character described, companion work-shaping rolls provided with circumferential ribs, a work-feeding chute leading to one of said rolls, a pivoted chute gate provided with cam followers, another of said rolls having a work-receiving pocket, the first specified roll being provided with gate-operating cams, means to hold work for conveyance to position between said rolls, and dislodging devices on one roll to force work into the pocket of said other roll, said chute being recessed for the passage of the rib of the first roll, said cams, work-holding means and dislodging devices, and said cam followers being recessed for passage of the last two elements.

23. In a machine of the character described, a plurality of work-shaping rolls, associated work-conveying means, and means permitting the dwelling of work between adjacent rolls, said work-conveying and dwelling-permitting means cooperating to cause work to travel from roll to roll preventing the work from emerging from the opposite side of said rolls while it is between adjacent rolls.

24. In a machine of the character described, a pair of rotatable work-shaping rolls each provided with work-holding means near its periphery movable therewith to relatively approach and pass the means of the other roll during the rotation of said rolls.

25. In a machine of the character described, a pair of rotatable work-shaping rolls, one roll being provided with means for regulating the feeding of work to said rolls, said means being movable into the zone of the other roll, the latter roll being fashioned to permit passage of said means without interference.

26. A roll having a surface adapted to reduce a blank and provided with an under-

cut work-receiving pocket adjacent to the periphery of the roll.

27. A roll having a surface adapted to reduce a blank and provided with an undercut work-receiving pocket adjacent to the periphery of the roll and having a curved-wall socket at one end thereof.

28. A roll having a surface adapted to alter the shape of a billet and provided longitudinally with a semi-circular groove lying below the peripheral surface of the roll, a peripheral portion of which overhangs the groove to form a work pick-up.

29. A roll having a surface adapted to alter the shape of a billet and provided with a longitudinally extending semi-circular groove, one edge of which connects with the periphery by a flat wall extending inward therefrom at an acute angle, said groove formed under the periphery so that its open-side is approximately at a right angle thereto.

30. A forging machine having spaced companion rolls each provided with surfaces adapted to simultaneously alter the shape of a billet, one of said rolls having work-carrying means adjacent the periphery and secured to the ends thereof and with work throw-off means, another of the rolls being provided with a work-engaging pocket and a socket formed below the peripheral surface of the roll, and means to rotate said rolls in the same direction at the same speed.

31. A forging machine comprising spaced rolls having surfaces adapted to alter the

shape of a billet, one of said rolls being provided with billet receiving pockets disposed adjacent its periphery and secured at the ends of said roll, and with work throw-off means circumferentially spaced from said billet receiving pockets, another of the rolls being provided with a work-receiving and work-carrying pocket adapted to receive the work, one edge of said pocket being adapted to serve as a pick-up and remove work from between the rolls and also to retain the work in the pocket during roll movement, and said pocket, after passing the vertical diameter of the roll, being capable of discharging the work at a tangent to said roll, a feeding chute for supplying billets to the rolls, a discharge chute for the second named roll, and means for rotating the rolls simultaneously in the same direction at like speeds.

32. A roll having a periphery adapted to alter the shape of a billet and provided with a pocket, one wall of which extends inward and forms a chord to the periphery, the bottom wall of the pocket being curved and merging into the periphery to partly inclose the pocket, the juncture of the two serving as a work pick-up and also to retain a piece of work in the pocket during a portion of the angular travel of the roll.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

FREDERICK R. LONG.

Witnesses:

HENRY F. TRAUGH,
E. M. KOCHER.