No. 671,563. Patented Apr. 9, 1901.

H. PERRINS.

MANUFACTURE OF METALLIC TUBES.

(Application filed Dec. 17, 1900.)

(No Model.) 4 Sheets—Sheet 1.

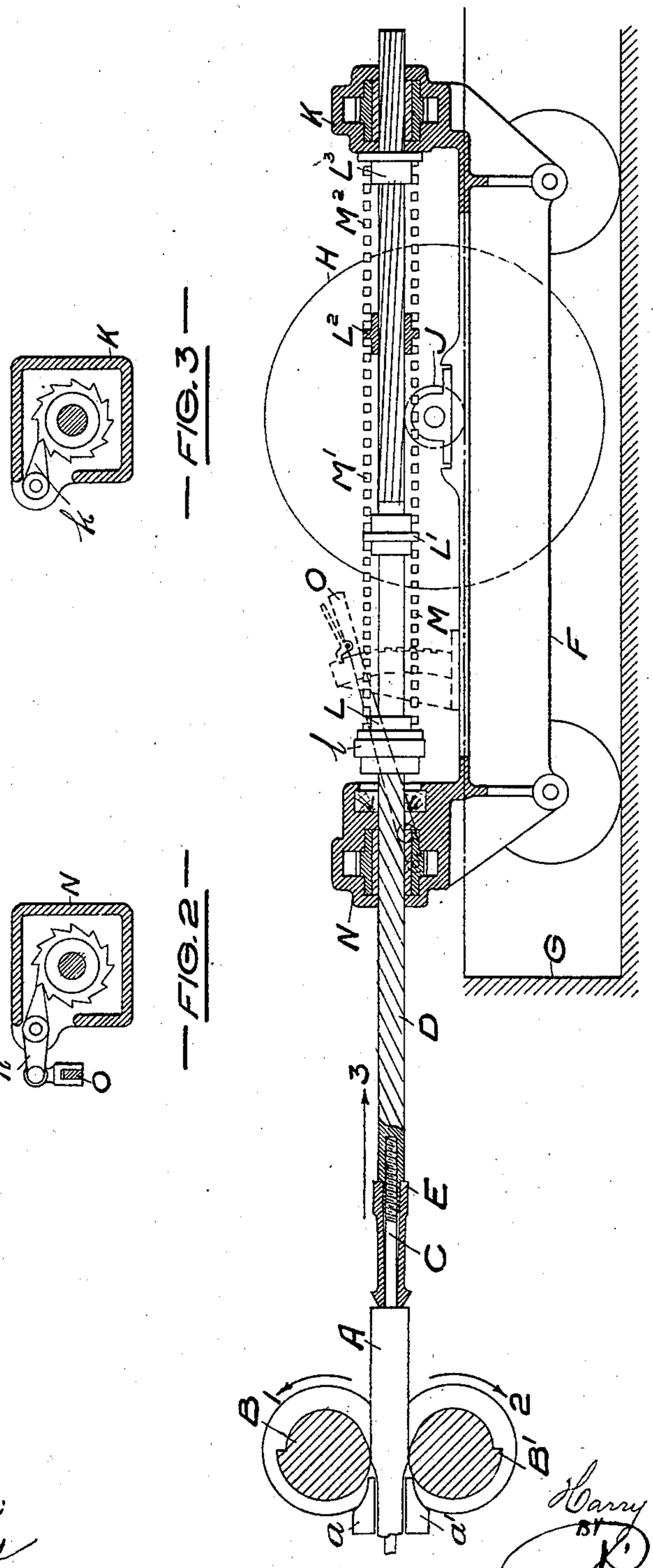


FIG. 1.

FIG. 3.

FIG. 2.

WITNESSES;
Ella L. Giles
Otto Munn

INVENTOR
Harry Perrins
BY
Richards & Co
ATTORNEYS.

No. 671,563. Patented Apr. 9, 1901.

H. PERRINS.

MANUFACTURE OF METALLIC TUBES.

(Application filed Dec. 17, 1900.)

(No Model.) 4 Sheets—Sheet 2.

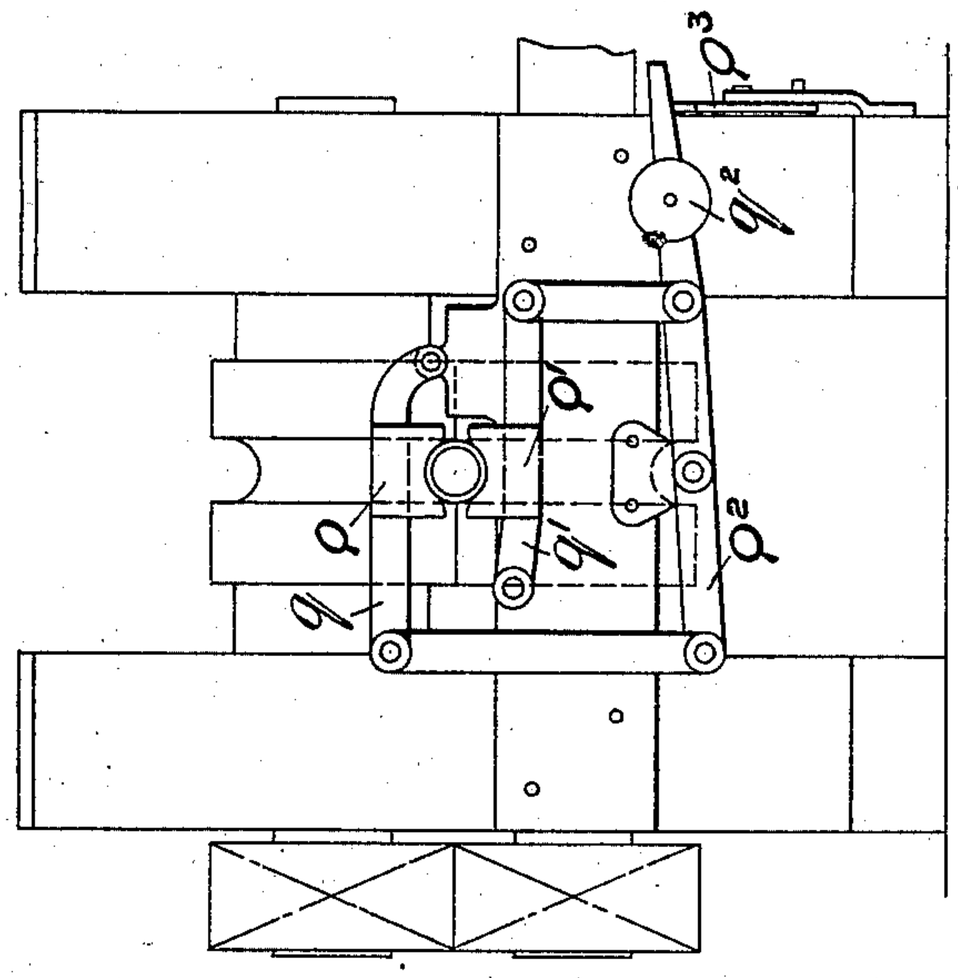


FIG. 5

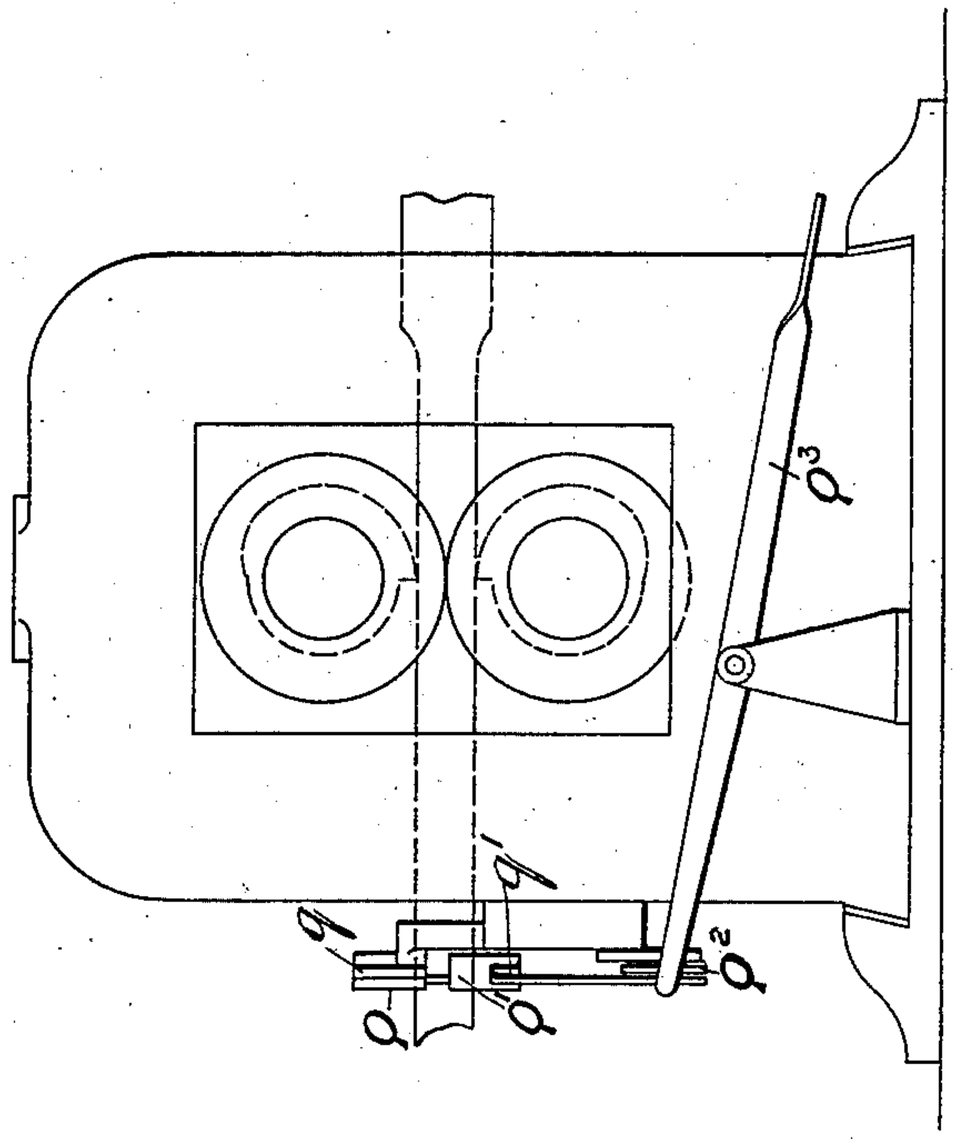


FIG. 4

WITNESSES:
Ella L. Giles
Otto Munck

INVENTOR
Harry Perrins
BY Richards & R
ATTORNEYS

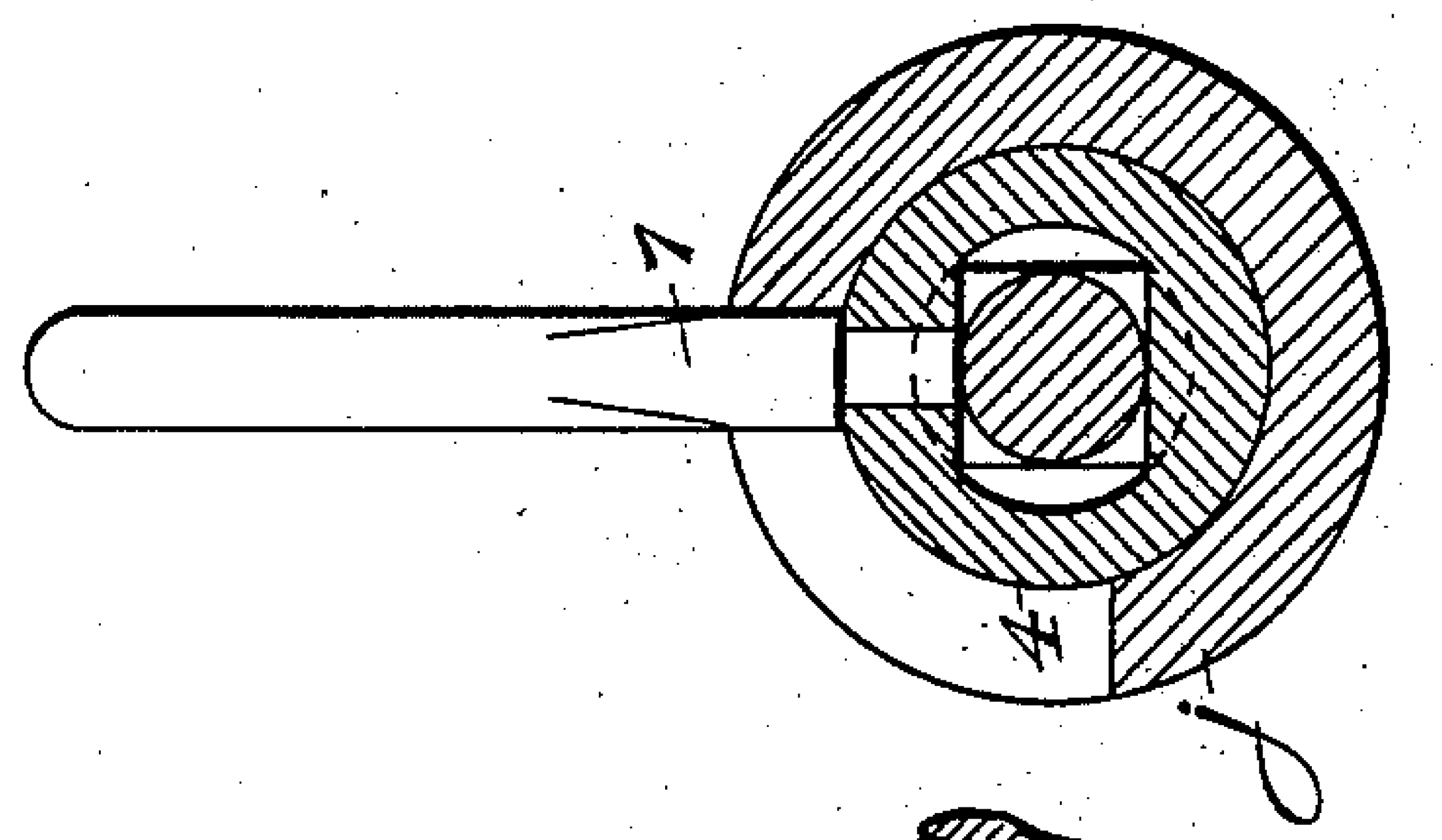
No. 671,563. Patented Apr. 9, 1901.

H. PERRINS.

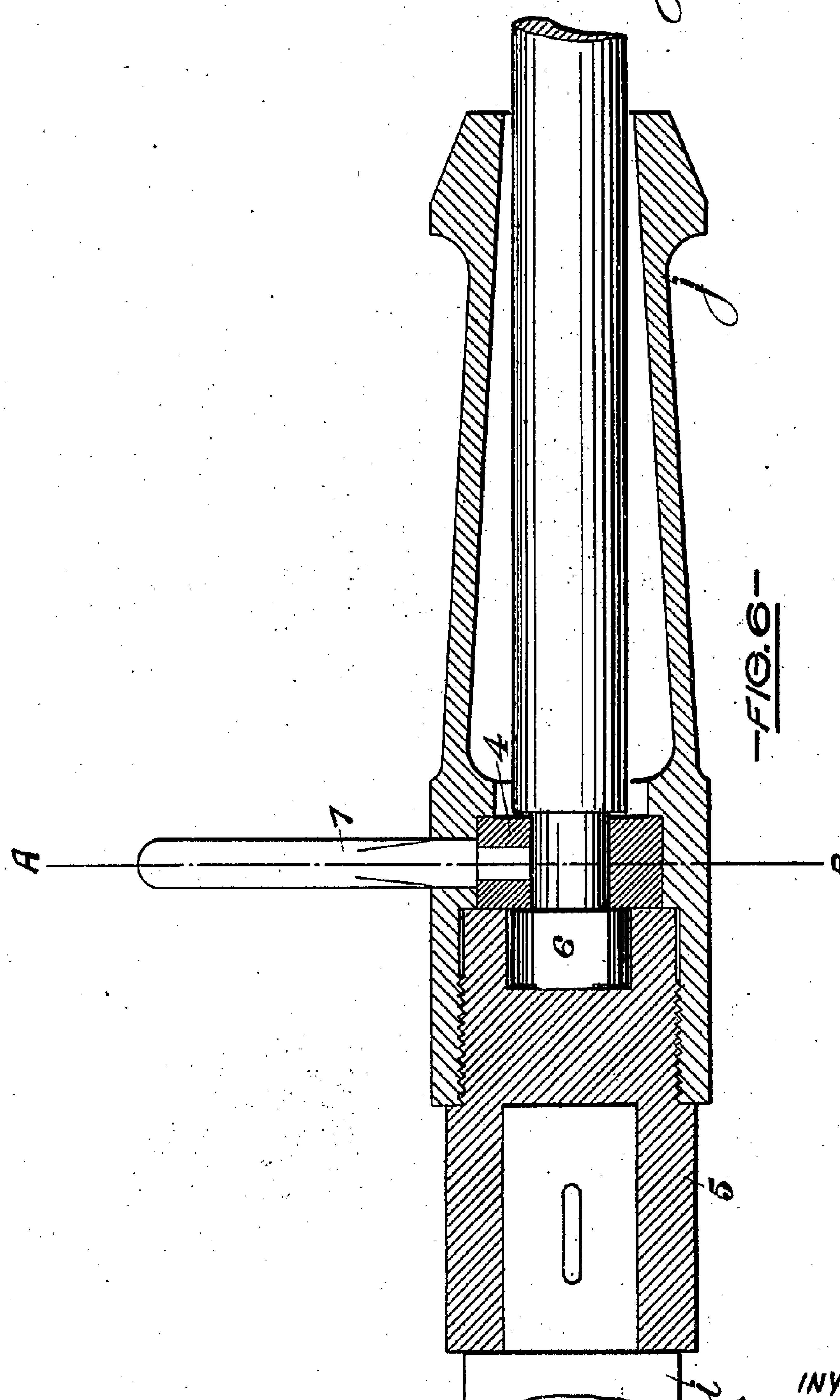
MANUFACTURE OF METALLIC TUBES.

(Application filed Dec. 17, 1900.)

(No Model.) 4 Sheets—Sheet 3.



-FIG.7-



-FIG.6-

WITNESSES:
Ella L. Giles

INVENTOR
Harry Perrins
BY Richards & Co
ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

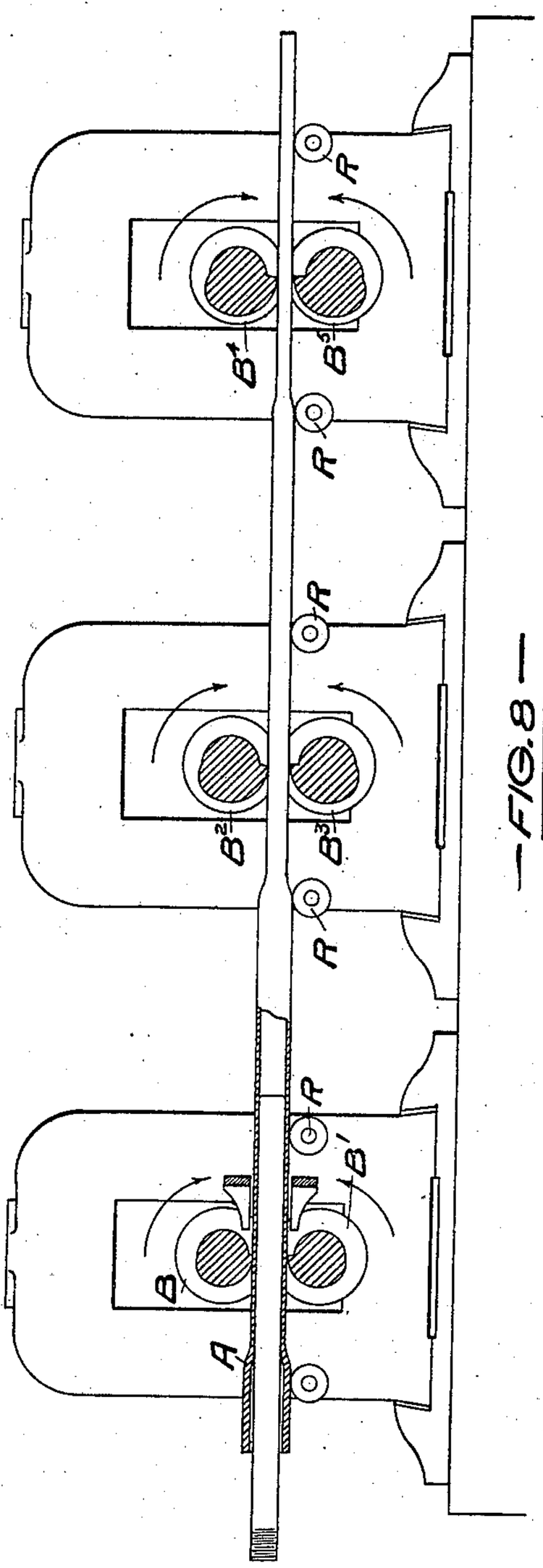
No. 671,563. Patented Apr. 9, 1901.

H. PERRINS.

MANUFACTURE OF METALLIC TUBES.

(Application filed Dec. 17, 1900.)

(No Model.) 4 Sheets—Sheet 4.



—FIG. 8.—

WITNESSES:
Ella L. Giles
Otto Munk

INVENTOR
Harry Perrins
BY
Richards
ATTORNEYS

UNITED STATES PATENT OFFICE.

HARRY PERRINS, OF STOURBRIDGE, ENGLAND, ASSIGNOR TO PERRINS, LIMITED, OF WARRINGTON, ENGLAND.

MANUFACTURE OF METALLIC TUBES.

SPECIFICATION forming part of Letters Patent No. 671,563, dated April 9, 1901.

Application filed December 17, 1900. Serial No. 40,209. (No model.)

To all whom it may concern:

Be it known that I, HARRY PERRINS, a subject of the Queen of Great Britain and Ireland, and a resident of The Hawthorns, Wollaston, Stourbridge, in the county of Worcester, England, have invented certain new and useful Improvements Relating to the Manufacture of Metallic Tubes, (for which I have filed an application in Great Britain, No. 5,425, bearing date March 22, 1900,) of which the following is a specification.

This invention consists of improvements relating to the manufacture of iron and other metal tubes, my object being to provide means for the more effectual, convenient, and expeditious production of finished tubes from hollow blooms or shells.

Referring to the four accompanying sheets of explanatory drawings, Figure 1 is a sectional side elevation showing my improved means for feeding the hollow bloom or shell through the gapped or pilger rolls, by which it is stretched in length and reduced in thickness to the required finished dimensions. Fig. 2 is a sectional end elevation of the forward ratchet-box, and Fig. 3 a similar view of the rear ratchet-box shown, at Fig. 1. Fig. 4 is a side elevation, and Fig. 5 an end elevation, showing my means for preventing movement of the tube and mandrel when released from the feeding-machine. Fig. 6 is a sectional side elevation, and Fig. 7 a sectional end elevation on the line 1 2, Fig. 6, showing, to a larger scale, one form of coupling or connection between the mandrel and the push-bar of the feeding-machine. Fig. 8 is an elevation representing a group of gapped or pilger rolls as arranged tandem fashion for the production of a tube having varying diameters.

The same reference-letters in the different views indicate the same or similar parts.

The hollow bloom or shell A, Fig. 1, for the production of a tube is placed on a mandrel and subjected to the action of a pair of rolls B B′ of the well-known gapped type, which act intermittently upon a short length of the bloom to be rolled, the said bloom being gradually reciprocated between the rolls, so that the point of operation is gradually advanced from one end to the other. The rolls are driven in the directions indicated by the arrows 1 and 2 in any ordinary manner. During the period of rotation in which the smaller radii of the rolls coincide the bloom or shell is advanced through the rolls by my feeding-machine, (shown at Fig. 1,) while during the period of rotation in which the larger radii of the rolls coincide the bloom or shell, with the mandrel and the part of the machine supporting the same, are propelled in the direction indicated by the arrow 3; but during such return movement the pressure of the rolls upon the portion of the bloom or shell A between them causes the metal to flow along the mandrel, (in the direction opposite to that indicated by the arrow 3,) thus reducing its thickness to the required size and correspondingly lengthening the tube. The bloom or shell A, as shown at Fig. 1, has been partially reduced and elongated by the gapped rolls. The finished portion of the tube is shown to the left hand of the center of the rolls, while the portion of the bloom or shell remaining to be operated upon by the rolls is shown to the right hand.

The mandrel C is detachably connected with the push-bar D, which has a socket-like projection E fixed to its forward end. Such socket-like projection E (with a modified form of mandrel attachment) is also shown in the larger-scale views at Figs. 6 and 7. The detachable connection between the mandrel C and the push-bar D, as illustrated at Fig. 1, is formed by a screw-thread around the rear portion of the mandrel and a correspondingly-screwed socket or aperture in the front end of the bar.

The push-bar D is free to slide within bearings formed by a traveling bed or carriage F, movable on wheels along the base of a box or trough G. The required movement of the said carriage is effected by a hand-wheel, as H, having on its shaft a pinion J for gearing in a rack formed on or secured to the upper end of the trough G. Around the rear part of the push-bar D, I form slow-pitch spiral grooves or screw-threads to engage a corresponding ratchet-nut carried in a pawl-box K, arranged to permit of the rotation of the nut in the one direction only.

Between the collars L, L′, L^2, and L^3, mount-

ed on the push-bar D, I dispose the respective spiral springs M, M′, and M². The collars are freely mounted on the push-bar, which can thus slide through them. The collar L abuts against the fixture *l* on the bar itself and the collar L³ against the ratchet-box K. During the action of the larger radii or the working surfaces of the rolls B B′ upon the hollow bloom or tube-shell A such shell, with its mandrel C, and the push-bar D are, as hereinbefore indicated, propelled in the direction of the arrow 3, and during such movement the springs are compressed; but when the gapped portions or smaller radii of the rolls (which do not act upon the tube-shell) coincide with each other the springs react upon the push-bar D and propel it, together with the mandrel C and tube-shell A, in the reverse direction to that indicated by the arrow 3 until arrested by stops, as *a a′*, arranged in the pass between the rolls B B′ and forming part of the housings or framing of the rolls. The carriage F is held stationary during the return movement of the push-bar D by means of the hand-wheel H, hereinbefore referred to; but during the forward movement of the push-bar under the action of the springs a slight forward or feeding movement is imparted to the carriage by the hand-wheel H. In this manner the complete tube is gradually advanced through the rolls during its reciprocation.

No rotary motion is imparted to the push-bar D during its return movement (or its movement in the direction of the arrow 3) by the working of the grooved rear part through the nut in the ratchet-box K, as the nut itself is then free to rotate; but during the forward stroke under the impulse of the springs the nut is prevented from turning by the pawl *k*, Fig. 3, of the pawl-box K, and thus a slight rotary movement is imparted to the push-bar and the connected mandrel with the tube thereon. By such automatic turning of the tube the rolls are caused to act around the entire circumferential surface instead of upon only two sides of the tube, as would occur without such turning.

After the hollow bloom or tube-shell has been nearly passed right through the gapped rolls B B′ and so converted into a finished tube it is necessary to disengage the mandrel from the push-bar in order to effect the reduction and stretching of the rear end of the tube-shell. For this purpose I form a quick screw-thread around the fore part of the push-bar D (having its direction of spiral opposite to that of the slow-pitch screw-thread at the rear end of the bar) and pass the same through a corresponding nut having ratchet-teeth formed around its periphery and mounted in a box N. Normally the said nut is free to rotate within the box as the screwed push-bar passes through it; but after the hollow bloom or tube-shell has been nearly passed right through the rolls the nut is locked or prevented from rotation by the pawl-lever *n*, which is then thrown into engagement with the ratchet-teeth of the nut by means of any suitable lever device, as O. When the nut is thus locked or prevented from rotation, the push-bar on each return stroke (or movement in the direction indicated by the arrow 3) will have such a rotary movement imparted to it, while the tube and its mandrel are gripped tightly between the rolls, as to cause it to unscrew and retreat from the mandrel C. In this manner the socket-like projection E (which is in rigid attachment with the bar D) is carried back at each stroke a sufficient distance to clear the rolls and enable the same to bite and operate upon the rear end of the metal forming the tube-bloom, and thus the entire bloom is passed through the rolls as a finished tube. The conical nose or forward end of the said socket-like projection E (which is shown more clearly at Fig. 6) is made at such angle or degree of sharpness that the reduction in diameter between the larger and the smaller ends is greater than the reduction that occurs in the pass between the pilger-rolls in a corresponding peripheral length as the tapering or working portions of the said rolls approach each other. Thus if any part of the conical nose should, near the completion of the reduction and stretching of each bloom, be pushed in contact with the rolls no seizure will occur, as the succeeding portions of the peripheries of the rolls will advance upon a portion of the nose of such a smaller diameter as will prevent it from being affected or even touched by the rolls.

Instead of providing for an automatic movement of the push-bar and its socket-like projection relatively to the mandrel, as hereinbefore described, I sometimes provide for the entire release of the mandrel from the push-bar, preferably in the manner illustrated at Figs. 6 and 7. In this modification the mandrel is secured to the push-bar within the socket projection E by means of a rotatable holder, as P, located between the socket projection and an attachment-piece *d*, fixed to the push-bar D. The head of the mandrel is of an oval or similar shape, and the eye through the rotatable holder P and the aperture in the forward end of the attachment-piece *d* have a similar shape to admit the said head; but when the said head *c* is in position as shown at Figs. 6 and 7 the holder P is rotated through a right angle by means of the handle-piece *p*, and its aperture is thus so disposed, as illustrated in the figures, as to prevent the withdrawal of the mandrel. When necessary, however, the mandrel can be at once withdrawn if the handle-piece *p* is so operated as to dispose the eye through the holder P in the same position as the aperture in the attachment-piece *d*—that is, to make the larger sides of the apertures in both parts coincide with each other.

Before releasing the mandrel from the holder P for the purpose of effecting the reduction and stretching of the rear end of the tube bloom or shell the top roll is raised to

relieve the pressure on the tube, and it is then necessary to provide means for preventing the action of the bottom roll (upon which the tube rests) from moving both tube and mandrel. For this purpose I arrange a frictional grip, as shown at Figs. 4 and 5, to hold the forward or the reduced and stretched portion of the tube beyond the rolls. The grip consists of a pair of tube embracing or gripping pieces Q Q′, respectively connected to the levers q q', which are both linked to the lever Q^2 on opposite sides of its fulcrum or pivot pin, as shown. The said lever Q^2 is operated as required by means of the foot-lever Q^3, upon which the pressure is maintained throughout the period in which it is necessary to grip the tube. On removal of the foot-pressure the counterweight q^2 effects the release of the gripping-pieces from the tube.

After the release of the mandrel from the holder P the portion of it which was inclosed by the socket projection E will receive and support the metal flowing from the rear end of the bloom as it is passed through the rolls by hand or otherwise and so reduced to the required diameter and correspondingly stretched or lengthened.

In the production of tubes having stepped or variable diameters, such as the tube A shown in course of manufacture at Fig. 8, I feed the bloom, with its supporting-mandrel, through a pair of pilger-rolls, as B B′, in the manner hereinbefore described; but beyond the said pair of rolls B B′ and in line with the same I arrange other pilger-rolls, as B^2 B^3 and B^4 B^5, which act upon the portions of the tube already reduced and stretched by the rolls B B′. The portions of tube passing through the rolls B^2 B^3 and B^4 B^5 are preferably not internally supported by a mandrel, and thus at such portions the diameter of the tube is reduced in the manner shown. The tube is supported externally while passing through the tandem series of rolls by means of small rollers, as R. The various sets of pilger-rolls are all positively driven in any ordinary manner.

When the tubes are required to have internal fin-like projections, the mandrels employed in their manufacture are provided with corresponding channels or depressions, into which the metal is forced by the action of the rolls. In like manner if external projections are required the working surfaces of the rolls are provided with channels or depressions.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In machines for the manufacture of metallic tubes from hollow blooms or shells, the combination consisting of a pair of gapped rolls rotating in opposite directions, bloom-arresting stops fixed in the pass between the said rolls, a reciprocating push-bar, a mandrel detachably connected to the said push-bar, and a conically-nosed socket-piece in attachment with but projecting from the push-bar, said socket-piece being thus supported independently of the mandrel and inclosing a portion of the said mandrel, substantially as described.

2. In machines for the manufacture of metallic tubes from hollow blooms or shells, the combination consisting of a pair of gapped rolls rotating in opposite directions, bloom-arresting stops fixed in the pass between the said rolls, a slow-pitch spirally-grooved or screw-threaded reciprocating push-bar, a ratchet-nut through which the said push-bar reciprocates, a pawl-box permitting the nut to rotate in one direction only, a mandrel detachably connected to the said push-bar and a conically-nosed socket-piece in attachment with but projecting from the push-bar, said socket-piece being thus supported independently of the mandrel and inclosing a portion of the said mandrel, substantially as described.

3. In machines for the manufacture of metallic tubes from hollow blooms or shells, the combination consisting of a pair of gapped rolls rotating in opposite directions, bloom-arresting stops fixed in the pass between the said rolls, a quick-pitch spirally-grooved or screw-threaded reciprocating push-bar, a ratchet-nut through which the said push-bar reciprocates, a pawl-box permitting the nut to rotate in one direction only, a mandrel screwed within the forward end of the push-bar, and a conically-nosed socket-piece in attachment with but projecting from the said forward end of the push-bar, said socket-piece being thus supported independently of the mandrel and inclosing a portion of the said mandrel, substantially as described.

4. In machines for the manufacture of metallic tubes from hollow blooms or shells, the combination consisting of a pair of gapped rolls rotating in opposite directions, bloom-arresting stops fixed in the pass between the said rolls, a reciprocating push-bar having a quick-pitch spiral groove or screw-thread along one part of it and a slow-pitch spiral groove or screw-thread along another part of it, ratchet-nuts through which the said screwed parts respectively reciprocate, pawl-boxes permitting the respective nuts to rotate in one direction only, a mandrel screwed within the forward end of the push-bar, and a conically-nosed socket-piece in attachment with but projecting from the said forward end of the push-bar and inclosing a portion of the said mandrel, the direction of spiral of the said quick and slow screw-threads of the push-bar being in opposite directions, substantially as described.

5. In machines for the manufacture of metallic tubes from hollow blooms or shells, the combination consisting of a pair of gapped rolls rotating in opposite directions, bloom-arresting stops fixed in the pass between the said rolls, a push-bar, a mandrel detachably connected to the said push-bar, a conically-nosed socket-piece in attachment with but

projecting from the push-bar, said socket-piece being thus supported independently of the mandrel and inclosing a portion of the said mandrel, push-bar-supporting wheeled carriage, carriage-operative hand-wheel and rack-gear, and push-bar-propelling springs disposed between a portion of the carriage and a fixture on the bar itself, substantially as described.

6. In machines for the manufacture of metallic tubes from hollow blooms or shells, the combination consisting of a pair of gapped rolls rotating in opposite directions, bloom-arresting stops fixed in the pass between the said rolls, a reciprocating push-bar, a mandrel detachably connected to the said push-bar, a conically-nosed socket-piece in attachment with but projecting from the push-bar and inclosing a portion of the said mandrel, tube-gripping pieces, a foot-lever, and linkage between the foot-lever and the said gripping-pieces, substantially as described.

7. In machines for the manufacture of metallic tubes from hollow blooms or shells, the combination consisting of a tandem series of pairs of gapped rolls, bloom-arresting stops fixed in the pass between the foremost pair of rolls, a reciprocating push-bar, a mandrel detachably connected to the said push-bar, a conically-nosed socket-piece in attachment with but projecting from the push-bar, said socket-piece being thus supported independently of the mandrel and inclosing a portion of the said mandrel, and tube-supporting rollers, the rolls in each pair of the said series rotating in opposite directions, substantially as described.

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

HARRY PERRINS.

Witnesses:
EDWARD MARKS,
HARRY DAVIS.