(No Model.) 3 Sheets—Sheet 1.

W. H. APPLETON.

MACHINE FOR ROLLING SEAMLESS TUBING.

No. 412,010. Patented Oct. 1, 1889.

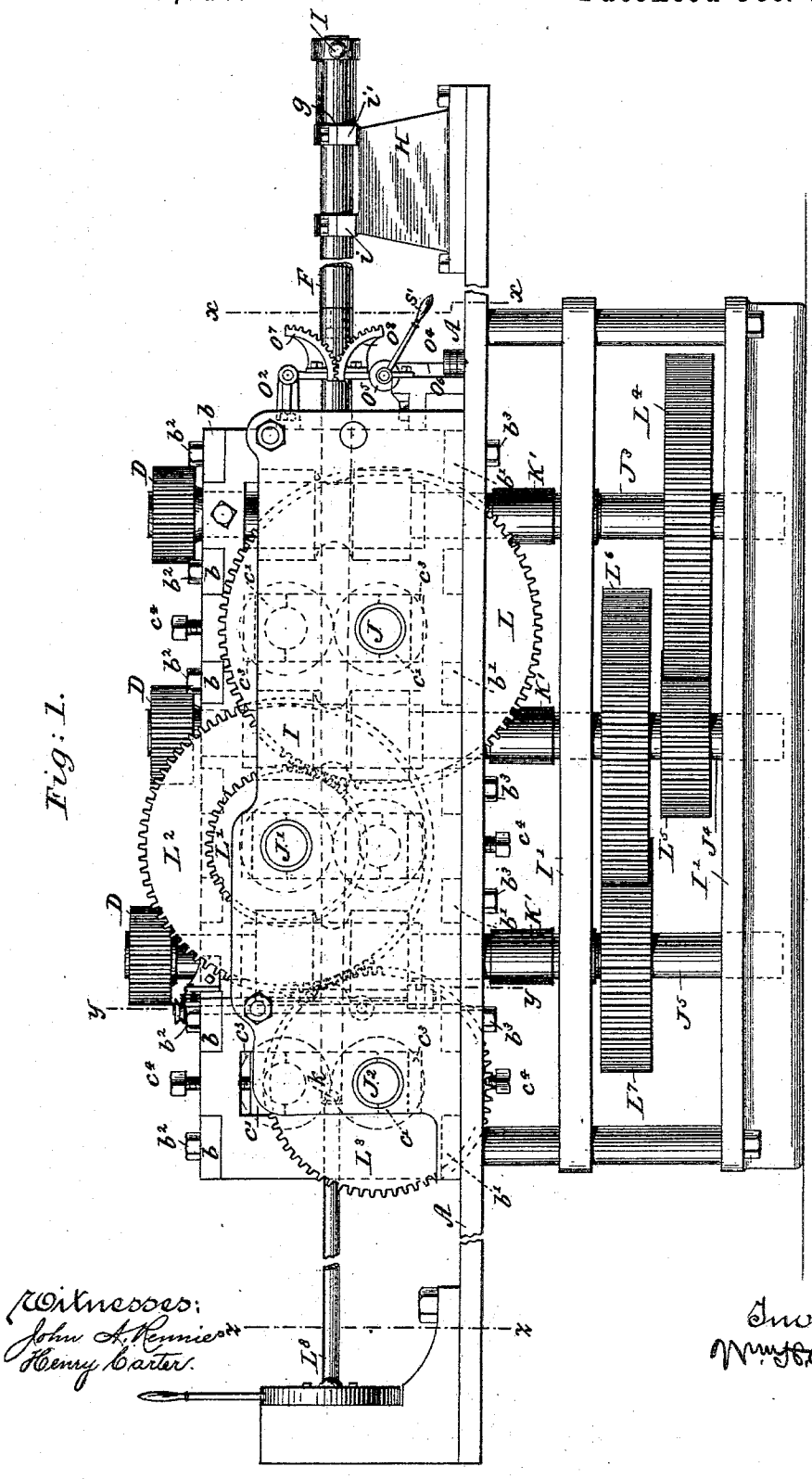


Fig: 1.

Witnesses:
John A. Rennie
Henry Carter.

Inventor:
Wm H Appleton

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 2.

W. H. APPLETON.

MACHINE FOR ROLLING SEAMLESS TUBING.

No. 412,010. Patented Oct. 1, 1889.

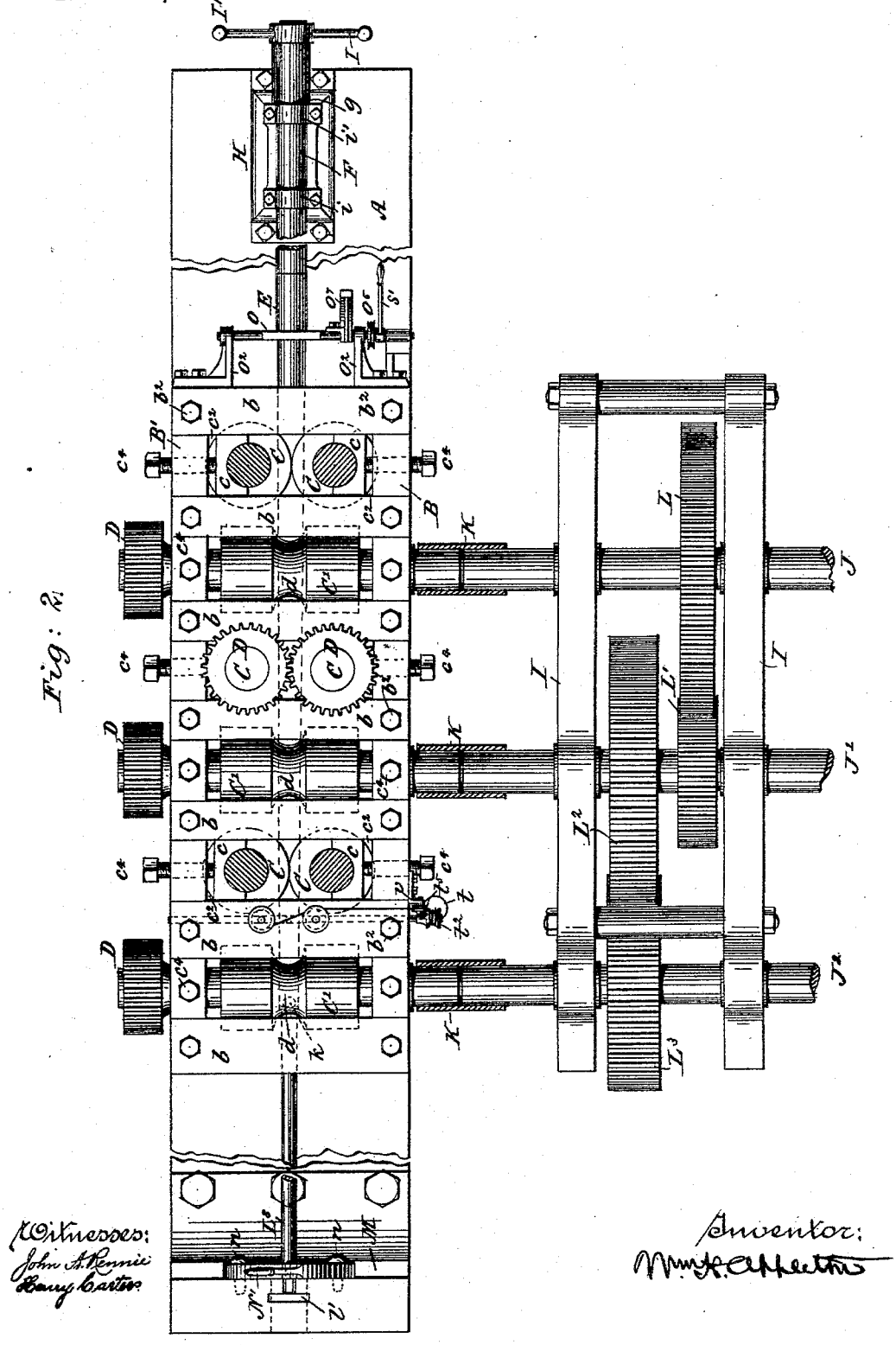


Fig. 2.

Witnesses:
John A. Rennie
Benj. Carter

Inventor:
Wm. H. Appleton

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 3.

W. H. APPLETON.

MACHINE FOR ROLLING SEAMLESS TUBING.

No. 412,010. Patented Oct. 1, 1889.

Fig: 3.

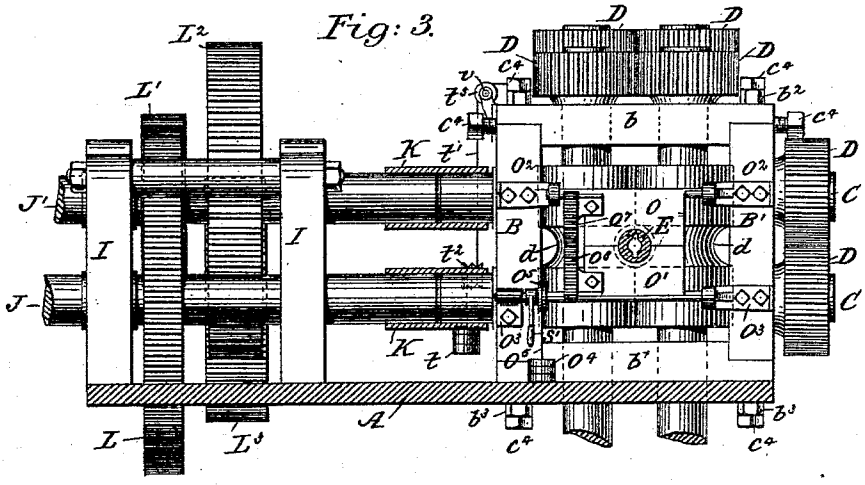


Fig: 4.

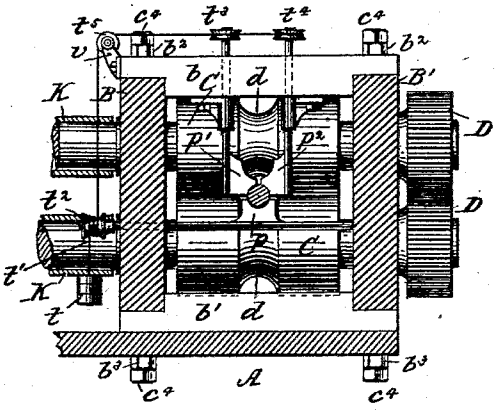


Fig: 5.

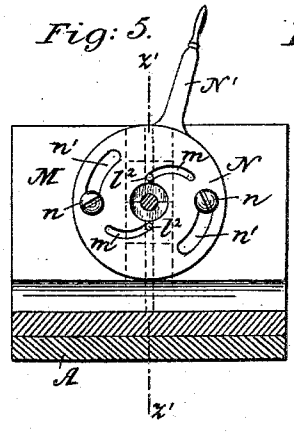


Fig: 6.

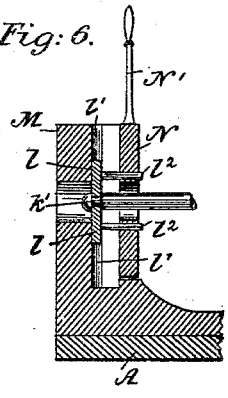


Fig: 7.

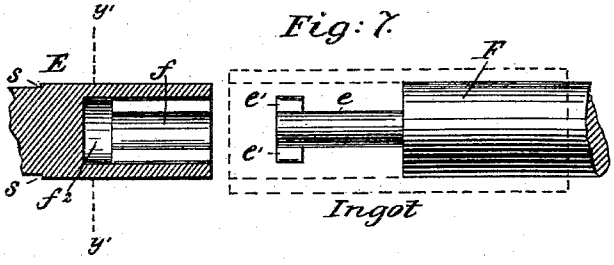


Fig: 8.

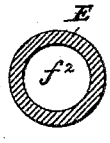
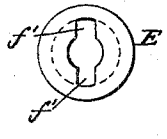


Fig: 9.



Witnesses:
John A. Rennie.
Henry Carter.

Inventor:
Wm. H. Appleton

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

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

MACHINE FOR ROLLING SEAMLESS TUBING.

SPECIFICATION forming part of Letters Patent No. 412,010, dated October 1, 1889.

Application filed November 2, 1888. Serial No. 289,816. (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 relates to that class of machines in which a plurality of pairs of rolls are employed in connection with a mandrel which extends between them, and has for its object to provide a machine of this character which shall not only be simple in construction, but shall at the same time be more efficient in operation than those heretofore in use.

To this end my invention consists, first, in the combination, with the rolls by means of which the ingots are reduced and a mandrel arranged to project between them, of a stock adapted to be engaged with and disengaged from the mandrel, and not only receive the ingots to be transformed, but permit of their being transferred thereto; second, in the combination, with the rolls for reducing the ingots, the mandrel arranged to project between them, and the stock, of mechanism for supporting the mandrel centrally between the rolls when the latter are free from the ingot; third, in the combination, with the rolls for reducing the ingots, the mandrel extending between them, and the stock, of a strut to act against the end of the mandrel opposite to that engaged by the stock to resist the longitudinal strain imparted to it by the ingot in passing over the same, or to assist the stock in so doing; and, fourth, in various other constructions and combinations of devices, all as will hereinafter more fully appear.

Referring to the accompanying drawings, which form a part of this specification, Figure 1 is a side elevation of a machine embodying my invention, some of the parts being broken out for convenience in illustration; Fig. 2, a plan view of the same with some of the parts shown in section; Fig. 3, a sectional elevation of the machine, taken on the line x x of Fig. 1 and looking in the direction toward which the ingot moves in passing between the roll; Fig. 4, a section of the machine, taken on the line y y of Fig. 1, looking toward the left in that figure; Fig. 5, a similar section taken on the line z z of Fig. 1; Fig. 6, a section of the parts shown in Fig. 5, taken vertically thereof on the line z' z'; Fig. 7, a detail showing the adjoining ends of the mandrel and stock, with an ingot in dotted lines, the end of the mandrel being illustrated as in longitudinal section; Fig. 8, a section of the mandrel, taken on the line y' y' of Fig. 7; and Fig. 9, an end view of the mandrel, showing the form of the orifice therein which receives the locking member carried by the stock.

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

A indicates the base-plate or other suitable support, upon which are mounted the main housings of the machine. These housings may be constructed in various ways. As shown in the drawings, however, they are composed of two members or side frames B B′, which are connected by suitable cross-pieces b b', extending across from one to the other, and being secured to them by suitable screws or bolts b^2 b^3.

C C′ indicate the rolls by means of which the reduction or transformation of the ingots is effected, the same being respectively mounted in suitable bearings c c', which are fitted to appropriate guideways c^2 c^3, formed in or secured to the main housing of the machine, and are adjustable therein by means of screws c^4. The rolls C are preferably arranged to turn upon vertical axes and the rolls C′ upon horizontal axes, the two series being so disposed as to bring their several pairs 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. As thus arranged, the rolls of each pair in both the vertical and horizontal series are geared together, as shown at D, whereby to insure their rotation in unison, and in order to provide for taking and properly acting upon the ingot as it passes through the machine the several pairs of rolls, instead of rotating at the same surface velocity, move at differential speeds, each succeeding 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 the action of the preceding pair thereon. To effect this result and cause the proper rotation of the rolls, I find it convenient to employ the housings II', the former of which is arranged in relation to the horizontal rolls and the latter in relation to the vertical rolls, all as shown. Mounted in suitable bearings formed in the housing I are the shafts J J' J^2, &c., which are so disposed as to bring the axis of the shaft J into coincidence with the axis of the under roll of the first horizontal pair, the axis of the shaft J' into coincidence with the axis of the upper roll of the second horizontal pair, and the axis of the shaft J^2 in coincidence with the shaft of the under roll of the third horizontal pair, and so on, the succeeding shafts, when employed, alternately from the under roll of one pair to the upper roll of the next pair, the object of which disposition being to dispense with idlers and the necessary complication of mechanism incident thereto. Secured upon the shaft J is a gear L, which meshes with the small gear L', fast upon the shaft J', which also carries a larger gear L^2, that meshes with the small gear L^3, secured to the shaft J^2, which in practice would be provided with a larger gear to mesh with a smaller gear upon the next shaft, if one was employed, and so on throughout the series, the succeeding shaft being provided with a smaller gear meshing with a larger gear on the preceding shaft. As the several shafts J J' J^2, &c., are connected to the several rolls of the horizontal series by suitable couplings K, it will be seen that when power is applied to any one of them a differential motion will be communicated to the several pairs of rolls with which they are connected, the first pair moving at a given velocity, the next pair at an increased speed, and the next at a still further accelerated velocity, and so on. Similarly with respect to the vertical rolls the shafts J^3 J^4 J^5, &c., being connected to their ends by couplings K' in the same order as the former shafts are connected to the horizontal rolls, and the gears L^4 L^5 L^6 L^7, &c., being proportioned and arranged substantially the same as the gears L L' L^2 L^3, &c., power applied to one of these shafts will communicate to the several pairs of rolls a progressively-increased rotation with respect to the first or entering pair, which will be so timed as to make them properly co-operate with the horizontal series.

In the manufacture of columns or tubing having a rectangular form in cross-section the several pairs of rolls may be made with smooth peripheries without any depressions or indentations formed in them; but in the rolling of articles having a cylindrical or polygonal contour in cross-section I find it convenient to provide each of said rolls with a circumferential groove *d* in its peripheral surface, which will be of such form transversely that when brought into relation with the groove in its companion roll the two will conform to the cross-section of the article to be produced.

E indicates the mandrel over which the ingot is passed and the completed article produced. This mandrel is arranged to project between the several pairs of rolls, as shown, and may be made either of uniform diameter throughout or tapering, as desired. I prefer, however, to make it of tapering form from a point opposite the bite of the first pair of rolls, or slightly in advance thereof, to its discharging end, leaving the remaining portion of it at its receiving end of such shape and size as will permit of the ready passage of the ingot on over it. To hold this mandrel in proper position between the rolls during the time the ingot is being passed on over the same, and at the same time provide means for supplying fresh ingots thereto, I employ the stock F, which is constructed of proper size and shape to receive an ingot, and is provided at its inner end with a suitable means whereby it may be locked to and unlocked from the mandrel when required. The means whereby the locking together of the stock and mandrel and their unlocking are effected may be of various forms. I prefer, however, to employ that form illustrated in Figs. 7, 8, and 9 of the drawings as being the most simple and efficient for the purpose, the same consisting of a stud or reduced portion *e*, extending outward axially from the end of the stock, with suitable lugs *e' e'* projecting radially therefrom near its outer extremity, and of an orifice or socket *f*, for its reception and engagement, formed in the end of the mandrel, as shown. The contour of this orifice or socket in cross-section will be such as to correspond to that of the stud and lugs, with an enlarged central portion and radial grooves *f' f'*, and will terminate at its inner end in an enlarged chamber f^2, which will preferably be of cylindrical or other convenient form, in order to permit of the said stud being partially rotated therein when fully inserted, and at the same time afford a suitable shoulder or abutment with which the lugs *e'* may engage when brought into relation therewith, and effect the locking of the parts together.

The stock F will be of uniform diameter from the point *g* to its inner end, and will be fitted to both rotate and move longitudinally in suitable boxes or bearings *i i'*, formed in or secured to the bracket or standard H, which will be rigidly secured to the base-plate A or other suitable support. From the point *g* to its rear end the stock will preferably be of an enlarged diameter, in order to provide a shoulder to act against the bearing *i'*, and thereby resist the strain put upon the mandrel by the ingot in passing over the same during the rolling operation, its rear end being provided with

suitable appliances whereby to effect its operation—such, for instance, as the projecting arms or handles I I′.

As the parts are thus constructed and arranged, the locking of the stock to the mandrel, when unlocked therefrom, is effected by seizing the arms or handles I I′ and forcing the stock forward longitudinally through the bearings *i i′* toward the machine until the forward movement is arrested by the shoulder at *g*. This movement of the stock carries the stud *e* thereon into the orifice *f*, formed in the end of the mandrel, after which a partial rotation of the stock will carry the lugs *e′ e′* behind the shoulder formed between the inner end of the grooves *f′ f′*, and the parts will be securely locked together, the shoulder *g* serving to resist any strain that may be given to the mandrel in the direction in which the ingot travels in passing over it. The unlocking of the parts will be effected by a reversal of these operations, the stock being first rotated backward until the lugs *e′ e′* register with the grooves *f′ f′*, after which the stud will be withdrawn from the orifice by drawing back the stock through the medium of the arms or handles I I′.

The stock F will in most instances be sufficient to resist the strain put upon the mandrel in the rolling operation without assistance. I sometimes find it convenient, however, to employ in connection therewith, and sometimes as a substitute therefor, a strut L^8, which engages at one of its extremities with the end of the mandrel over which the completed product is discharged and at its other extremity abuts against a suitable stop on the resisting-bracket. This strut is preferably made of a size sufficiently small in cross-section to permit of the article being produced passing readily over it, and of a length somewhat greater than such article, in order to permit of it passing wholly thereon when discharged from the rolls. The inner end of said strut in the preferred form of construction rests loosely in a semi-spherical recess *k*, formed in the end of the mandrel over which the completed article is discharged, and its outer end is provided with a circumferential groove *k′*, in which engage jaws *l l*, fitted to slide in suitable guideways *l′ l′*, formed in the resisting bracket or standard M, which in turn is fixedly secured to the base-plate or other convenient support. These jaws are each provided on its front with a pin or stud l^2 for engagement with one or the other of the volute-shaped slots *m m*, formed in the annulus N, which is secured to the front of the resisting bracket or standard M concentric to the axis of the strut by screws *n*, passing through the curved slots *n′* therein in such a manner as to be rotated thereon, and is provided with a suitable handle N′, whereby it may be operated. By this means, as will be seen, provisions are made not only for holding the strut, and with it the mandrel, from all longitudinal movement, but also for removing from the former the article being produced, the rotation of the annulus N in one direction serving to force the jaws *l l* into engagement with the groove *k′*, and thereby securely holding the strut, and in the opposite direction withdrawing them therefrom and permitting of the article passing between them and off said strut when it is desired to remove it.

In order to hold the mandrel from contact with the rolls when it is free from an ingot, I find it convenient to employ the supporting devices *o o′* and *p p′* p^2, the former of which are located near its receiving end and the latter near its discharging end. The supporting devices *o o′* are preferably provided on their adjoining edges with suitably-shaped recesses for engaging with the mandrel when brought into contact therewith, and are journaled so as to swing on horizontal axes in suitable brackets o^2 o^3, respectively, projecting outward from the housings of the machine, as shown. In their normal position these supporting devices will be held in contact with the mandrel by means of a weight o^4, which is secured to a pulley o^5, fast on the journal of the lower of said devices by means of a cord o^6, and their movement in unison will be effected through the instrumentality of the geared sectors o^7 o^8, with which they are provided. Incidental to the assistance rendered the supporting devices *p p′* p^2 in holding the mandrel from contact with the rolls, these supporting devices *o o′* may also be employed for holding it from longitudinal movement in a direction through the rolls when disconnected from the stock, in which event I provide the mandrel with a small shoulder *s*, Fig. 7, with which such devices abut when in their normal position, and secure to the under of said devices *o′* an arm or handle *s′*, by means of which it may, with the upper device *o*, be forced back into its normal position when removed therefrom, and with the mandrel securely held in that position.

The supporting devices *p p′* p^2 are best shown in Fig. 4, and are journaled in the housings of the machine in such a manner as to be swung back away from the mandrel by the action of the ingot in passing through the machine. These supporting devices, like the former, will be held normally in contact with the mandrel, the device *p* serving to support it against the action of gravity and the two others acting to hold it from being raised or carried sidewise against the rolls. When the mandrel is held alone by the stock and the strut is not employed, the supporting device *p* only will be required, the devices *p′* p^2 being dispensed with; but when the strut is used without the assistance of the stock then all of them will be necessary, as the action of the strut upon the mandrel may be such as to carry it against the upper rolls or the side of the groove when the end of the ingot first enters between the rolls. In order to return

these supporting devices to their normal positions after having been swung therefrom by the passage of the ingot, various means may be adopted. I prefer, however, to employ a weight t and to connect it to the said devices by a cord t', passing around suitable pulleys t^2, t^3, and t^4, secured, respectively, to their shafts, and over the pully t^5, mounted on a suitable hanger v, secured to the housings of the machine.

As thus constructed, the operation of the machine is as follows: The parts being in the position shown in Figs. 1 and 2, the stock is first rotated backward until the lugs on the stud projecting from its end register with the groove in the end of the mandrel, and is then drawn backward longitudinally through its supporting-bearings to the proper extent. The heated ingot is next placed in front of the inner end of the stock with the axes of the two in coincidence, or substantially so, and the stock forced through the orifice in the former, as shown in Fig. 7, and interlocked with the mandrel, after which the supporting devices o o' are swung back away from the mandrel by raising the handle s', and the ingot is slid off the stock upon the mandrel and into the bite of the first pair of rolls. From these the ingot passes between the succeeding pairs of rolls and is transformed into the desired article, being discharged from the last or finishing pair either upon a suitable supporting-table or upon the strut, when one is employed. To remove the article from the strut when discharged thereupon, all that is necessary is to withdraw the jaws from the groove in the end of the strut by a backward rotation of their operating-annulus and sliding it off over its end, after which the jaws may be again forced down into engagement with the groove and the course of procedure above pointed out repeated, and so on.

From the foregoing it will be seen that I produce a machine for the manufacture of tubular articles from hollow ingots which is not only simple in construction, but convenient and effective in operation, and well suited for the purposes for which it is intended.

While I have shown the best means contemplated by me for carrying my invention into practice, I wish it distinctly understood that I do not limit myself strictly thereto, as it is obvious that I may modify the same in various ways and still be within the scope thereof—as, for instance, instead of using six pairs of rolls, I may use eight or more pairs, or, if preferred, a lesser number may be employed. So, also, with respect to the mandrel-supporting devices, instead of employing weights for holding them in their normal positions, I may make use of springs therefor, or may use weights with some and springs with others. Again, instead of connecting the strut to the mandrel loosely, I may, if I so desire, secure it rigidly thereto.

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

1. The combination, with the rolls of a rolling-machine, and a mandrel for co-operation therewith, of a stock for holding the mandrel in proper position with respect to said rolls during the rolling operation, adapted to receive the ingot to be transformed and permit of its transfer to the mandrel, substantially as described.

2. The combination, with the rolls of a rolling-machine, a mandrel for co-operation therewith, and a stock for engaging with the receiving end of said mandrel, adapted to receive the ingot to be transformed and permit of its transfer to the mandrel, of a strut for acting against the discharging end of such mandrel and a resisting bracket or support against which the strut acts, substantially as described.

3. The combination, with the rolls of a rolling-machine, a mandrel for co-operation therewith, and a stock for holding said mandrel in proper position during the rolling opeeration, adapted to receive the ingot to be transformed and permit of its transfer to the mandrel, of devices for supporting said mandrel from contact with the rolls when free from an ingot, substantially as described.

4. The combination, with a plurality of pairs of vertical and horizontal rolls arranged in alternate series and a mandrel extending between them, of a stock for holding said mandrel in proper position between the rolls during the rolling operation, provided with suitable means whereby it may be locked to and unlocked from such mandrel, and supporting devices therefor, substantially as described.

5. The combination, with a plurality of pairs of circumferentially-grooved vertical and horizontal rolls arranged in alternate series, and a mandrel extending between them and lying in said grooves, of a stock for holding said mandrel in proper position between the rolls during the rolling operation, adapted to receive the ingot to be transformed and permit of its transfer to the mandrel, and a bracket provided with suitable bearings in which such stock is fitted to slide and rotate, substantially as described.

6. The combination, with a plurality of pairs of vertical and horizontal rolls arranged in alternate series, a mandrel arranged to co-operate therewith, and a stock for holding the mandrel in proper position respecting said rolls during the rolling operation, of a bracket or standard provided with suitable bearings in which the stock is mounted and devices for supporting the mandrel and holding it from contact with the rolls when free from an ingot and when disengaged from the stock, substantially as described.

7. The combination, with a plurality of pairs of circumferentially-grooved vertical and horizontal rolls arranged in alternate se-

ries, a mandrel extending between them and provided with a locking member, and a stock for holding said mandrel in proper position between the rolls during the rolling operation, provided with a locking member, whereby it may be locked to and unlocked from said mandrel, of a bracket or standard having a bearing in which said stock is mounted and devices for supporting the mandrel and holding it from contact with the rolls when free from an ingot and when disengaged from the stock, substantially as described.

8. The combination, with the rolls of a rolling machine, and a mandrel for co-operation therewith, provided with a locking member at its end, of a stock for holding said mandrel in proper position between the rolls during the rolling operation, provided with a locking member, whereby it may be engaged with and disengaged from the mandrel, and a support for such stock, substantially as described.

9. The combination, with a mandrel provided with the orifice *f*, having the radial grooves *f' f'* and enlarged chamber f^2, of the stock provided with the stud *e*, having the lugs *e' e'* formed thereon, substantially as described.

10. The combination, with a plurality of pairs of vertical and horizontal rolls arranged in alternate series and a mandrel extending between them, of a strut for holding said mandrel in proper position between the rolls during the rolling operation and a resisting bracket or standard against which said strut acts, substantially as described.

11. The combination, with a plurality of pairs of circumferentially-grooved vertical and horizontal rolls arranged in alternate series, a mandrel arranged to project between them and lie in the grooves thereof, and a strut for holding said mandrel in proper position between the rolls during the rolling operation, of a resisting bracket or standard against which the strut acts and devices for supporting the mandrel and holding it from contact with the rolls when free from an ingot, substantially as described.

12. The combination, with the strut L, provided with a groove or shoulder at its end, and a resisting bracket or standard M, of suitable jaws and means for causing them to engage with said groove or shoulder or recede therefrom, substantially as described.

In testimony whereof I have hereunto set my hand this 6th day of October, 1888.

WILLIAM H. APPLETON.

Witnesses:
EDWARD W. HUTCHINGS, Jr.,
HENRY CARTER.