

No. 714,763.

Patented Dec. 2, 1902.

E. W. VAUGHAN.
APPARATUS FOR DRAWING METAL.

(Application filed Aug. 25, 1902.)

(No Model.)

3 Sheets Sheet 1.

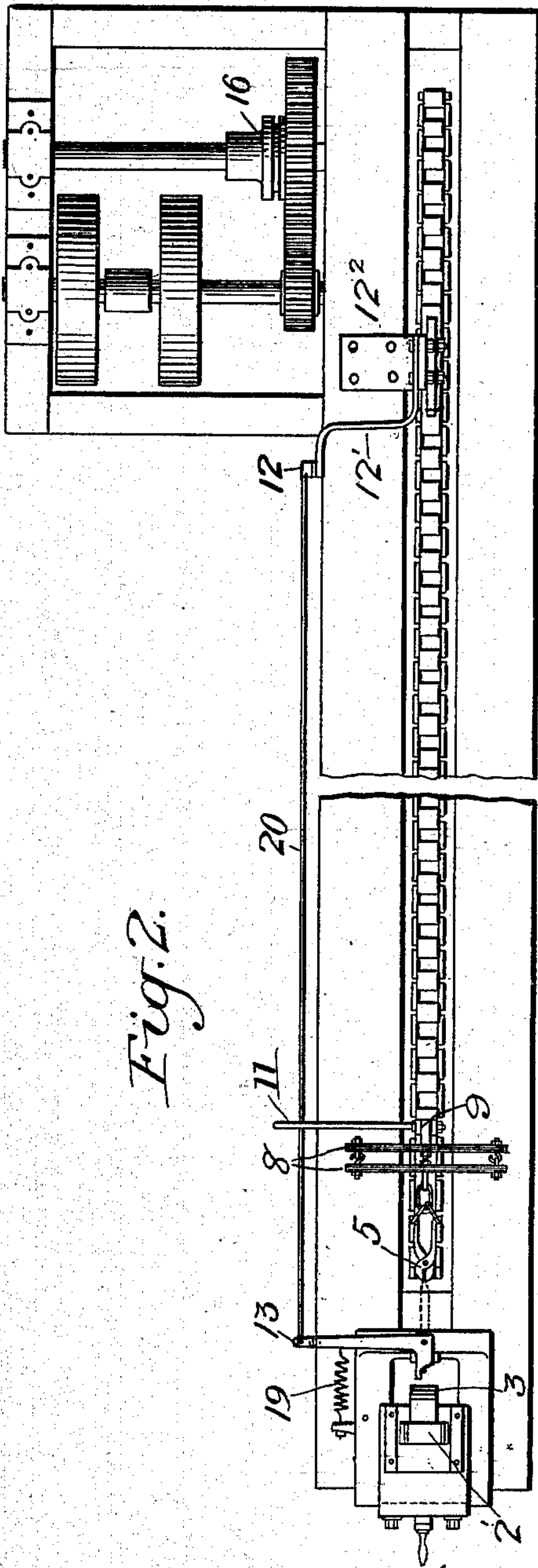


Fig. 2.

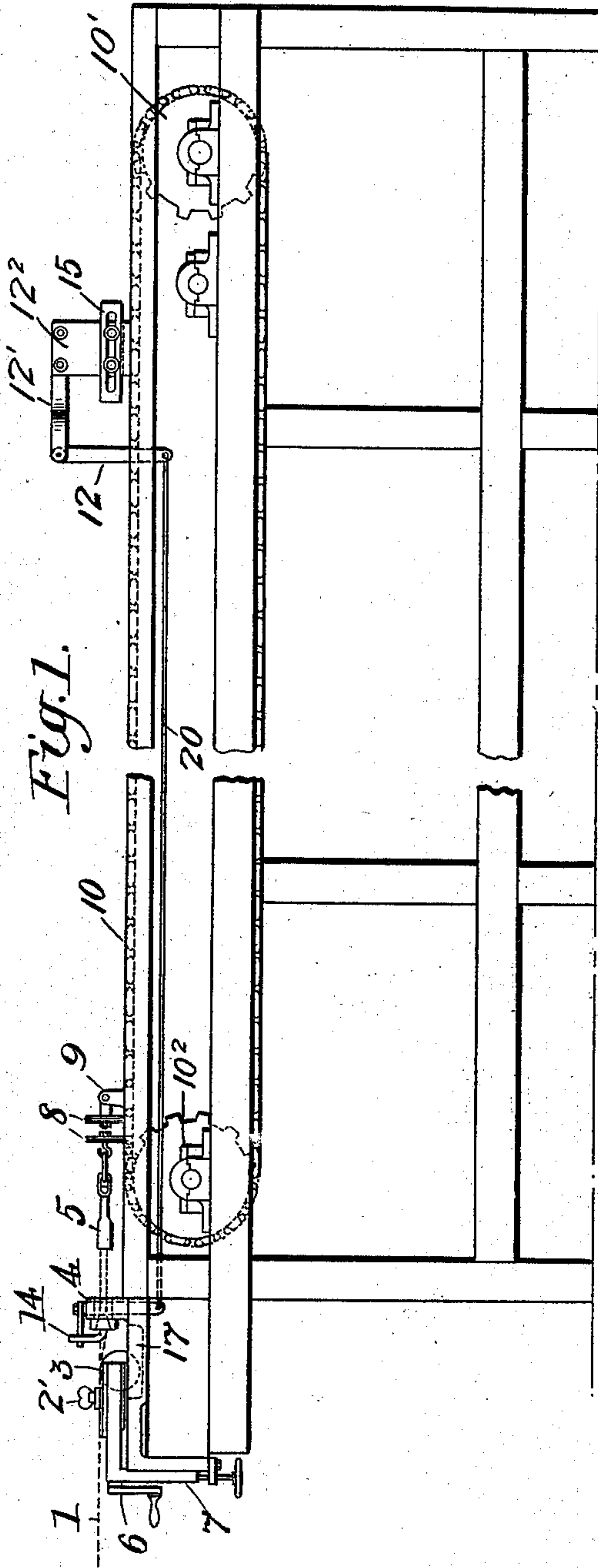


Fig. 1.

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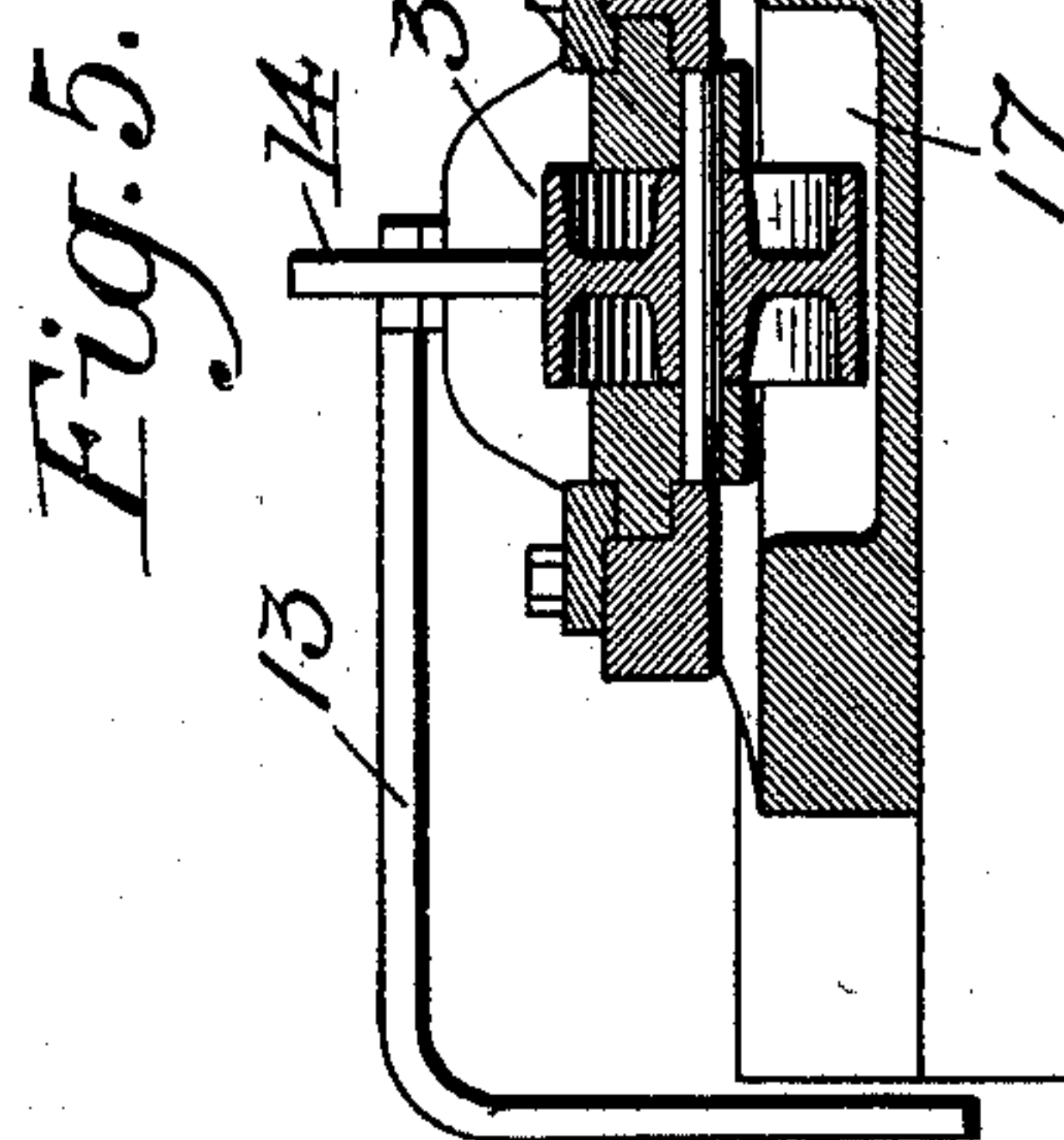
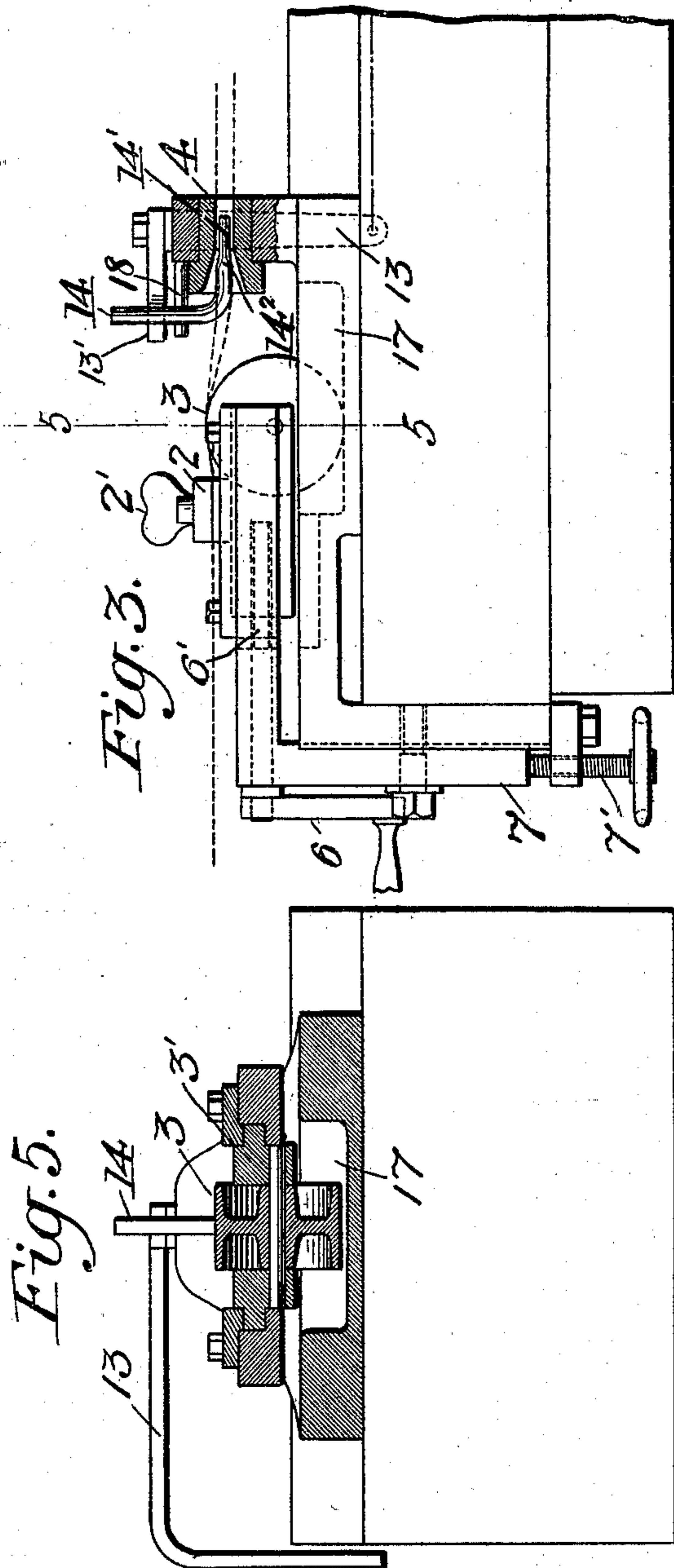
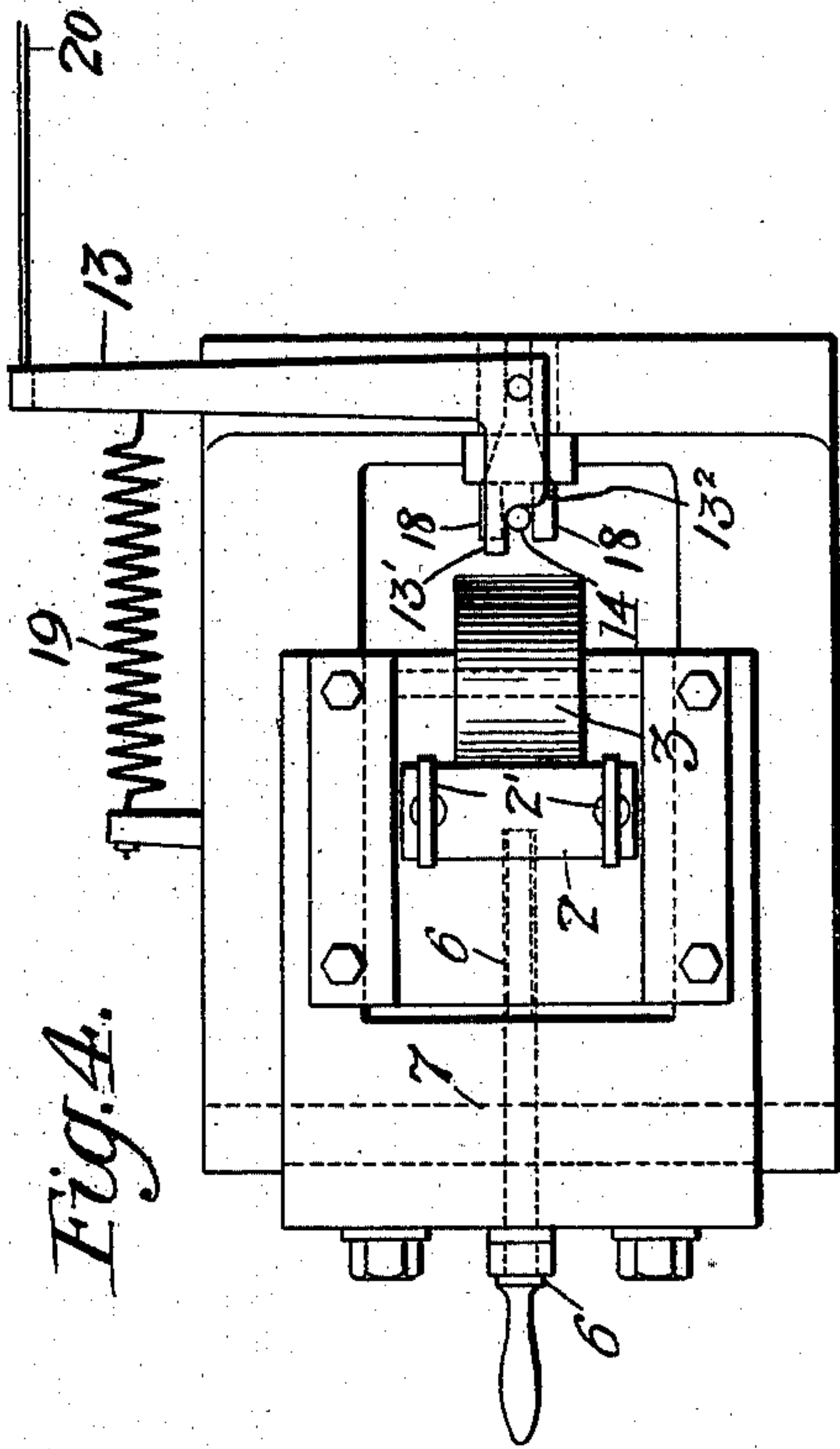
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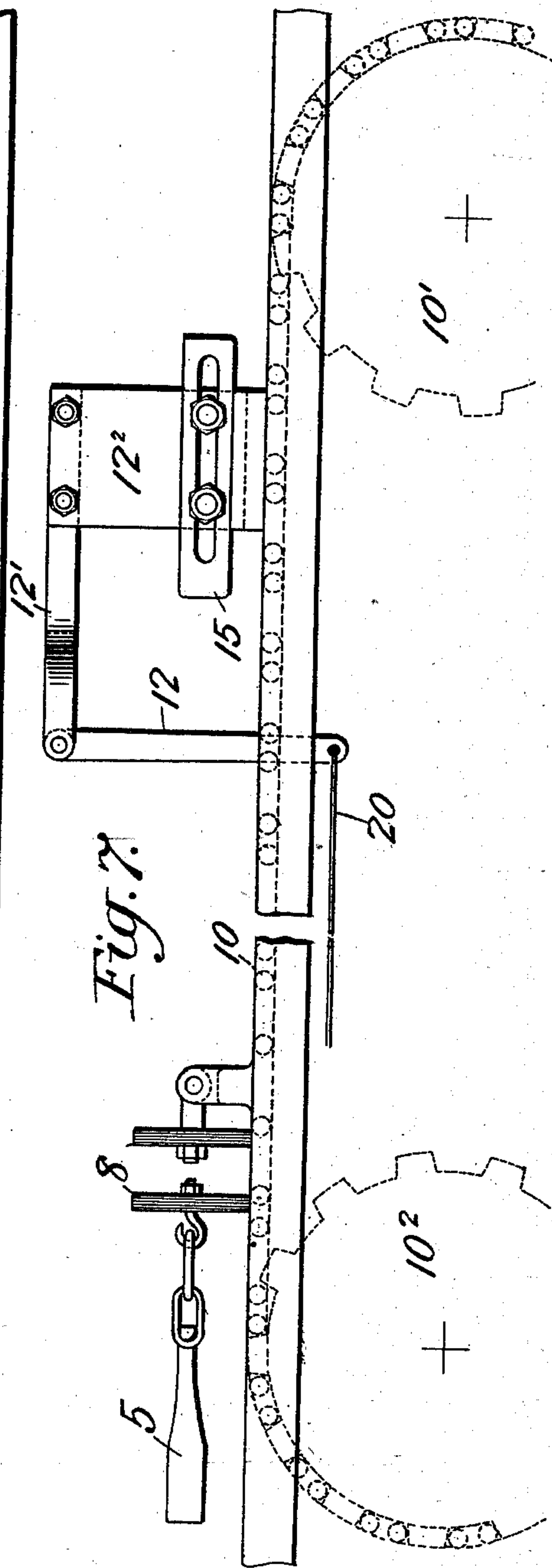
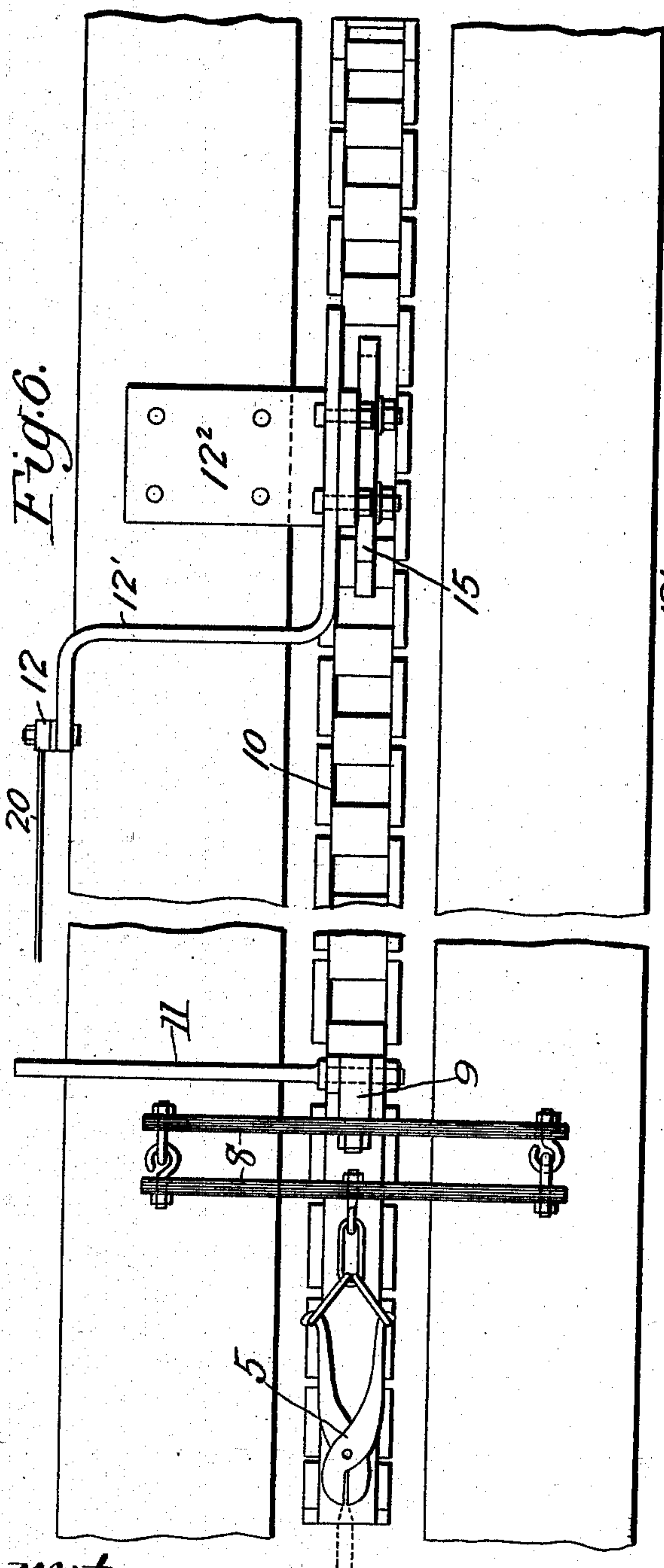
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3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR DRAWING METAL.

SPECIFICATION forming part of Letters Patent No. 714,763, dated December 2, 1902.

Application filed August 25, 1902. Serial No. 120,892. (No model.)

To all whom it may concern:

Be it known that I, EDWIN WILLIAM VAUGHAN, a citizen of the United States, residing at Worcester, county of Worcester, State of Massachusetts, have invented certain new and useful Improvements in Apparatus for Drawing Metal; 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 machines for forming tubes from flat strips or skelps, and has for its objects to provide a machine of this character with means for accurately supporting and guiding the strip or skelp as it is delivered to the die in order to prevent buckling of the edge of the strip and corresponding imperfections in the finished tube; also, to provide a machine of this character with means that are practically automatic for stretching and straightening successive lengths of tubes before they are removed from the machine.

The mechanism hereinafter illustrated and described is primarily designed as a machine for forming light metal tubes—such, for instance, as are used for curtain-rods; but it is evident that the principle may be applied to open or closed shapes of any form drawn from various materials.

In the manufacture of tubes from flat stock a number of methods are employed. One of the most important and generally used is to lead a flat strip of metal or skelp into a forming-die, which gradually turns the edges of the strip over in a suitable manner to form the tube. In some cases several dies in series are used and often, but not always, a mandrel fitting loosely into the die is inserted, around which the material wraps in the process of forming. This latter operation, however, is not absolutely necessary, especially in the manufacture of round tubes. In carrying out this particular method in connection with the machines heretofore in use in order to produce perfect tubes great care must be exercised in the following particulars: first, the stock must be very carefully selected to secure strips of uniform width, thickness, and composition, and great care

must be used in feeding the strips into the die; otherwise the turned edges will tend to buckle and unsightly and useless tubes will result; second, the tubes must be straightened after coming from the die, the tension required for forming the tubes not being sufficient for this purpose.

So far as I am aware no special provision has heretofore been made to accomplish the first object other than the skill and careful attention of the workman.

For the purpose of straightening the tubes the following operation has been usually resorted to: After a suitable length of tube has been drawn a plug is inserted in the taper of the die, which arrests the movement of the tube in the die. The finished end is then stretched as much as necessary by further operation of the draw-bench. This is generally accomplished by throwing a belt from a loose to a tight pulley or by manipulating some type of friction-clutch according to the well-known methods of starting machinery, which for this purpose is highly objectionable, as but a comparatively small extension of the tube is required, which can only be obtained under the most favorable circumstances by imparting a series of jerks to the tube, due to the repeated starting and stopping of the mechanism, and obviously this jerking of the metal would be highly injurious to the finished product. It is to avoid these two difficulties—the buckling of the edges of the strip or skelp and the unsatisfactory straightening process—that my invention is designed. I preferably employ a draw-bench of the endless-chain type of a design well known in the art and the regular type of forming-die. In order to produce an even feeding of the strip or skelp to the die and to prevent buckling of the edges, I pass the strip through friction-clamps, then over a roll and into the die, where the forming process is carried out. The friction-clamps hold the strip taut as it is passed to the forming-die and also prevent to a certain extent the buckling of the stock at the edges, and it is to completely overcome this buckling feature that I introduce a roll between the clamps and the forming-die. This roll runs in a bath

of oil and also serves to lubricate the surface of the strip before passing into the die. The friction-clamps are placed below the highest point of the roll and cause the strip to lie perfectly flat over this highest point, so that the stock passes evenly and uniformly in a perfectly-flat position under tension over the roll and into the die, where its edges will readily tend to take the form or shape for which the die is adapted. For the purpose of straightening the tube thus formed my apparatus consists in mechanism for clamping the tube in some manner at or near the die and subjecting said tube to tension, preferably by means of an elastic connection with the chain of the draw-bench, which stretches or elongates the tube, and as the amount of elongation is equal in each case the operation gives an equal set to all of the tubes, so that a perfectly straight uniform product results.

The preferred form of my invention is illustrated in the accompanying drawings, in which—

Figure 1 represents a complete draw-bench in side elevation. Fig. 2 is a plan view of the same. Fig. 3 is a fragmentary side elevation, partly in section, of the forming-die, the friction-clamp, and the guiding-roll, with the means for adjusting the last-mentioned devices. Fig. 4 is a plan view corresponding to Fig. 3. Fig. 5 is a section on line 5 5 of Fig. 3. Fig. 6 is an enlarged fragmentary view corresponding to Fig. 2. Fig. 7 is an enlarged fragmentary view corresponding to Fig. 1.

Referring to the drawings, the numeral 1 represents a flat strip of metal or skelp which is being fed to the machine to form a tube. The strip is fed under a friction-clamp which is mounted upon one end of the draw-bench in juxtaposition to the forming-die 4, which is of ordinary construction. Said friction-clamp comprises a flat block 2, which is mounted upon the top of a longitudinal slide 3' and is adapted to be adjusted toward and from the slide by means of suitable thumb-screws 2'. The slide 3' is mounted in suitable guides in a vertical slide 7, and each of said slides is adjusted to vary the position of the friction device with respect to the die either longitudinally or vertically by means of the adjusting-screws 6' and 7', respectively. Mounted in suitable bearings in the end of the slide 3' is a roller 3 in such relation to the friction-clamp that the latter lies just below the highest point of the roll. The lower part of the roll dips into an oil-bath 17, which is formed by a depression in the bed-plate of the draw-bench. Within the die 4 there is inserted a mandrel 14, which comprises a circular end section 14', with an enlarged angular end joined to the circular section by a taper or incline 14², which constitutes a clutch when in engagement with the die. Beyond the die the draw-bench is provided with the usual sprocket-chain 10, which runs over suitable sprockets 10' and 10² at opposite ends of the

bench, the former being connected by appropriate gearing to a drive-shaft, as indicated. Secured to the chain is the usual type of clamping or gripping device 5, which is adapted to grip the end of the tube as the latter passes from the die in the continuous operation of forming the tube. This clamp 5 is attached to the draw-bench chain 10 by means of two metal springs 8, which are preferably formed as compound leaf-springs joined by hooks and eyes at their respective extremities, one of said springs being attached to the chain by means of a lug 9 and the other having a detachable connection with the grip 5 by means of the double-link device commonly employed in clamps of this character. Secured to the chain 10, adjacent to the springs 8, is a projecting rod or stop 11.

Mounted upon the upper face of the draw-bench and adjacent to the upper reach of the chain is an angular plate 12², to which is secured a rearwardly-extending bracket 12', to which in turn is pivoted a depending lever 12. Secured at a point above the die 4 is a second pivoted bell-crank lever 13, which is provided with a forwardly-projecting finger 13', which constitutes a shoulder or stop against which the upturned end of the mandrel 14 rests while the tube is being drawn. The lever 13 is maintained in its normal position to hold the mandrel within the die, with the forward rounded portion thereof in proper relation to receive the strip or skelp by means of a spring 19, attached at one end to the machine-frame and at the other end to said lever 13. The edge of lever 13 adjacent to finger 13' is rounded or beveled to permit the end of said lever to be readily drawn from its engagement with the mandrel. Levers 12 and 13 are connected by a rod 20, so that as lever 12 is moved in the direction of the length of the bench lever 13 will be moved a corresponding amount, and the end thereof in front of the die will be withdrawn from engagement with the mandrel. Adjustably secured to the front of the angular plate 12² and in alinement with the upper reach of the chain 10 is a stop 15, which lies directly in the path of the lug 9.

With the mechanism in the particular relation shown and described it will be observed that the metal strips or skelps are fed under the friction-clamp 2, which is adjusted to bear with just sufficient pressure to insure the necessary tension on the strip as it is drawn through the die. From the friction-clamp the skelp is led over the guide-roll 3, which is just sufficiently above the clamp to insure the flattening out of the strip before the latter reaches the die. The rotation of the feed-roll distributes oil from the bath 17 over the surface of the skelp to lubricate the metal before it passes to the die, and thereby facilitates the shaping of the tube. The end of the skelp is then passed through the die and engaged by the clamp 5, after which the draw-bench chain is started and a continuous length

of the skelp drawn through the friction-clamp over the roll and through the forming-die, where the desired shape is imparted to it. During this operation the circular section 14' of the mandrel 14 is held in central position in the die to assist in the formation of the tube in the manner well known to those skilled in the art. The mandrel is maintained in this particular relation by the forwardly-projecting guide-rods 18, which prevent lateral movement of the mandrel, and by the engagement of said mandrel with the end or heel of the bell-crank lever 13, adjacent to the finger 13' thereof, which prevents the mandrel entering farther into the die. It is to be noted that the tension on the skelp may be readily adjusted by loosening or tightening the friction-clamp 2, and both the clamp and the roll 3 may be raised or lowered, advanced or retracted with respect to the die by operating the adjusting-slides 3' and 7 by means of their adjusting-screws 6' and 7'. As the tube is drawn and chain approaches the limit of its forward movement the stop or arm 11 strikes the depending lever 12 and rocks the same toward the rear of the machine, which, by means of connecting-rod 20, rocks the bell-crank lever 13 to the rear, thereby withdrawing the end or heel thereof from engagement with the upturned end of the mandrel 14. The feed of the skelp immediately draws the mandrel thus freed from the bell-crank lever fully into the die 4, where the taper or clutch section 14² on said mandrel securely clamps the tube against the surface of the die and prevents further feeding of the skelp. The forward movement of the draw-bench, however, still continues until the lug 9 reaches the stop 15. As the end of the tube, however, is still held fast in the clamp 5, the springs 8 are stretched or distended, thereby putting additional tension on the tube, which is sufficient to elongate and straighten it. After reaching the lug 15 the machine is stopped as soon as possible, which may be accomplished either automatically or by an attendant. In order to arrest the movement of the chain positively when the stop 15 is reached without subjecting the drive mechanism to severe strain, a friction-clutch 16, of any preferred type is placed between the gear on the shaft of sprocket-wheel 10' and said shaft, which clutch is so regulated as to permit the drive mechanism to continue to rotate after the chain has been stopped. The tube is then cut away in front of the die and taken from the machine. The draw-bench is then reversed. The draw-head is brought back into the position shown in Figs. 1 and 2, thereby releasing the lever 12, which under the action of spring 19 returns to its normal position and likewise reengages the forward end of lever 13 with the upturned end of mandrel 14, forcing the mandrel out of the die. The clamp is then again applied to the tube and the process is repeated.

The peculiar feature of the straightening

process lies in the fact that the tube itself is more or less elastic, and a tube which has been elongated to a point at which it should become straight will, if instantly released, be liable to return to its former curved condition, although if it be held in position for a few seconds before the tension is removed it will remain straight.

Having thus described my invention, what I claim is—

1. In a metal-drawing machine, the combination with a die, a draw-head, and means for actuating the latter, of a friction-clamp through which the skelp passes, and a roll for flattening the skelp between the friction-clamp and the die, whereby buckling of the skelp is prevented.

2. In a metal-drawing machine, the combination with a die, a draw-head, and means for actuating the latter, of a friction-clamp through which the skelp passes, a roll between the friction-clamp and the die, and a lubricating-bath in which said roll rotates, whereby buckling of the skelp is prevented and said skelp is lubricated before entering the die.

3. In a metal-drawing machine, the combination with a die, a draw-head, and means for actuating the latter, of a friction-clamp through which the skelp passes, a roll between the friction-clamp and the die, and means to adjust the clamp and the roll horizontally and vertically with respect to the die.

4. In a metal-drawing machine, the combination of a die, a draw-head, means for actuating the latter, means anterior to the die to exert a tension upon and flatten the skelp before it enters the die, means for arresting the movement of the metal through the die, and mechanism for subsequently stopping the movement of the draw-head, whereby the drawn metal is stretched and straightened by the excess movement of the draw-head.

5. In a metal-drawing machine, the combination of a die, a draw-head, means for actuating the latter, means anterior to the die to exert a tension upon and flatten the skelp before it enters the die, a clutch for arresting the movement of the metal through the die, mechanism operated by the draw-head to actuate the clutch, and mechanism for subsequently stopping the movement of the draw-head, whereby the drawn metal is stretched and straightened by the excess movement of the draw-head.

6. In a metal-drawing machine, the combination of a die, a draw-head, means for actuating the latter, means anterior to the die to exert a tension upon and flatten the skelp before it enters the die, a combined mandrel and clutch adapted to assist in forming the metal in the die and finally arrest the movement of the metal through the die, a lever engaging said mandrel to retain the latter in forming relation in the die, trip mechanism operated by the draw-head to release the lever from the mandrel and cause the latter to clutch the

metal in the die, and stop mechanism to subsequently arrest the movement of the draw-head, whereby the metal is stretched and straightened by the excess movement of the draw-head.

7. In a metal-drawing bench, the combination of a die, a draw-head, an elastic connection between the head and the bench, automatic means for arresting the movement of the metal through the die, and devices for subsequently and automatically stopping the draw-head, whereby the drawn metal is uniformly stretched and straightened by the combined action of the flexible connection and the relative advance of the draw-head.

8. In a metal-drawing bench, the combination of a die, a draw-head, an elastic connection between the head and the bench, a clutch for arresting the movement of the metal through the die, means actuated by the drawing-bench to operate said clutch, and a stop device to subsequently engage and arrest the bench, whereby the metal is uniformly stretched and straightened.

9. In a metal-drawing bench, the combination of a die, a draw-head, an elastic connection between the head and the bench, a combined mandrel and clutch adapted to assist in forming the metal in the die and finally arrest the movement of the metal through the die, a lever engaging said mandrel to retain the latter in forming relation in the die, trip mechanism operated by the advance of the bench to release the mandrel and operate the clutch, and stop mechanism to subsequently arrest the bench, whereby the drawn metal is stretched and straightened.

10. In a metal-drawing bench, the combination of a die, a draw-head, an elastic connection between the head and the bench, a combined mandrel and clutch cooperating with said die, a lever pivoted adjacent to said die and holding the mandrel in forming relation therein, a second lever pivoted to the supporting-frame, a rod connecting said levers, a detent on said bench to actuate said connected levers and release the mandrel and thereby arrest the movement of the metal through the die, and a stop on the frame to engage and arrest the bench, whereby the drawn metal is uniformly stretched and straightened.

11. In a metal-drawing bench, a die, a draw-head, means for arresting the movement of the metal through the die, and a spring connection between the draw-head and the bench, whereby an increased tension is temporarily imposed upon the drawn metal to straighten the same.

12. In a metal-drawing bench, a die, a draw-head and mandrel cooperating with said die, said mandrel comprising a forward section to assist in the forming operation and a tapered rear section adapted to enter the die and arrest the movement of the metal through the die.

13. In a metal-drawing bench, the combination of a die, a draw-head connected with the bench, automatic means for arresting the movement of the metal through the die, and devices for subsequently and automatically stopping the draw-head, whereby the drawn metal is uniformly stretched and straightened by the excess movement of the draw-head.

14. In a metal-drawing bench, the combination of a die, a draw-head, a connection between the head and the bench, a clutch for arresting the movement of the metal through the die, means actuated by the drawing-bench to operate said clutch, and a stop device to subsequently engage and arrest the bench, whereby the metal is uniformly stretched and straightened.

15. In a metal-drawing bench, the combination of a die, a draw-head, a connection between the head and the bench, a combined mandrel and clutch adapted to assist in forming the metal in the die and finally arrest the movement of the metal through the die, a lever engaging said mandrel to retain the latter in forming relation in the die, trip mechanism operated by the advance of the bench to release the mandrel and operate the clutch, and stop devices to subsequently arrest the bench, whereby the drawn metal is stretched and straightened.

16. In a metal-drawing bench, the combination of a die, a draw-head, a connection between the head and the bench, a combined mandrel and clutch cooperating with said die, a lever pivoted adjacent to said die and holding the mandrel in forming relation therein, a second lever pivoted to the supporting-frame, a rod connecting said levers, a detent on said bench to actuate said connected levers and release the mandrel and thereby arrest the movement of the metal through the die, and a stop on the frame to engage and arrest the bench, whereby the drawn metal is uniformly stretched and straightened.

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

EDWIN WILLIAM VAUGHAN.

Witnesses:

GEO. TYLER BACKUS,
BARTLETT E. TOWNE.