R. C. STIEFEL & J. H. NICHOLSON.

APPARATUS FOR ROLLING TUBING.

APPLICATION FILED DEC. 26, 1903.

923,726.

Patented June 1, 1909.

3 SHEETS—SHEET 1.

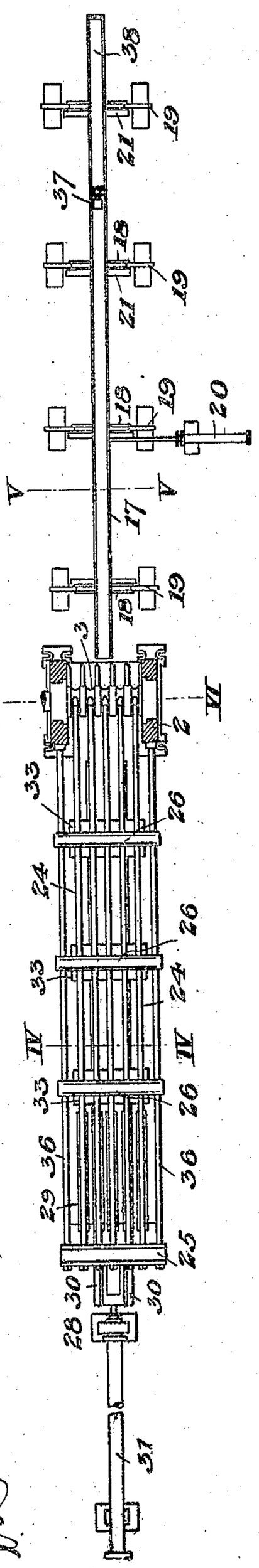

Fig. 1.

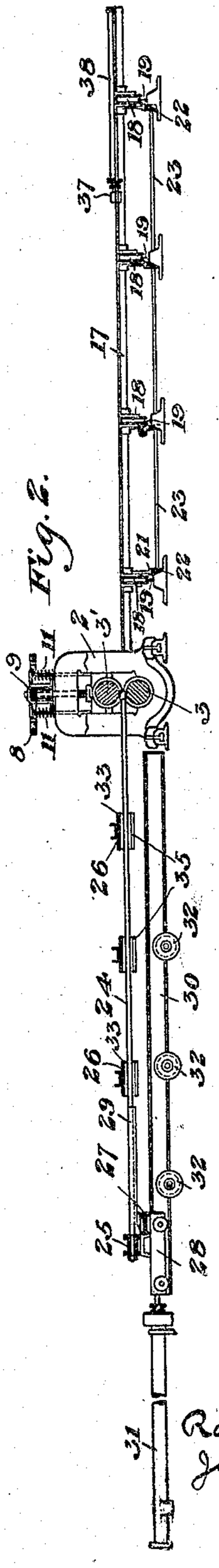

Fig. 2.

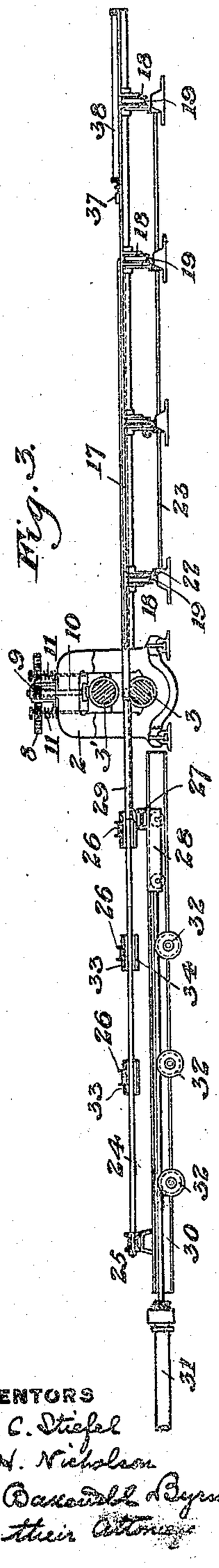

Fig. 3.

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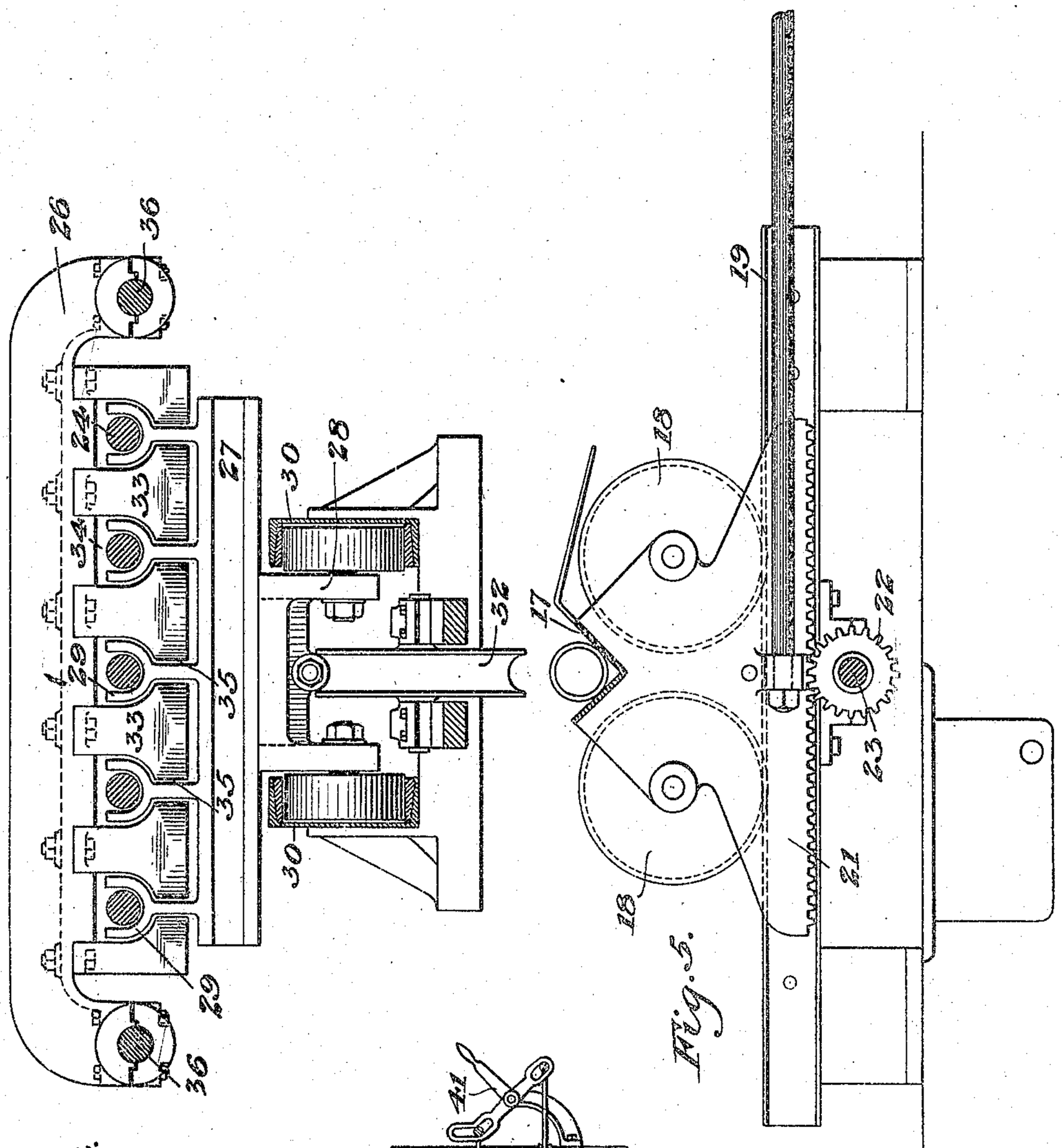

Fig. 5.

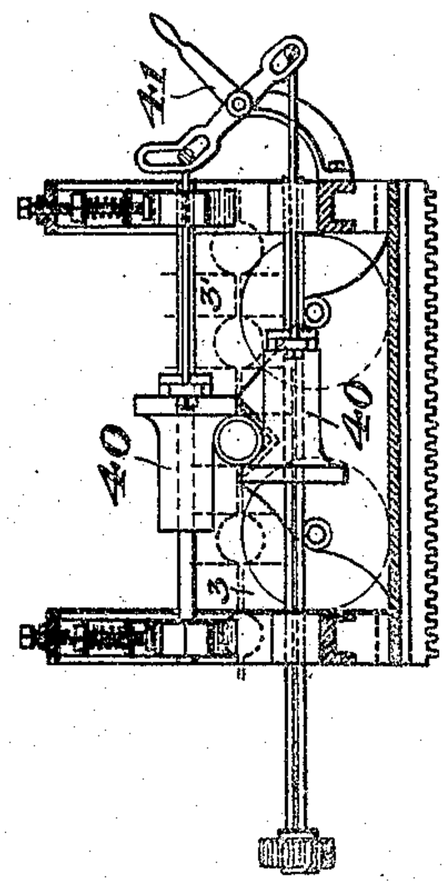

Fig. 6.

Fig. 4.

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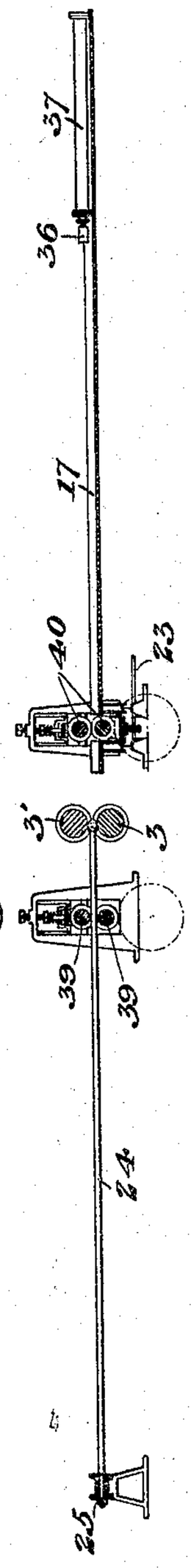

Fig. 7.

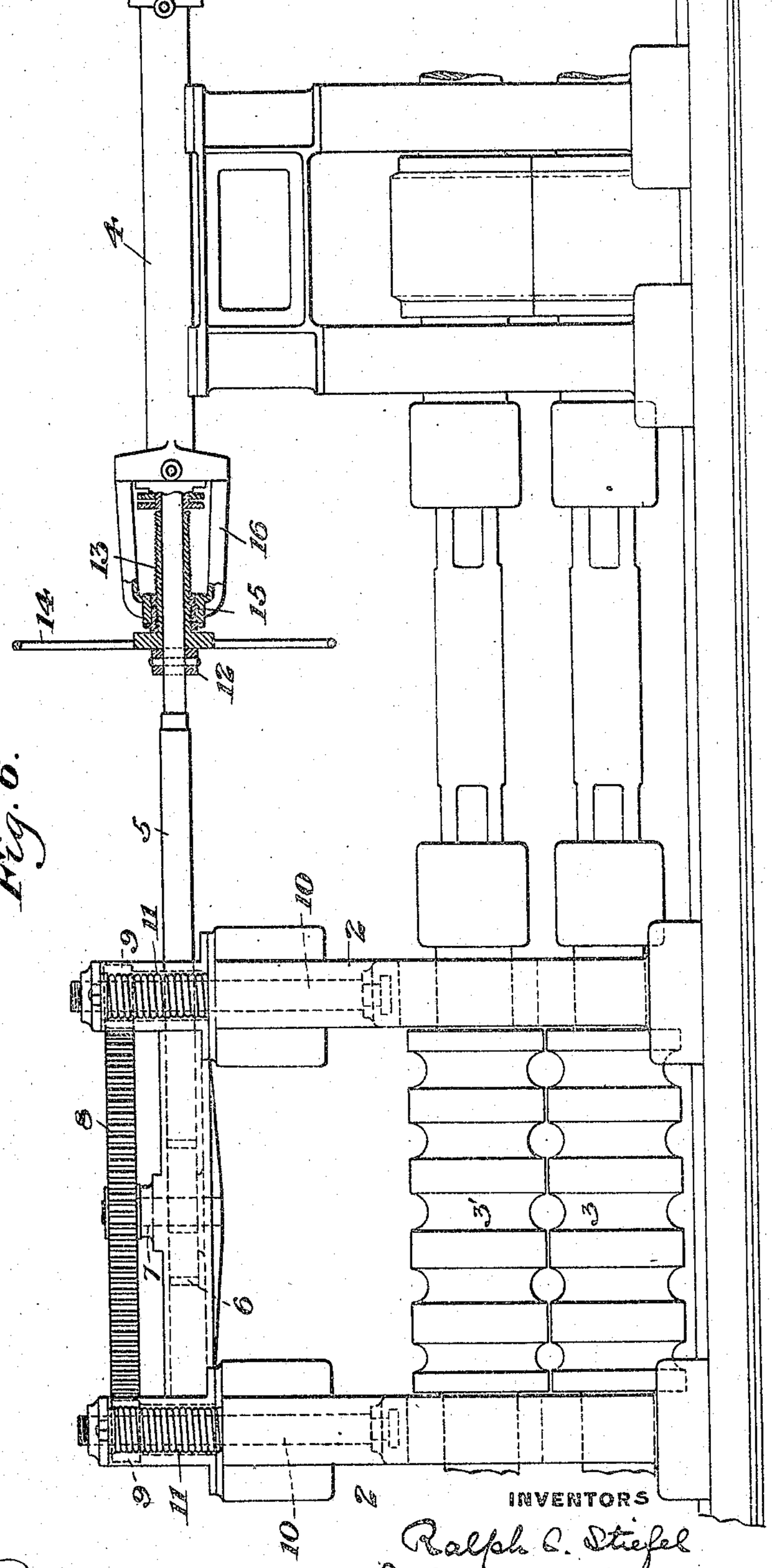

Fig. 6.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR ROLLING TUBING.

No. 923,726. Specification of Letters Patent. Patented June 1, 1909.

Application filed December 26, 1903. Serial No. 186,520.

To all whom it may concern:

Be it known that we, RALPH C. STIEFEL, of Ellwood City, Lawrence county, Pennsylvania, and JOHN H. NICHOLSON, of Pittsburg, Allegheny county, Pennsylvania, have invented a new and useful Apparatus for Rolling Tubing, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a plan view of a mill constructed in accordance with our invention; Fig. 2 is a longitudinal central section thereof; Fig. 3 is a view similar to Fig. 2, showing the parts in the position which they occupy when the tube is being returned to the feeding side of the rolls; Fig. 4 is a cross sectional view on a larger scale on the delivery side of the rolls, the section plane being on the line IV—IV of Fig. 1; Fig. 5 is a vertical section on a larger scale on the feeding side of the rolls, the section plane being on the line V—V of Fig. 1; Fig. 6 is a vertical section through the rolling mill on the line VI—VI of Fig. 1; Fig. 7 is a diagram side elevation showing a modified construction of the stripping mechanism for returning the tube to the feeding side of the rolls, and Fig. 8 is a vertical cross-section on the line VIII—VIII of Fig. 7.

In the manufacture of seamless tubes much time has been lost because of the difficulty and delay incident to removing the tubes from the rods upon which they are delivered as they pass from the rolls, and returning them to the feeding side of the rolls. This has greatly increased the cost of manufacture and has limited the length and thickness of wall to which the tubing can be rolled.

The saving of time is of especial importance in the rolling of tubes on account of the rapid chilling of the comparatively thin walls which are exposed to contact with the air and cooler bodies of metal on both inside and outside. The saving of a very short time may mean the difference between the completion of a tube at a single heat and the necessity for a reheating.

Our invention provides a simple means for overcoming the difficulties heretofore experienced and enabling the rolling operation to be expedited and to be accomplished with a very considerable saving of labor and expense.

The apparatus which forms the subject of our invention may be modified in various particulars. The preferable form is shown in the drawing in which 2 represents the roll housing containing a pair of rolls 3, 3′, which are arranged to be driven continuously in a single direction, the upper roll being vertically movable in the housing in order to separate it from the lower roll sufficiently to provide a space for the return feeding of the tube. Variously constructed mechanism may be employed for this purpose, but we prefer as shown in Fig. 6, to use a power cylinder or motor 4, connected with a rack 5, which drives a pinion 6 on the shaft 7 of a pinion 8 which in turn meshes with toothed nuts 9 on the adjusting screws 10 of the upper rolls, the upper roll being counterbalanced by springs 11 or otherwise, so that when the rack 5 is projected or retracted the upper roll will be correspondingly moved down rapidly toward the lower rolls, or permitted to be raised by the counterbalancing mechanism.

For the purpose of adjustably determining the exact distance from the lower roll to which the upper roll is moved in its down motion, we employ a collar 12 fixed to the piston 4′ of the cylinder 4, and a threaded sleeve 13 adapted to be rotated by a hand-wheel 14 and working in a stationary nut 15 which is connected by a frame 16 to the cylinder 4 or other fixed portion of the apparatus. By turning the wheel 14 the sleeve 13 working in the nut 15 will cause it to be projected or retracted to the desired extent, and the wheel 14 will then constitute a stop with which the collar 12 will engage and will limit the downward motion of the upper rolls to the point desired. We are thus enabled, by the cylinder 4, to raise the upper roll rapidly to the desired extent, and after adjustment of the hand-wheel 14 to move said roll back toward the lower roll and bring it to the exact distance of separation therefrom which may be required. By adjusting the roll between the passes we are enabled to complete the rolling of a tube in a single groove of the rolls, and this is our preferred practice.

On the feeding side of the rolls is a feed

table comprising a trough 17 mounted on wheeled carriages 18, the wheels of which run upon parallel transverse tracks 19. These carriages and the feed table can be moved laterally into line with any of the roll passes by a power cylinder 20 or other suitable motor, the parallelism of movement of the carriages being secured by racks 21 thereon in gear with pinions 22 on a shaft 23 which extends along the table and connects the pinions of the several carriages.

On the delivery side of the rolls, we employ a series of rods 24 which are fixed at the rear end to a stop 25 and extend forward through supports 26 to the respective roll passes, being suitably formed at the ends to receive the mandrels over which the tubes are rolled. The use of a number of these rods is desirable though not essential to our invention, as we employ only one rod and may shift it laterally from time to time to the roll pass at which the tube is to be rolled.

For the purpose of returning the rolled tube back to the feeding side of the rolls, we do not lift the mandrel rod and pull the tube over the rolls, but we employ a stripping mechanism which strips the tube longitudinally from the rod and returns it to the feeding side of the rolls through the same roll-groove and in the same axial line in which it had been delivered from the rolls. This stripping mechanism, when adapted for a series of parallel rods as shown in the drawing, comprises a cross-head 27 carried by a wheeled buggy 28 and having upwardly projecting troughs or forks 29 which fit the rods 24. The wheels of the buggy 28 move in suitable channel guides 30 and they are actuated by a pushing cylinder or motor 31, the rod 31' of which is supported from sagging by rollers 32.

In order that the rod supports 26 may not interfere with the operation of the stripper, we prefer to construct them of yokes or frames 33 having openings 34 in which the rods rest, the yokes being slotted at 35 in order to permit the shanks of the troughs or forks 29 to pass the yokes as they travel along the rods during their longitudinal motion when actuated by the cylinder. The yokes 26 are supported by side rods 36 which extend from the back stops 25 to the roll housing and are suitably supported at intermediate points. The feeding of the tube to the rolls is effected by a pusher 37 forming part of the piston of a power cylinder 38 which is mounted on and moved with the feed table 17.

The operation is as follows: The tube to be rolled having been suitably heated is placed on the feed table 17, and the latter is brought opposite to the pass of the rolls in which the rolling is to be effected, a mandrel having been placed on the end of the rod 24 at that pass. The pusher 37 is then projected and advances the tube into the roll pass over the mandrel. It is then engaged by the rolls and is delivered upon the rod 24 which is in line with that pass. When the rear end of the tube has emerged from the rolls, the rolls are separated as above explained, the mandrel is removed and the stripper 29, which was in the retracted position shown in Fig. 2, is then projected by the motor 31 and is caused to engage the end of the tube, which it pushes along the rod, stripping it therefrom, returning it through the roll pass in the same axial line in which it was delivered, and finally depositing it upon the feed table. The stripper is then retracted, the mandrel replaced on the rod, the rolls brought together after having been adjusted so as to approach somewhat more closely than before, and the tube is then fed back into the roll-pass by the pusher 37 and delivered again upon the rod 24, after which it may be returned as before described to the feeding side of the rolls. At each return of the tube the stripper preferably passes between the rolls so as to clear the tube therefrom.

The operation of rolling the tube through a single roll groove may be repeated as often as necessary to complete the finishing of the tube. We prefer as above described to finish the tube in a single groove and to employ the several grooves or passes respectively for rolling tubes of different sizes, but it will be understood that after rolling the tube once or oftener at a single groove it may be shifted laterally and finished at another groove or grooves.

We do not consider the form of the stripper or of the feed table to be essential to our invention as broadly claimed, since these may be modified in many ways by the skilled mechanic. We believe we are the first to provide means whereby the tube after having been delivered upon the mandrel rod is returned to the feeding side of the rolls through the same or an adjacent roll pass as that in which it was delivered therefrom, the rolls exerting working pressure upon the tube only during its forward passage. This operation is very quickly effected, and as the rolls can be continuously driven in a single direction without reversing or stopping them, the operation of the mill as described is as nearly continuous and uninterrupted as possible. This arrangement of rolls results in a considerable saving of power as well as time, inasmuch as each stand of reversing mills requires a separate engine, whereas several stands of continuously driven rolls may be completed to a single engine.

In Figs. 7 and 8 we show the mill provided with a modified construction of stripping mechanism for returning the tube to the feeding side of the rolls. In this case we employ at each side of the rolls one or more pairs of rollers 39, 40 which extend trans-

versely of the rods on the delivery side of the rolls and extend above and below the feed table on the feeding side of the rolls so that the tube as it comes from the rolls, passes between the rollers. One or both of each pair of rollers is driven in an opposite direction relatively to the rolls, and the upper roller is yieldingly pressed toward the lower roller. When the tube has left the pass of the main rolls and the rolls are separated, the rotation of the rollers 39, acting on the tube with sufficient frictional engagement to move the tube when freed from the bite of the rolls, will return the tube back along the rod and between the rolls to the feeding side of the latter. When the front end of the tube passes the rolls, it is engaged by the rollers 40 on the feeding side of the rolls, and it is drawn thereby until its rear end has passed the plane of the rolls. These rollers 40 may be reversed in direction to feed the tube again to the rolls, in which case the pusher cylinder 37 may be dispensed with. For the purpose of imparting to the tube a quarter-turn before it is fed to the rolls, and thus effacing the fins which may have been formed thereon at the preceding roll pass, we prefer to arrange the rollers 40 so as to be longitudinally movable in opposite directions by means of lever mechanism 41, or otherwise. By thus moving the rollers oppositely before the tube is fed back to the rolls the tube may be given a quarter-turn for the purpose above stated.

We claim:

1. A tube mill comprising continuously driven rolls having a pass, a tube receiving rod at the delivery side of the rolls and alined with the pass, a removable mandrel for the rod, means to separate the rolls to permit the work being returned therebetween, reciprocating means to strip a tube from the rod back between the rolls when separated, after the removal of the mandrel, and adjustable means to limit the movement of the roll separating means to gage the size of the opening when the rolls are moved toward each other; substantially as described.

2. A tube mill comprising continuously driven rolls provided with a pass, a tube receiving rod at the delivery side of the rolls and alined with the pass, a removable mandrel for the rod, means to separate the rolls to permit the return of the work between the rolls, a reciprocating stripper to return the work between the rolls when the rolls are separated, and adjustable means to limit the movement of the roll separating device to gage the movement of the rolls when moved toward each other.

3. A tube mill comprising continuously driven rolls provided with a series of passes, a series of tube receiving rods at one side of the rolls and alined with the respective passes, a feed device upon the opposite sides of the rolls and shifting laterally into cooperative relation with any of the passes, means for separating the rolls to permit the return of the work between the rolls, a reciprocating stripper common to all of the rods to return the work between the rolls, and adjustable means to limit the movement of the roll separating means to gage the movement of the rolls when moved toward each other; substantially as described.

4. Apparatus for rolling tubes, comprising rolls and means for separating them, a mandrel rod on which the tube is delivered, stripping mechanism and supports for the rod, said supports having openings permitting the passage of the stripping mechanism; substantially as described.

5. A tube mill comprising rolls, a tube-receiving mandrel rod, a stripping mechanism, and supports for the rod, said supports having openings permitting the passage of the stripping mechanism, substantially as described.

6. A tube mill comprising rolls provided with a pass, a tube-receiving mandrel rod at one side of the rolls and alined with the pass, means for separating the rolls to permit return of the work between the rolls without compression, stripping mechanism, and a support for the rod having an opening permitting passage of the stripping mechanism, substantially as described.

7. A tube mill comprising rolls having a pass, a tube-receiving mandrel rod alined with the pass, means for supporting the rod from above, and a stripper working beneath the rod, the support having an opening to permit passage of the stripper, substantially as described.

8. A rolling mlil comprising continuously driven rolls having a pass, a work support at the delivery side of the rolls, means for separating the rolls to permit of the work being returned therebetween, reciprocating means to strip the work from the support back between the rolls when separated, and an adjustable stop to limit the movement of the rolls when moved toward each other, substantially as described.

In testimony whereof, we have hereunto set our hands.

RALPH C. STIEFEL.
JOHN H. NICHOLSON.

Witnesses:
JOHN MILLER,
H. M. CORWIN.