(No Model.) 2 Sheets—Sheet 1.

W. H. APPLETON.

MACHINE FOR ROLLING SEAMLESS TUBING.

No. 412,012. Patented Oct. 1, 1889.

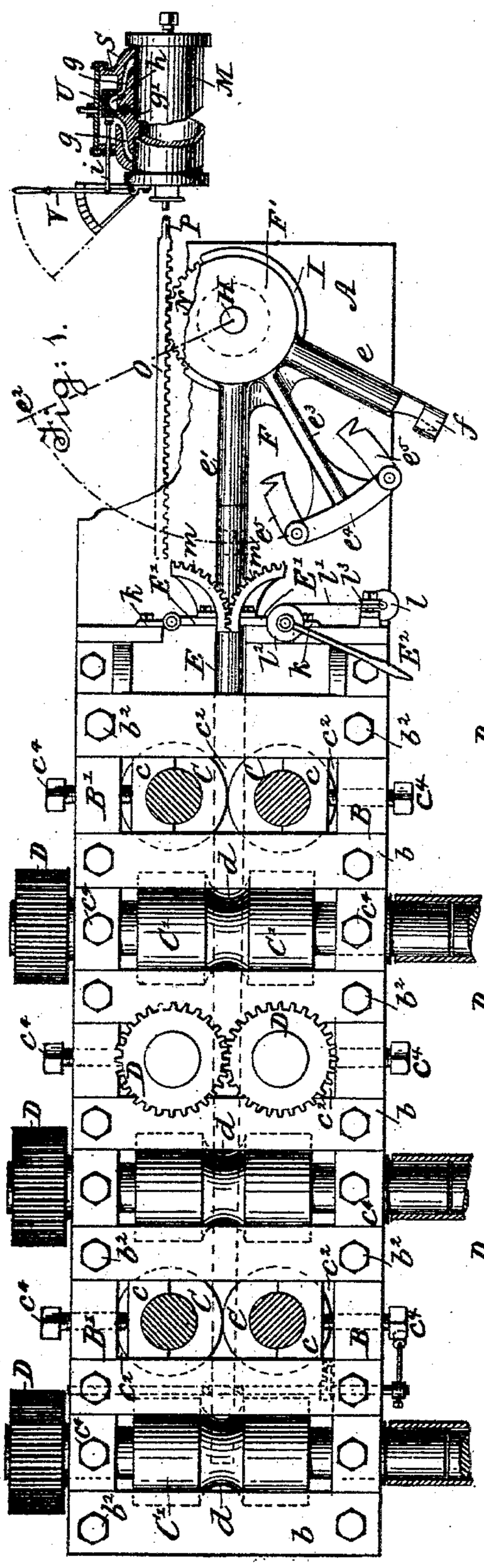

Fig. 1.

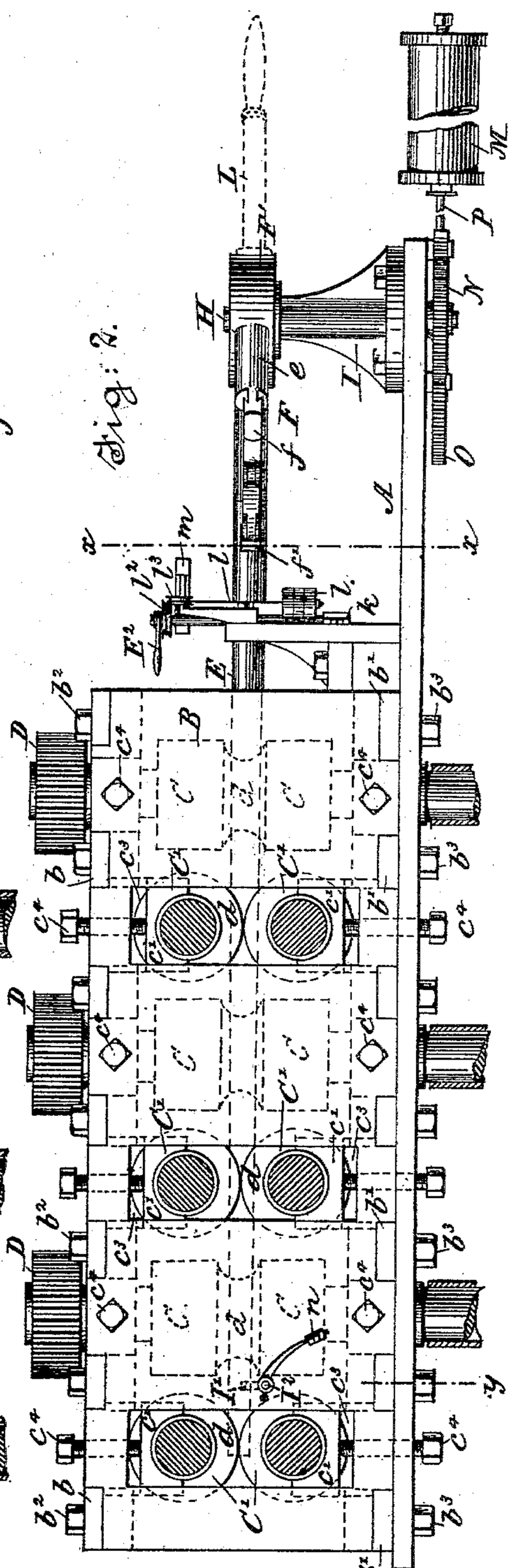

Fig. 2.

Witnesses:
John A. Kennie
Henry Carter

Inventor:
Wm. H. Appleton

(No Model.) 2 Sheets—Sheet 2.

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No. 412,012. Patented Oct. 1, 1889.

Fig: 3.

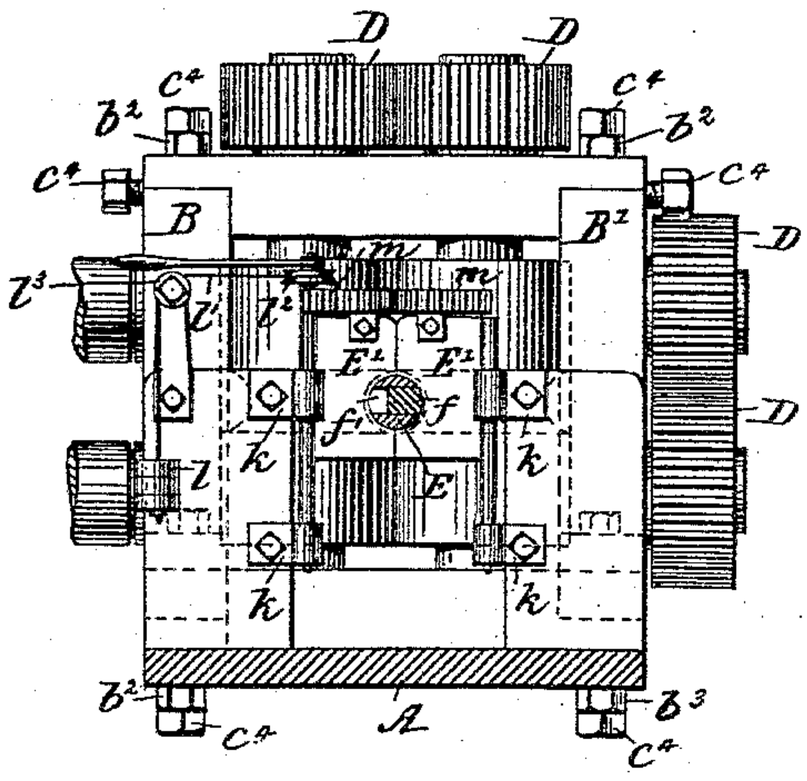

Fig: 4.

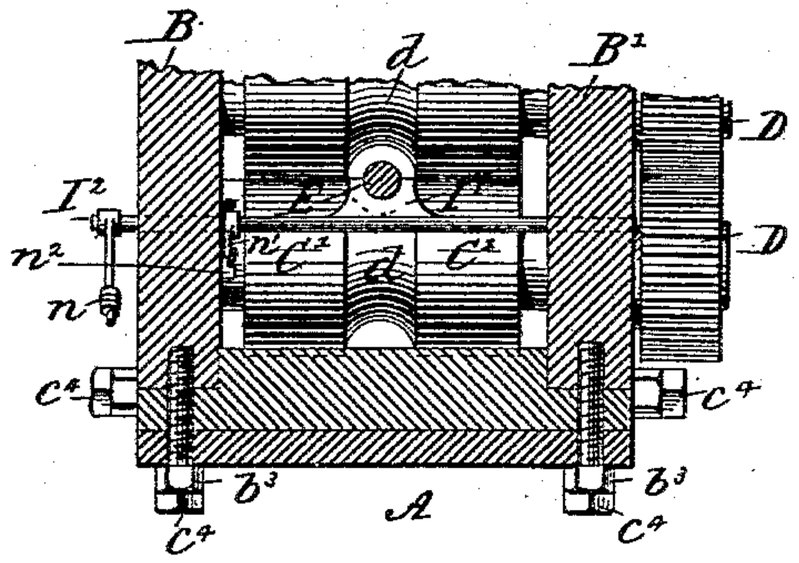

Fig: 5.

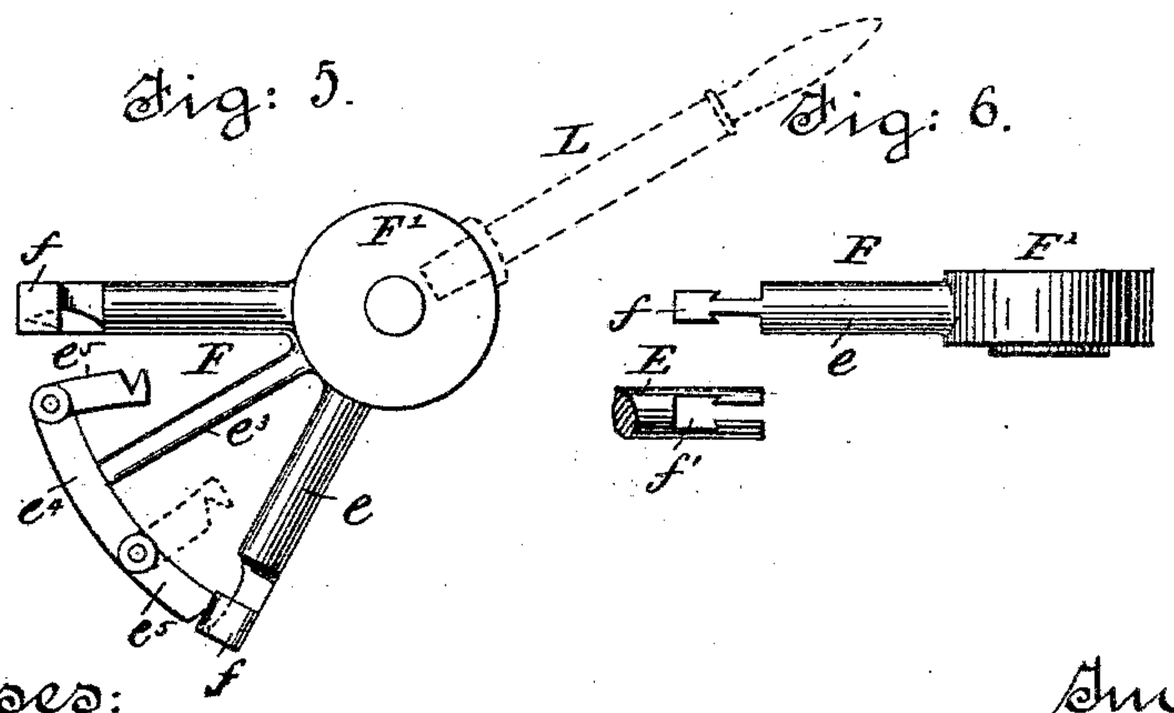

Fig: 6.

Witnesses:
John A. Rennie.
Henry Carter.

Inventor:
Wm. H. Appleton

UNITED STATES PATENT OFFICE.

WILLIAM H. APPLETON, OF NEW YORK, N. Y.

MACHINE FOR ROLLING SEAMLESS TUBING.

SPECIFICATION forming part of Letters Patent No. 412,012, dated October 1, 1889.

Application filed January 30, 1889. Serial No. 298,043. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. APPLETON, a citizen of the United States, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Machines for Rolling Seamless Tubing, Columns, and other Hollow Articles from Hollow Ingots, of which the following is a specification.

My invention, while relating to that class of tube-rolling machines in which pairs of vertical and pairs of horizontal rolls arranged in alternate relation with respect to each other are employed in connection with a stationary mandrel, over which the ingot is passed and the completed article produced, extending between them, is designed more especially as an improvement upon that form of machine illustrated and described in an application for Letters Patent filed by me in the United States Patent Office on or about November 2, 1888, Serial No. 289,816, to which reference may be had.

In the machine shown and described in the application aforesaid the mandrel is held in proper position between the rolls during the rolling operation by means of a stock which, while adapted for engagement with and disengagement from the same, is so mounted as to be capable of a longitudinal backward movement away from said mandrel when disengaged therefrom to receive a fresh ingot and afterward of a forward or reverse movement toward it for the purpose of engagement therewith and transfer to it of said ingot preparatory to its reduction and transformation.

My present invention, while employing a stock for holding the mandrel in proper position between the rolls during the rolling operation, differs from that shown and described in the application mentioned in that, instead of having the said stock so formed and mounted as to necessitate a forward and backward longitudinal movement of the same in its support or bearings when a fresh ingot is to be received and transferred to the mandrel, it is constructed in the form of a hub, which is so mounted as to permit of an oscillating movement upon its axis, and is provided with two or more arms for the reception of ingots extending radially therefrom, the said arms being severally adapted to engage with the mandrel to properly hold it in position between the rolls during the rolling operation and permit of the ingot carried by it being transferred thereto as one or the other of them is brought into relation therewith by the oscillation of its supporting-hub upon its axis.

The present invention, therefore, consists, first, in the peculiarly-constructed stock, having a plurality of arms for receiving the ingots and permitting of their transfer therefrom; second, in the combination of such stock with a mandrel, whereby the latter is not only held in proper position between the rolls during the rolling operation, but provisions are made for supplying fresh ingots to it as required; third, in the combination, with the mandrel and the stock, of means whereby the latter may be oscillated or moved around its axis to bring one or the other of its arms into proper relation with respect to the mandrel; and, fourth, in certain other constructions and combinations of parts, all as will hereinafter appear.

Referring to the accompanying drawings, which form a part of this specification, Figure 1 is a plan view of a rolling-machine with my improvements applied thereto, some of the parts being broken away for convenience of illustration and others omitted; Fig. 2, a side elevation of the same, the cylinder being broken out and the driving mechanism omitted; Fig. 3, a sectional elevation of the machine, taken on the line $x\ x$ of Fig. 2; Fig. 4, a similar view taken on the line y of the same figure; Fig. 5, a plan view of the stock, detached; and Fig. 6, a side elevation of the same, also detached, showing in addition the end of the mandrel with which the arms of the said stock engage.

In all the figures like letters are employed to designate corresponding parts.

A indicates the base-plate or support, upon which are or may be mounted the main housings of the machine, the same consisting, preferably, of the two side frames or members B B′, which are connected by cross-pieces $b\ b'$, extending across from one to the other, and being secured thereto by suitable screws or bolts $b^2\ b^3$.

C C′ indicate the rolls through the instru-

mentality of which the reduction and transformation of the ingots are effected, the rolls C being arranged to turn upon vertical axes and the rolls C′ upon horizontal axes. These rolls will be made either smooth upon their peripheries or provided with appropriately-shaped circumferential grooves, as the nature of the work in which they are to be used may demand. When employed in the manufacture of articles having a square or rectangular form in cross-section, they will preferably be made smooth; but when used in the rolling of cylindrical or polygonal forms they will be provided with grooves *d*, of appropriate contour in cross-section to conform thereto. The rolls of both the vertical and horizontal series are arranged in pairs, and are so placed as to bring them into alternate relation with, for instance, a pair of horizontal rolls following a pair of vertical rolls and a pair of vertical rolls following a pair of horizontal rolls, and so on throughout the train. As thus disposed the vertical series are mounted in bearings *c*, which are fitted to suitable guideways c^2, formed in the upper and under sides of the housings, and the rolls of the horizontal series in bearings *c′*, likewise fitted to appropriate guideways c^3 in the upright sides thereof, the bearings for both the vertical and horizontal series being adjustable in their respective guideways by means of screws c^4, whereby to bring the rolls into proper relation.

D indicates the gears, by means of which the rolls of each pair are connected and caused to rotate in unison. These gears are preferably of the spur form, and are so proportioned as to insure the same surface velocity of the companion rolls of each pair; but while the rolls of each pair are thus moved at the same velocity the rolls of the different pairs are caused to travel at different speeds, the first or entering pair moving at one velocity, the next pair in the series at a greater surface speed, and the succeeding pair at a still further accelerated velocity, and so on throughout the train, each successive pair moving enough faster than the preceding pair to not only take up the same amount of ingot as the preceding pair, but also the elongation due to its action thereon.

The means whereby the several pairs of rolls are operated and this differential velocity imparted to them, however, has not been illustrated, as the same forms no part of my present invention, but is or may be of the form shown and described in the application for Letters Patent aforesaid and require no further description herein.

E indicates the mandrel over which the ingot is passed and the completed article produced. This mandrel may be constructed in any of the well-known forms common in this class of devices. I prefer, however, to make it of a gradually-diminishing diameter from its receiving to its discharging end, or at least that portion of it over which the ingot travels as its transformation is being effected, in order to reduce to the minimum the friction of such ingot in passing over the same; but however constructed it will be arranged to project between the rolls C C′, as shown in the drawings. To hold it at all times in this position, I employ a stock F, which, while capable of various modifications, in my preferred form of construction consists of a suitable hub-like portion F′, having extending radially therefrom a plurality of arms *e e′*, which are severally constructed of the proper dimensions and length to permit not only of readily entering the ingot to be transformed, but also of extending some distance therethrough.

As thus constructed, the stock is secured to the upper end of a vertical shaft H, mounted in suitable bearings formed in or attached to the bracket or standard I, which in turn is fixedly and immovably secured to the base A or other convenient support. The bracket or standard will be of the proper height, and its disposition upon the base-plate A or other convenient support will be such as to insure that the axis of each of the arms *e e′*, when brought into relation with the axis of the mandrel, shall form a prolongation thereof, and in order to provide for the locking of these arms to the mandrel when one or the other is brought into relation therewith to hold such mandrel against the longitudinal strain put upon it during the rolling operation they are each provided at its outer or free end with a T-shaped head *f*, which is adapted to engage with a correspondingly-shaped slot *f′*, formed transversely through the receiving end of the mandrel, as shown. By this construction and arrangement of parts, as will be seen, when the arm *e′* is in engagement with the mandrel E, the arm *e* will be disengaged therefrom and occupy a position to receive a fresh ingot, as shown in Fig. 1. Similarly, when the arm *e* is carried into engagement with the mandrel E, the arm *e′* will be moved into the position indicated in dotted lines at e^2 in such figure, and a fresh ingot may be supplied to it preparatory to its return and re-engagement with said mandrel, as before, and so on, the oscillation of the stock back and forth upon its axis serving to carry first one and then the other of these arms into a position to receive a fresh ingot and afterward into engagement with the mandrel, to not only permit of the transfer of the ingot carried by it thereto, but also to hold said mandrel from longitudinal movement during the time that such ingot is undergoing transformation.

In order to prevent longitudinal movement of the mandrel during the time that the arms *e e′* are disengaged from it, and also to hold the slot therein in proper position for engagement with the heads *f f* when brought into relation therewith, the body F′ is provided with a third arm e^2, which projects radially therefrom and carries at its outer or free end

an arc-shaped flange e^4, the radius of which will be of the proper length to carry it outward from the axis of the hub F′ to the same distance as the heads *f*. This flange is preferably made of the same size and form in cross-section as the heads *f f*, but instead of being rigidly connected at its outer ends thereto it is provided at these points with hinged sections e^5 e^5, which may be swung back away from the heads, as shown in Fig. 1, or outward into engagement with them, as illustrated at the lower portion of Fig. 5. When these hinged sections are swung outward and engaged at their outer or free ends with the heads *f f*, the flange will be continuous throughout between them and may be passed entirely through the slot *f′*, formed in the receiving end of the mandrel, as the engagement of such heads therewith is changed from one to the other, the mandrel during these movements being held by the flange in the same manner as it is held by the heads themselves when interlocked therewith. Afterward, when either of the arms are carried into relation with the mandrel and the head *f* on its outer end is engaged with the slot *f′*, the hinged sections e^5 e^5 may be swung back upon their hinges and facility thereby afforded not only for transferring the ingot carried by it to the mandrel, but also for supplying a fresh ingot to the other.

The oscillation of the stock F upon its axis to bring the arms *e e′* into alternate relation with the mandrel E may be effected either by hand or by power. When accomplished by hand, I find it convenient to employ a suitable lever inserted in the hub F′, as shown, for instance, in dotted lines at L in Figs. 2 and 5. I prefer, however, to effect the movement of this stock by power, as the efficiency of the machine is thereby increased, and to this end various mechanisms may be employed. The form which I consider the best suited for this purpose consists of a suitable cylinder M, from which the desired motion may be imparted to the stock through the intermediaries of a gear N, secured to the lower end of the shaft H, a rack O in mesh with such gear, and a piston-rod P, connected to said rack at one of its ends and carrying at its other a suitable piston fitted to the interior of the cylinder in such a manner as to be capable of a reciprocating motion therein. By this arrangement of parts, as will be seen, steam or other actuating agent admitted to either end of the cylinder will act against the piston, causing it to move forward with it, and through the rack, shaft, and gear will effect the oscillation of the stock in one direction. The flow of steam or other actuating agent continuing, these movements will progress until the piston reaches the opposite end of the cylinder, when they will be arrested and may be reversed, to effect the backward oscillation of the stock, by admitting the actuating agent to the other end thereof. In order to control the flow of this actuating agent to and from the opposite ends of the cylinder, to effect the forward and backward oscillation of the stock, I employ the chest S, which is secured to or makes a part of the cylinder itself, and is provided with suitable ports *g* and *g′*, the former of which leads to the opposite ends of the cylinder and the latter to the discharge or exhaust pipe. In connection with this chest I also make use of the valve U, which is provided with a chamber or recess *h* upon its under side, and with a suitable stem *i*, that is connected at its outer end to a lever V. This chamber or recess will be made of the proper length to extend over the port *g′* and over one of the ports *g* at the same time, leaving the other port *g* wholly uncovered, as shown in Fig. 1, but, with the valve, may be moved back and forth by the lever V to cover the port *g′* and first one of the ports *g* and then the other, as may be desired. When the valve is in the position shown in the figure last mentioned, the actuating agent in the chest S is free to flow through the port *g* into the front end of the cylinder M, and, acting upon the piston, will force it backward toward the rear end of said cylinder, the actuating agent in advance of the same escaping through the port *g*, chamber or recess *h*, and port *g′*. A similar but opposite result will be accomplished when the valve U is moved over the ports *g′* and over the port *g*, located at the front of the cylinder. The port *g*, at the rear end, being open, the actuating agent in the chest S will flow therethrough, and, acting against the rear of the piston, will force it forward in the cylinder, the actuating agent in front of the same escaping through the ports *g g′* and recess or chamber *h*. Thus by simply sliding the valve back and forth over the ports, as above explained, the actuating agent may be admitted to first one end of the cylinder and then to the other, and the piston thereby moved back and forth, and through the rack, gear, and shaft effect the requisite oscillation of the stock F.

At E′ E′ are shown the stops by means of which the mandrel is held from lateral movement during the time that the shifting of the arms *e e′* is being effected. These stops are preferably provided on their adjoining edges with suitably-shaped notches or recesses for engaging with the mandrel when brought into relation therewith, and are journaled so as to swing upon vertical axes in suitable brackets *k k*, secured to and projecting inward from the main housing of the machine. In their normal position these stops will be held in contact with the mandrel, but may be swung back on their journals away from the same by means of a handle E^2, fixedly secured to one of said journals, the movement of these stops in unison being effected through the instrumentality of suitable tooth-segments *m m*, with which they are provided. The means whereby the stops are normally held in contact with the mandrel may consist of a spring

or other equivalent device. In the drawings I have shown a weight *l* employed for this purpose, the same being suspended by a cord *l'*, which, passing around a pulley l^2, fast on the journal of one of the stops, extends over a second pulley l^3, and thence down to the weight itself, to which its lower end is firmly secured. By this arrangement of parts the normal contact of the stops with the mandrel is insured and provision is made for swinging them back away from the same when desired.

To hold the mandrel from contact with the rolls when free from an ingot, the support I' is employed. This support is provided on its upper edges with a suitable notch or recess with which to engage the mandrel when brought into relation therewith, and is secured to a shaft I^2, which is mounted in suitable bearings formed in or secured to the main housings B B'. In its normal position this support will be held vertically beneath the mandrel by means of a weight *n*, secured to one of the ends of its supporting-shaft and an arm *n'* and stop n^2; but it is capable of being deflected from that position when required.

When the machine is free from an ingot, the support will be held in its normal position and the mandrel will rest thereon; but when an ingot is passed between the rolls it will be struck by the forward end of such ingot, deflected over by it, and so held until the entire ingot has passed, when it will be returned by the weight *n* to its normal position and be so held until again deflected by the succeeding ingot, and so on.

As thus constructed and arranged the operation of my machine is as follows: The parts being in the position shown in Fig. 1, a heated ingot will be passed upon the arm *e*. The hinged sections e^5 e^5 will then be swung outward into engagement with the heads *f f* and the actuating agent admitted to the forward end of the cylinder M, which may be accomplished by throwing the lever V into the position shown in full lines in said figure. The continued flow of the actuating agent will bring the arm *e*, with its heated ingot, into relation with the mandrel, the arm *e'* being by the same movement carried into position to receive a fresh ingot, as indicated by dotted lines at e^2. The hinged sections e^5 e^5 are then swung back away from the heads *f f*, the stops E' E' are removed from contact with the mandrel, and the ingot slid forward into the rolls, between which it passes, and its transformation effected in a manner common to this class of machine. After the discharge of the completed article a heated ingot will be applied to the arm *e'*, the hinged sections e^5 e^5 again swung outward into engagement with the heads *f f*, the actuating agent admitted to the rear of the cylinder by throwing the lever V into the position indicated in dotted lines in Fig. 1, and the arm *e'*, and with it its heated ingot, will be brought into relation with the mandrel. The ingot will then be slid forward into the bite of the rolls and the same operation as before will be repeated, and so on, the arms *e e'* alternately supplying fresh ingots to the mandrel, which are successively passed between the rolls and converted into the finished product.

While in the foregoing I have described the best means contemplated by me for carrying my invention into practice, I wish it distinctly understood that I do not limit myself thereto, as it is obvious that the same may be modified in various ways without departing from the spirit thereof.

Having now fully described my invention and one way in which it is or may be carried into effect, what I claim, and desire to secure by Letters Patent of the United States, is—

1. A stock for holding a mandrel between the rolls of a rolling-machine, consisting of a suitable body with a plurality of arms extending therefrom, substantially as described.

2. A stock for holding a mandrel between the rolls of a rolling-machine, consisting of a suitable body with a plurality of arms extending therefrom radially to its axis, substantially as described.

3. A stock for holding a mandrel between the rolls of a rolling-machine, consisting of a body F', having a plurality of arms *e e'*, extending radially to its axis and provided at their outer ends with T-shaped heads, substantially as described.

4. A stock for holding a mandrel between the rolls of a rolling-machine, consisting of a suitable body F', having a plurality of arms *e e'*, provided with T-shaped heads at their outer or free ends extending radially from its axis, and a third arm e^3, provided with an arc-shaped flange e^4 and hinged sections e^5, substantially as described.

5. The combination, with the rolls of a rolling-machine and a mandrel provided with a suitably-shaped slot through its receiving end, of a stock for holding said mandrel between the rolls and supplying it with fresh ingots, consisting of a suitable body, a plurality of arms extending from such body and provided with suitably-shaped heads at their outer ends for engagement with said slot, and an arc-shaped flange for connecting such heads, provided with hinged sections at its ends, substantially as described.

6. The combination, with the rolls of a rolling-machine, a mandrel provided with a T-shaped slot through its receiving end, and a stock consisting of a suitable body, having a plurality of arms extending from it and provided with T-shaped heads at their outer ends and an arc-shaped flange for connecting such heads, of a piston and cylinder for communicating an oscillating movement to said stock to bring its arms alternately into engagement with the mandrel, substantially as described.

7. The combination, with a stock for holding the mandrel between the rolls of a rolling-machine, consisting of a suitable body F' and

arms *e e'*, extending radially to its axis, a shaft to which such stock is secured, and a bracket or standard in which the shaft is mounted, of a piston and cylinder and mechanism intermediate such piston and shaft, whereby to impart to the latter an oscillatory motion, and through it to the stock a similar movement, substantially as described.

8. The combination, with the stock consisting of the body F', arms *e e' e³ f f*, flange *e⁴*, and hinged sections *e⁵ e⁵*, the shaft H, the bracket or standard I, the gear N, the rack O, piston-rod P, having a piston thereon, the cylinder M, and means for controlling the flow of the actuating agent thereto, whereby to impart an oscillating movement to the stock, substantially as described.

In testimony whereof I have hereunto set my hand this 14th day of January, 1889.

WILLIAM H. APPLETON.

Witnesses:
WILLIAM T. PITT,
HENRY CARTER.