No. 611,609. Patented Oct. 4, 1898.

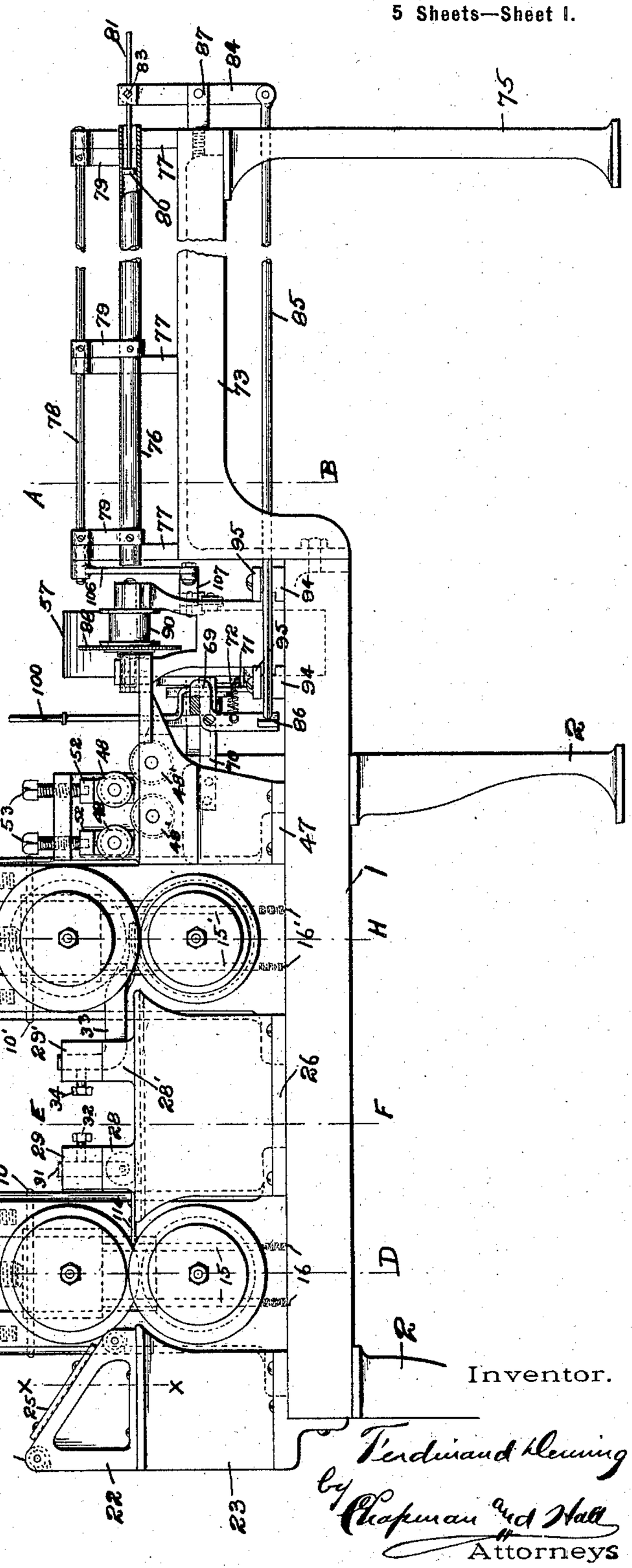
F. DEMING.

TUBE ROLLING MACHINE.

(Application filed May 21, 1897.)

(No Model.) 5 Sheets—Sheet 1.

FIG. 1.



Witnesses.
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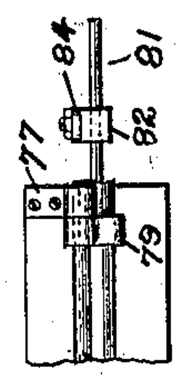
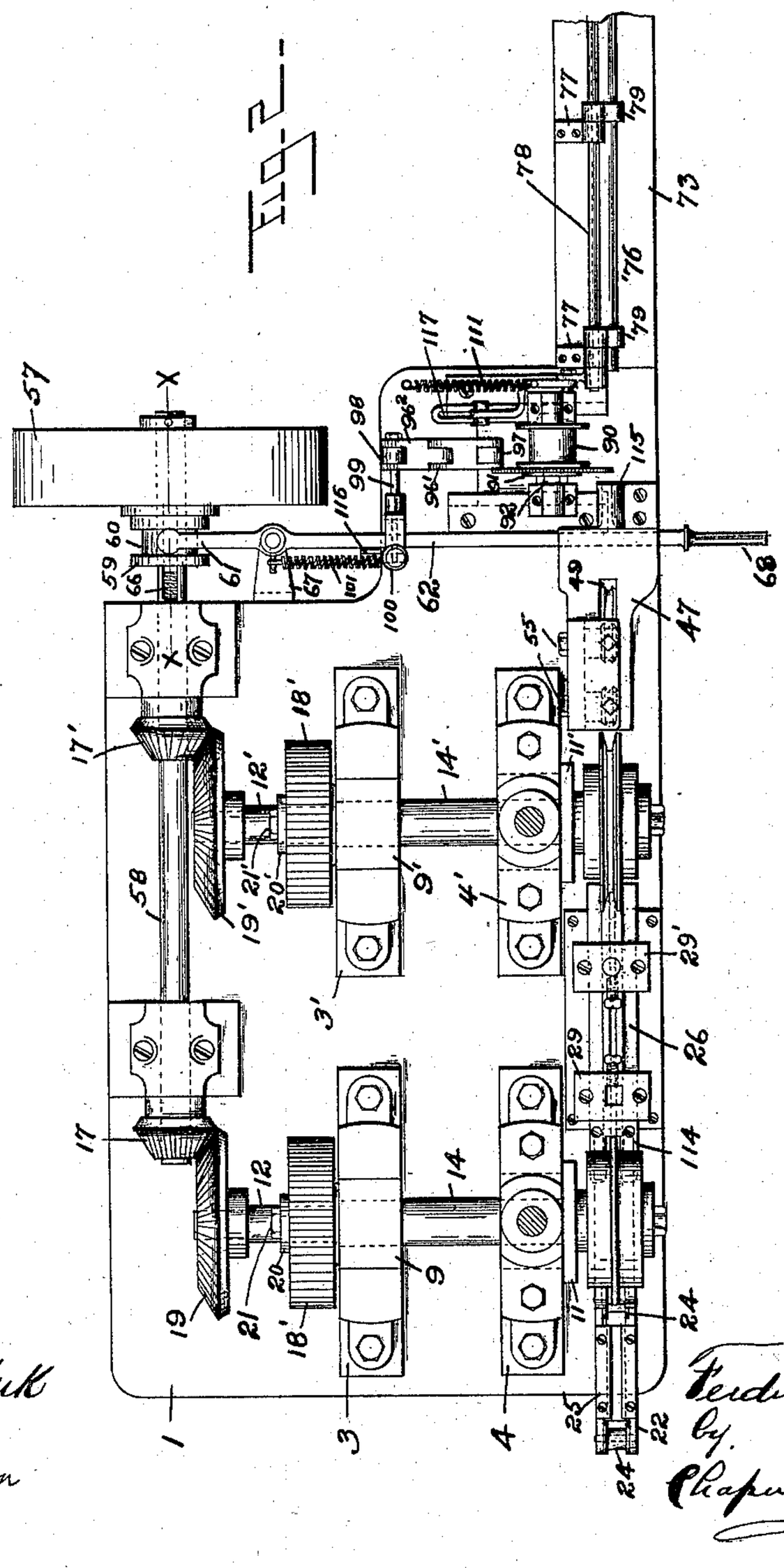


FIG. 2.



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(No Model.) 5 Sheets—Sheet 3.

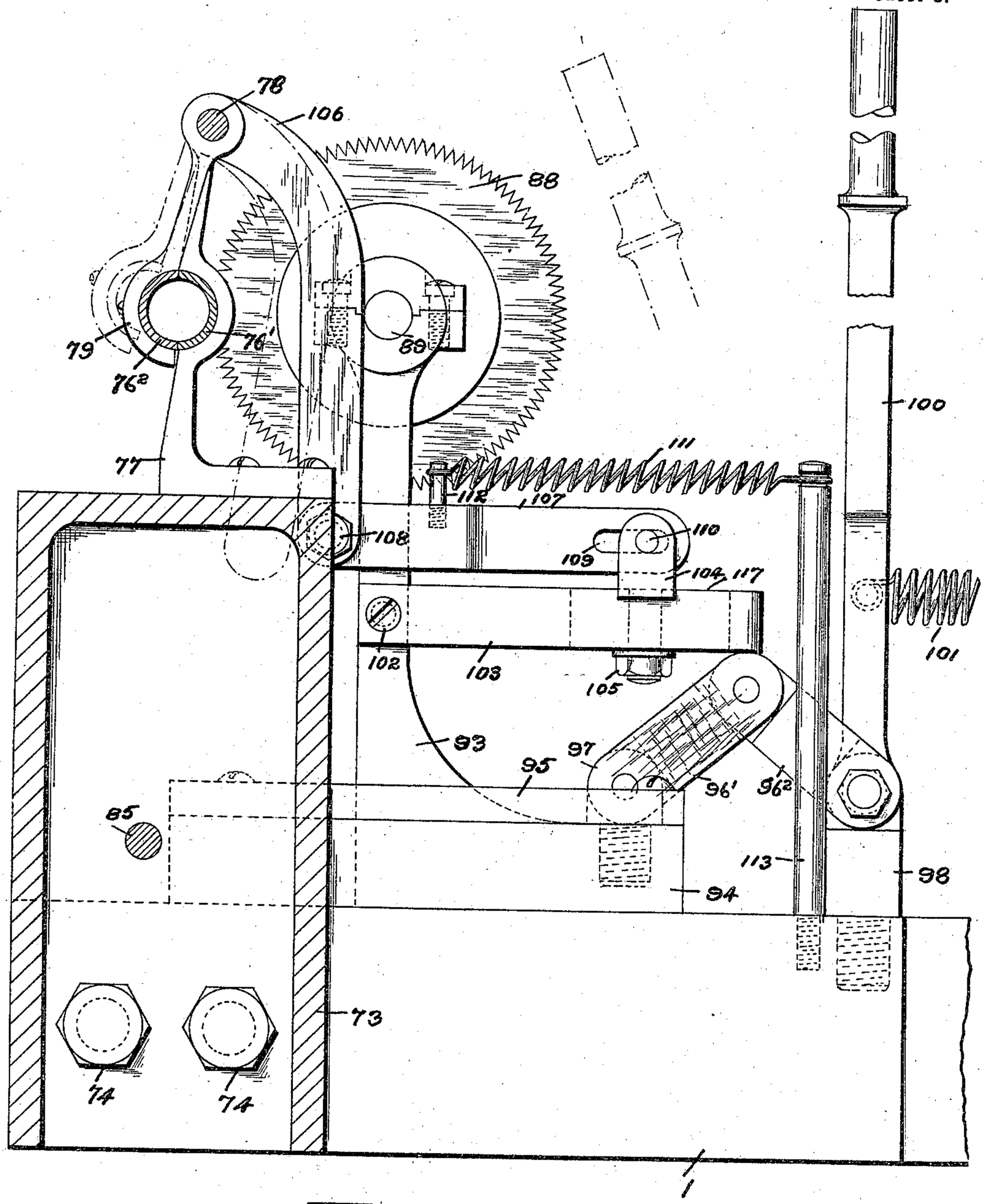

Fig. 3.

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(No Model.) 5 Sheets—Sheet 4.

Fig. 4.

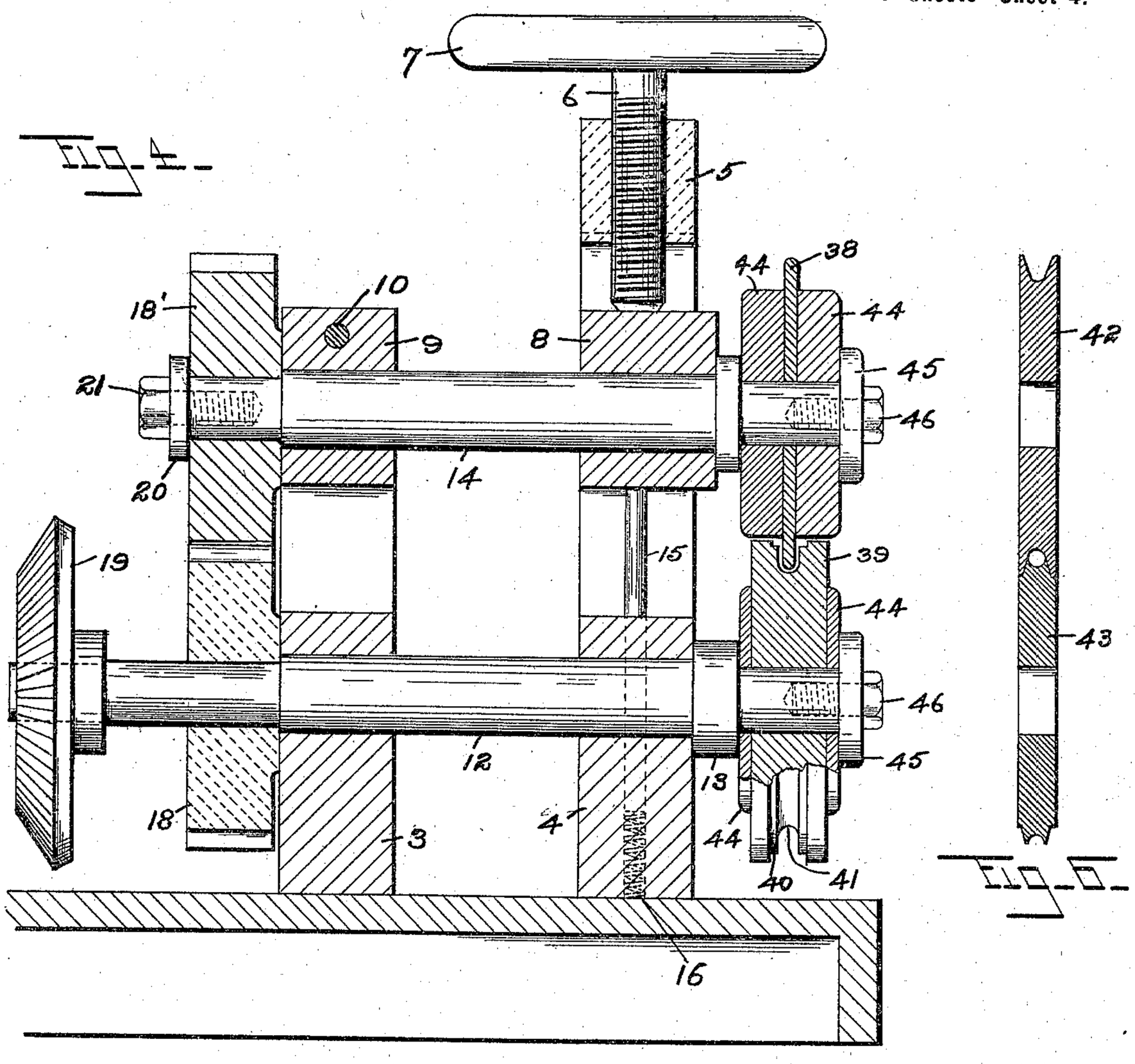


Fig. 5.

Fig. 8.

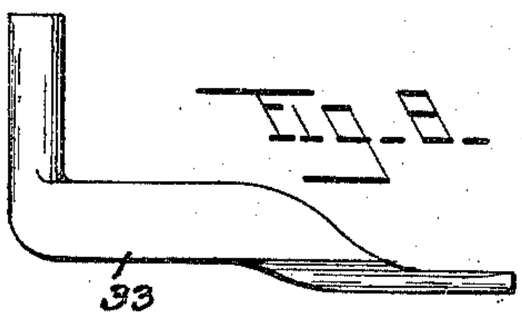


Fig. 9.

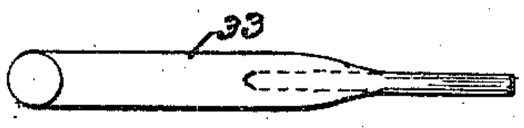


Fig. 5.

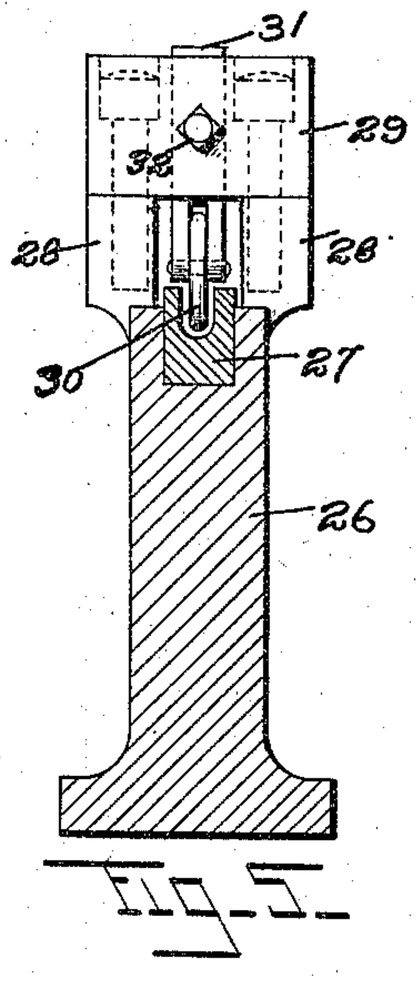
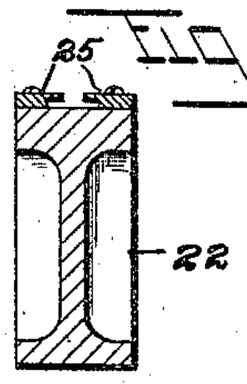


Fig. 7.



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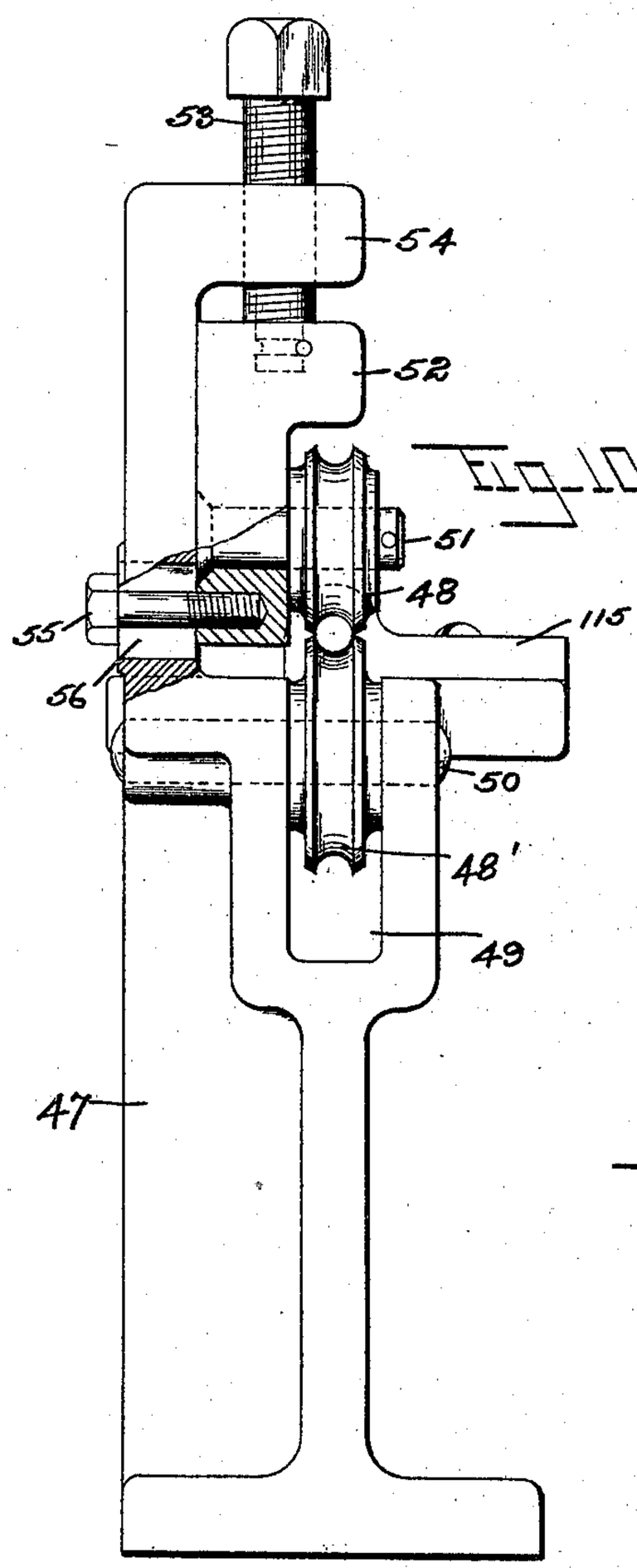

Fig. 10.

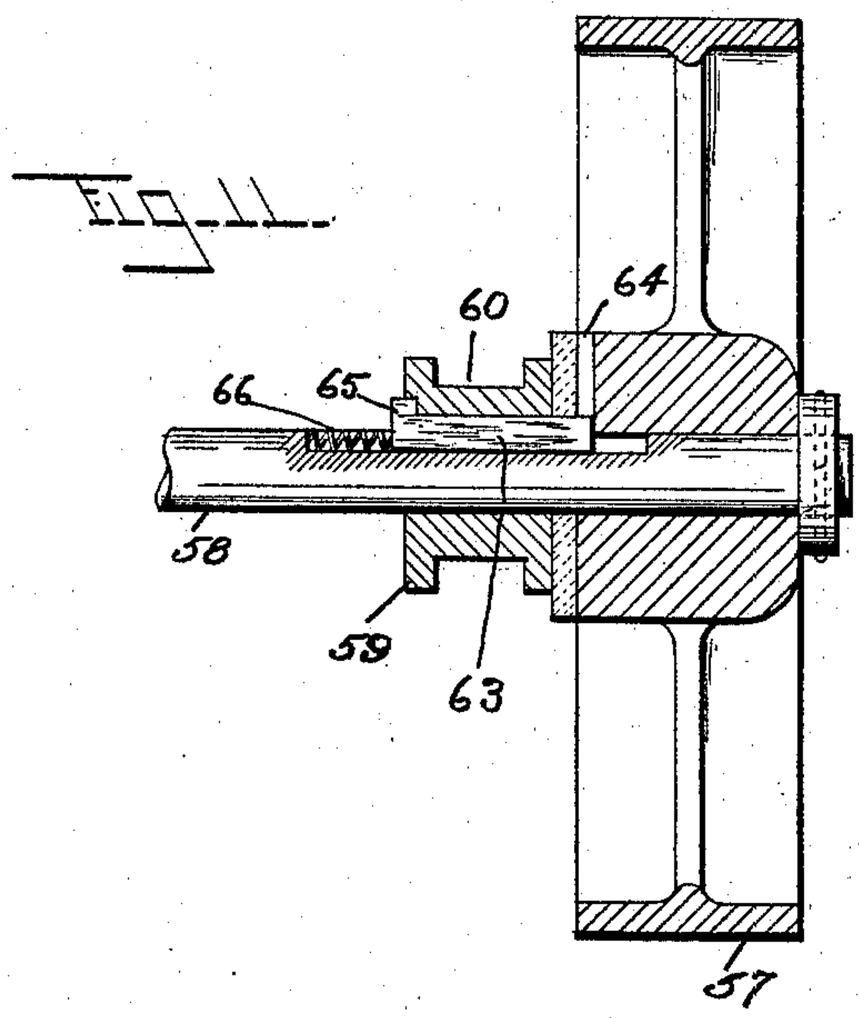

Fig. 11.

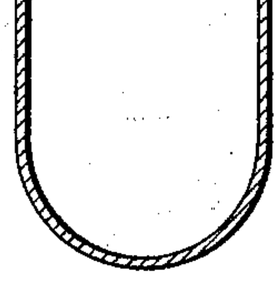

Fig. 12.

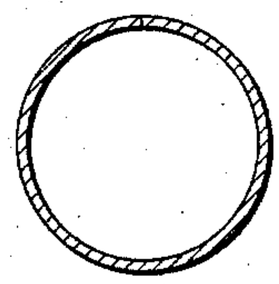

Fig. 13.

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UNITED STATES PATENT OFFICE.

FERDINAND DEMING, OF WATERBURY, CONNECTICUT, ASSIGNOR TO GEORGE H. CLOWES, OF SAME PLACE.

TUBE-ROLLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 611,609, dated October 4, 1898.

Application filed May 21, 1897. Serial No. 637,518. (No model.)

To all whom it may concern:

Be it known that I, FERDINAND DEMING, a citizen of the United States, residing at Waterbury, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Tube-Rolling Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to a new and improved machine for rolling tubes from a strip of metal, the finished tubes being of that class known as "brazed" tubing.

The object of my invention is to provide means composed of few parts, and those of simple design, to roll the tube, to combine means for automatically stopping the roll mechanism when a tube has been rolled of a predetermined length, and to economize floor-space as well as the expense of constructing and operating the machine.

To this end my invention consists of the tube-rolling machine constructed and operating as hereinafter fully described, and more particularly pointed out in the claims.

Referring to the drawings, in which like numerals designate like parts in the several views, Figure 1 is a front elevation of my improved tube-rolling machine. Fig. 2 is a plan view of the same. Fig. 3 is a section of the bed extension upon line A B of Fig. 1, showing a side elevation of the saw and tube-receiving mechanism. Fig. 4 is a section of the roll-frames upon line C D of Fig. 1. Fig. 5 is a section of the trough-stand upon line E F of Fig. 1. Fig. 6 is a section of the finishing-rolls upon line G H of Fig. 1. Fig. 7 is a section of the guide-frame upon line *x x* of Fig. 1. Fig. 8 is a side elevation of the triblet. Fig. 9 is a plan view of the same. Fig. 10 is an end elevation of the straightening mechanism. Fig. 11 is a section of the clutch mechanism upon line *x x* of Fig. 2. Fig. 12 is a transverse section of the metal strip after passing through the first pair of rolls. Fig. 13 is a transverse section of one form of a tube as completed by this machine.

I will first describe the construction of the roll mechanism that forms the tube and later the mechanism for determining the length of the same and for automatically stopping the roll mechanism and the saw device for cutting off the tube at its predetermined length.

Two pairs of rolls are used to shape the tube, the first pair forming the bottom of the tube by bending the strip of metal longitudinally into a U-shape strip and the last pair finishing the tube by folding the sides of the strip of metal over toward each other upon a triblet or forming-mandrel.

The numeral 1 designates the bed of the machine, supported upon the legs 2 2 and secured to the top side of which are the roll-shaft frames 3 4 3′ 4′. Bottom roll-shafts 12 12′ are journaled in the lower solid portion of the frames 3 4 3′ 4′ and are held against end movement by the collar 13 upon the front side and the spur-gear 18 upon the rear side of said frames. Upper roll-shafts 14 14′ are adjustable to a limited degree and are journaled in the shaft-boxes 8 9 8′ 9′, which are fitted into the open throat of the roll-shaft frames 3 4 3′ 4′. The boxes 9 9′ in the rear frames 3 3′ are secured by the swivel-pins 10 10′, and the boxes 8 8′ in the front frames 4 4′ are free to slide vertically, being held against end movement by the laterally-projecting lips 11 11′ upon the front side thereof. The threaded rods 6 6′, operating in the caps 5 5′ of the front frames 4 4′ and rotated by means of the hand-wheels 7 7′, provide means to adjust the shafts 14 14′. The rods 15 15′, bearing against the under side of the boxes 8 8′ and resting upon a coil-spring 16 16′ in the lower portion of the roll-frames 4 4′, hold the box permanently against the bottom of the said rods 6 6′ while in any adjusted position. A rotary motion is imparted to the lower roll-shafts 12 12′ through the bevel-pinions 17 17′ and bevel-gears 19 19′ and to the upper roll-shafts 14 14′ through the spur-gears 18 18′, which are rigidly secured to the said shafts. The spur-gears 18′ 18′ upon the upper roll-shafts are held against rotation by a key of ordinary construction and against end play by the washers 20 20′ and bolts 21 21′. The metal strip is delivered centrally to the first pair of rolls through the guide-strips 25 25, fastened to the inclined upper face of the guide-frame 22. Upon either end of the in-

clined face is an antifriction-roll 24 24. The projecting lip upon the guide-strips 25 25 holds the strip down against the guide-frame. The guide-frame 22 is bolted to the top face of the upright 23, the said upright being fastened to the bed of the machine. Located between the rolls in a line therewith and secured to the top of the bed 1 is the trough-stand 26, mortised in the upper face of which is the guide-trough 27, extending longitudinally throughout its length. Adjacent to each pair of rolls and projecting upward from either side of the trough-stand 26 are the integral lugs 28 28′, joined by the caps 29 29′. A guide-roll 30 is loosely mounted in the forked end of the roll-bar 31, which projects through a central hole in the cap 29 and is held by the set-screw 32. The guide-roll serves to hold the metal strip in the guide-trough 27 and prevents it from jumping upward. The size or shape of the trough 27 and the guide-roll 30 may be varied or changed so as to conform to the tube that is being rolled. A triblet or forming-mandrel 33, suspended between the last pair of rolls, (see Fig. 1,) is used to shape the interior of the tube. It is held rigid in the cap 29′ by the set-screw 34. The outer end or that portion of the triblet which lies between the rolls is shaped to conform to the interior of the tube, and from that point it is backed off gradually away from the roll end until it assumes the same shape as the inside of the strip as it leaves the first pair of rolls.

A section of the first pair of rolls is shown in Fig. 4, the upper roll consisting of a circular disk 38 with a rounded periphery and of substantially the same width as the inside diameter of the tube. The lower roll 39 has a peripheral groove 40 cut in its face of substantially the same width and depth as the metal strip to be rolled, and in the center of said groove is a deeper peripheral groove 41, the bottom of which is rounded to conform to the outside of the tube. Each of the second pair or finishing-rolls (a section of which is shown in Fig. 6) has a semicircular groove in its face of the same diameter as the outside diameter of the rolled tube, the groove in the upper roll 42 having flaring sides terminating at the bottom in the above-mentioned semicircular groove, and the face of the lower roll 43 is cut away, so that it will fit into the groove with flaring sides of the upper roll. Upon either side of all of the rolls is an annular ring or washer 44, the thickness of which is determined by the width of the roll. The said rolls are secured against rotation to their respective shafts by a feather of any common construction, and the washers 45 and bolts 46 hold them rigid against end play.

The straightening device comprises a stand 47, secured to the bed of the machine adjacent to and in a line with the finishing-rolls and provided with a series of straightening-rolls 48 48 48′ 48′. The lower stationary rolls 48′ 48′ are mounted between the walls of the slot 49 in the stand and rotate upon the central shaft 50. The upper rolls 48 48 are adjustable vertically and are mounted upon studs 51 in the slides 52 52, the slides being raised and lowered by the screws 53 53, the lower portions of which are pinned to the said slide and the threaded portion operating in the lip 54, projecting from the back of the stand. When the slide has been adjusted to its proper position, it is held rigid by the screws 55 55, which reach through an elongated slot 56 in the back of the stand and screw into the lower portion of the slide. 57 designates a loose pulley upon the horizontal shaft 58, which drives the said shaft by means of the clutch mechanism, consisting of the collar 59, having a peripheral groove 60 for the reception of the yoke end 61 of the shifting lever 62 and adapted to throw the feather 63, which is fitted into a spline in the horizontal shaft, into register with the radial slot 64 in the hub of the loose pulley. When the feather 63 registers with the said slot, the coil-spring 66 throws the feather into the said slot, thus uniting the pulley and shaft, causing the rolls to rotate. When it is desired to stop the machine, the collar 59, with the aid of the lever 62, is pushed along the shaft away from the pulley, and by means of the head 65 upon the feather the feather is drawn out of the slot 64, releasing the pulley and stopping the shaft. The shifting lever 62 is pivotally mounted on the bracket 67, with the handle end 68 reaching out over the front of the machine, so as to be in a convenient position for the operator. A latch-bar 70, which is bolted to the stand 47, supports the outer end of the shifting lever 62, and the spring-actuated latch 69 locks the shifting lever (see Fig. 1) against displacement when the machine is running. Coil-spring 72, one end of which is secured to the latch 69 and the other end to a pin 71 in the latch-bar 70, holds the latch 69 in a locked position, except when it is tripped by the mechanism presently to be described. The bed extension 73 is bolted at one end to the bed 1 by the bolts 74 74 and supported at the other end by the leg 75. Suspended over the bed extension 73 is the receiving-tube 76, split longitudinally into the two portions 76′ 76^2, the portion 76′ of which is held rigid by the brackets 77, fastened at their base to the bed extension 73 and provided with a bearing at their upper ends for the oscillating shaft 78. That portion of the receiving-tube designated 76^2 is fastened to the depending arms 79, which are rigidly secured to the oscillating shafts 78. When an oscillating motion is imparted to the said shaft, the depending arms carry the portion 76^2 of the receiving-tube away from the stationary portion 76′, opening the receiving-tube from end to end and allowing the contents of the tube to drop out upon the bed extension 73.

In the outer end of the receiving-tube 76 is the trip-plunger 80, having a reduced stem

81, adjustably secured in the block 82 by a set-screw 83, the said block being loosely joined to the upper end of the trip-lever 84. Trip-lever 84 is fulcrumed in the forked outer end of the stud 87, and pivotally connected to the lower end thereof is a trip-rod 85, which extends from said lever through the end of the bed extension 73 and terminates at a projecting lug 86 upon the latch 69. The circular saw 88 is mounted upon the saw-arbor 89, adjacent to the flanged driving-pulley 90, and held against the flange of said pulley by the washer 91 and nut 92. 93 designates the saw-slide, having journaled in its upper yoke portion the saw-arbor 89 and the lower portion of which travels in the ways 94 94, integral with the bed 1 and covered by the independent caps 95 95. A backward-and-forward movement is imparted to the saw-slide 93 through a toggle-joint composed of the two links 96′ 96^2, the outer ends of which are pivoted to the studs 97 98, permanently fixed to the slide 93 and the bed 1, respectively. Keyed to one end of the rock-shaft 99, upon the other end of which is rigidly secured the link 96^2, is a hand-lever 100, which when drawn toward the front of the machine throws down the links of the toggle-joint and forces the saw-slide forward. When the lever is released, the spring 101, which is fastened at one end to the lever 100 and at the other to the bracket 67, carries the lever back to its original position and with it the saw-slide. Fastened to one side of the saw-slide 93 by the screw 102 is the yoke-bar 103, provided with the longitudinal slot 117 near its outer end, in which is adjusted the yoke-stud 104, the said yoke-stud being fastened in any adjusted position by the nut 105 under the yoke-bar and upon the threaded portion of the yoke-stem. Lever-arm 106 at its upper end is pinned to the oscillating shaft 78 and pivotally secured at its lower end to the horizontal link 107 by the stud 108. The opposite end of said horizontal link is fitted between the sides of the yoke-stud 104 and provided with an elongated slot 109. The pin 110, which extends through the slot 109 of the horizontal link 107, is fastened rigidly in the yoke-stud 104, but slides freely in the said slot. Coil-spring 111, fastened at one end to a stud 112 in the horizontal link and at the other to a stud 113, screwed to the bed of the machine, is designed to normally hold the lever-arm 106 in its retracted position.

The operation of my improved tube-rolling machine is as follows: A flat strip of metal of the proper width and thickness is delivered to the first pair of rolls over the upper face of the guide-frame 22 and between the guide-strips 25 25, the antifriction-rolls 24 24 reducing the friction where the strip bends over the ends of the guide-frame. The metal strip can be delivered from a roll of metal or it may be delivered in lengths; but I prefer to use a roll, as it requires less room and can be handled much more easily than long strips of metal. Furthermore, after the strip has been started in the machine the roll requires no further attention by the operator. When the strip has been fed between the first pair of rolls by hand, the friction of the rolls upon its sides will draw in the balance of the strip without the aid of the operator. The forming-rolls are now started by means of the clutch mechanism above described, and the latch 69 locks the shifting lever against accidental displacement while the rolls are running. The metal strip is bent into a U-shaped strip by the first pair of rolls, as illustrated by Fig. 12. When the U-shaped strip leaves the first pair of rolls, it is carried through the guide-trough 27, under the triblet 33, and between the second pair of rolls. A stripper 114, with a forked end, is fastened to the top of the trough-stand 26, adjacent to the first pair of rolls, and strips the U-strip from the rolls and leads it into the guide-trough, thus preventing the strip from encircling the rolls. The guide-roll 30 holds the strip in the bottom of the trough as it is fed through. The sides of the U-strip first come into contact with the flaring sides of the groove in the top roll of the second pair, which turn them over toward each other upon the triblet and complete the tube, the triblet being a central mandrel and determining the inside diameter of the tube. When the tube leaves the second pair of rolls, it is carried between the straightening-rolls, which reduce all unevenness or crookedness in the tube. From the straightening-rolls it is carried through the end support 115, upon the outer end of the stand 47, and thence into the receiving-tube 76. As the rolled tube reaches the trip-plunger 80 it forces it outward and oscillates the trip-lever 84, which pushes the end of the trip-rod 85 against the lug 86 upon the latch 69, releasing the said latch and the shifting lever 62. The shifting lever being now free, the flat spring 116, which is fastened to the bed and which bears against the said lever, throws it over so that the clutch mechanism is released, stopping the forming-rolls and the tube-making mechanism. At this stage the operator grasps the lever 100 and cuts off the tube by means of the saw mechanism above described at the proper predetermined length. When the saw has completely severed the tube, the pin 110 in the yoke-stud 104, which is rigidly secured to the saw-slide by means of the yoke-bar, reaches the end of the slot 109 in the horizontal link and pushes forward the lower end of the lever-arm 106, which oscillates the shaft 78 and opens the receiving-tube 76, allowing the newly-rolled tube to fall out upon the bed extension 73 or a table placed adjacent thereto to receive it. The operator now releases his hold upon the lever 100, which is immediately drawn back to its original position by means of the spring 101 and carries with it the saw 88. As the saw-slide recedes the spring 111, fastened to the horizontal link 107, draws back the lever-arm 106 and closes the receiving-tube. The lever 100, the

lever-arm 106, the depending arm 79, and the portion 76 of the receiving-tube when in their extreme forward positions are represented by the broken lines in Fig. 3. The end support 115 is fastened to the overhanging lip of the stand 47 and is designed to hold the tube rigid during the sawing operation. The hole bored through it is of the same diameter as the tube, with the mouth of the bore enlarged, so that the tube may readily enter the support. When the operator releases the lever 100, he grasps the shifting lever 62 and starts the rolls again by means of the clutch mechanism. The latch locks the shifting lever in position, and the machine starts, as before, to roll the strip into a tube and continues until the tube reaches the trip-plunger, when the forming-rolls are again stopped automatically and the sawing operation is repeated as before.

Tubes of any size and of a great variety of shapes in cross-section can be rolled by the mechanism described by simply changing the shape of the forming-rolls.

Heretofore there has been great difficulty in cutting any number of tubes an equal length, it requiring the services of additional help to measure and to cut them off. A common method is to cut the flat strips into lengths before they are run through the rolls, an operation requiring much additional labor and necessitating a large amount of floor-space to accommodate the strips. In my machine the metal strip is fed to the machine from a roll, which may be of any length, and by adjusting the trip-plunger the tubes can be cut off to any predetermined length accurately and without further measurements. The saw mechanism is simple, compact, and readily operated by the same person operating the forming-rolls.

Another feature of my invention is the fact that the rolls can be removed from the roll-shaft at pleasure by removing a single bolt, and that in the front of the machine where it can be readily reached by the operator.

It is manifest that many minor changes can be made in my invention aside from those herein shown, and I would therefore have it understood that I do not limit myself to the exact construction herein shown and described, but hold myself at liberty to make such changes and alterations as fall fairly within the spirit and scope of my invention; but

What I do claim as new, and desire to secure by Letters Patent, is—

1. In a tube-rolling machine, in combination with the roll-driving mechanism, a first pair of rolls to form the strip into a substantially U shape and a second pair of rolls to fold the sides of the U-strip into a tubular form, one of the said first pair of rolls having a groove in its periphery of substantially the width and depth of the flat-metal strip, a deeper groove in the center of the aforesaid groove of substantially the same shape as the outside of the said U-strip, the other of said rolls having a periphery of substantially the same shape as the inside of the said U-strip; each of the rolls in the said second pair having peripheral grooves of substantially the shape of one-half the contour of the finished tube, the periphery of one of said second pair of rolls overlapping the periphery of the other of said rolls and having flaring sides extending from the outside diameter of the said roll to the said groove, substantially as set forth.

2. In a tube-rolling machine, the combination of rolls to form the tube, mechanism to rotate said rolls, means for automatically stopping the rotation of said rolls when a tube of predetermined length has been formed, and means for straightening the rolled tube with means for cutting off the same, substantially as set forth.

3. In a tube-rolling machine in combination with the tube-forming rolls and the rotating mechanism means for straightening the said tube after it has passed through the said rolls and means for automatically stopping the said rotating mechanism when a tube of a predetermined length has been formed, substantially as set forth.

4. In a tube-rolling machine, in combination with the tube-forming rolls, mechanism to rotate said rolls, clutch mechanism to connect said rotating mechanism with the power-receiving mechanism, a lever to operate said clutch mechanism, a spring-actuated latch device to normally lock said lever, and means for tripping said latch to release the said lever when a tube has been rolled of a predetermined length, substantially as set forth.

5. In a tube-rolling machine in combination with the tube-forming rolls and their rotating mechanism, clutch mechanism for driving the said rotating mechanism, a spring-actuated latch to hold the lever of said clutch mechanism in a locked position, a two-part receiving-tube for temporarily supporting the rolled tube after it has passed through the tube-forming rolls, an adjustable trip-plunger within the said receiving-tube and means for connecting the said trip-plunger with the said spring-actuated latch whereby the said lever may be released when a tube has been rolled of a predetermined length, substantially as set forth.

6. In a tube-rolling machine comprising tube-forming rolls and their rotating mechanism, clutch mechanism for driving the said rotating mechanism, and a spring-actuated latch for retaining the lever of said clutch mechanism in a locked position, the combination therewith of a saw mechanism, an oscillating shaft, a two-part receiving-tube for temporarily supporting the rolled tube one portion of which is connected with the said oscillating shaft, a trip-plunger within the said receiving-tube, a trip-rod connecting the said spring-actuated latch and the trip-plunger mechanism, and means for uniting the

said saw mechanism with the said oscillating shaft and imparting thereto its oscillating movement, substantially as set forth.

7. In a tube-rolling machine comprising rolls and their rotating mechanism, the combination therewith of means for cutting off the rolled tube, a two-part receiving-tube for supporting the said rolled tube, means within the said receiving-tube for stopping the said rotating mechanism and means for opening the said receiving-tube when the tube has been cut off, the said means being operated by the said saw mechanism, substantially as set forth.

8. In a tube-rolling machine, in combination with the forming-rolls, a guide-frame provided with antifriction-wheels to deliver the metal strip centrally to the first pair of rolls, a guide-trough between the first and the second pair of said rolls to guide the strip to the said second pair of rolls, a stripper located adjacent to the first pair of rolls to free the strip from the rolls and aid it in entering the said guide-trough, an antifriction-roll device to hold the said strip against the bottom of the said guide-trough and a triblet or mandrel suspended between the finishing-rolls, substantially as set forth.

9. In a tube-rolling machine, the combination of the forming-rolls, mechanism for rotating said rolls, a trough-stand between said rolls, a stripper secured to said stand adjacent to the first pair of rolls, a guide-trough in the upper face of said stand, and an antifriction-roll device adjustably secured to the said stand to hold the metal strip against the bottom of the said guide-trough, with a triblet suspended between the finishing-rolls and held in such suspended position by the said guide-stand, substantially as set forth.

10. In a tube-rolling machine, mechanism for guiding the metal strip from the first to the second pair of rolls comprising a stand secured to the bed of the machine, in the upper face of which is a trough conforming substantially to the shape of the metal strip that is guided through the same, upwardly-projecting integral lugs upon said stand, a cap joining each pair of said lugs, a roll device, for holding the said strip against the bottom of the said trough, suspended in one of said caps and a triblet or forming-mandrel suspended in the other of said caps, substantially as set forth.

11. In a tube-rolling machine, the combination of the longitudinally-split receiving-tube 76, the brackets 77 supporting one-half of said receiving-tube, the oscillating shaft 78, of the depending arms 79 secured to said oscillating shaft and one-half of the said receiving-tube, and the lever-arm 106 secured at one end to the said oscillating shaft, with means to operate said lever-arm whereby an oscillating motion may be imparted to said shaft, substantially as set forth.

12. In a tube-rolling machine, the combination of the receiving-tube, the saw mounted in the saw-slide, means for imparting a rotary and a reciprocating motion to said saw, and an oscillating shaft adapted to open the said receiving-tube, with lever mechanism connected with the said saw-slide and oscillating shaft whereby an oscillating motion is imparted to said shaft, substantially as set forth.

13. In a tube-rolling machine, the combination of the receiving-tube 76 with its supporting mechanism, the saw-stand 93, the yoke-bar 103 rigidly secured to said saw-stand, a yoke-stud 104 adjustably secured to the said yoke-bar, a lever-arm 106 one end of which is pinned to the said oscillating shaft, and a horizontal link 107 pivotally secured to the said lever-arm at one end and the other end adapted to slide in the said yoke-stud, with a pin 110 extending through said yoke-stud and a slot in the end of the said horizontal link, substantially as set forth.

14. In a tube-rolling machine, sawing mechanism composed of a stand carrying the saw-arbor and having a reciprocating motion, the said motion being imparted thereto by means of a rock-shaft located adjacent thereto and operated by a lever keyed to said shaft and a toggle which connects the said rock-shaft with the said stand, a saw-arbor journaled in the said stand and rotated by a pulley upon said arbor and a circular saw mounted upon said saw-arbor, substantially as set forth.

15. In a tube-rolling machine, a straightening device comprising a stand 47 provided with an overhanging lip 54, one or more non-adjustable rolls 48′ mounted in said stand, one or more adjustable rolls 48, one or more slides 52 adapted to be adjusted by a screw 53 operated in the said lip 54 and means, as the bolt 55, for fastening the said slides in any adjusted position, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

FERDINAND DEMING.

Witnesses:

WILLARD R. CARROLL,

GEORGE E. HALL.