(No Model.) 4 Sheets—Sheet 1.

F. H. DANIELS.

WIRE ROD ROLLING MILL.

No. 407,176. Patented July 16, 1889.

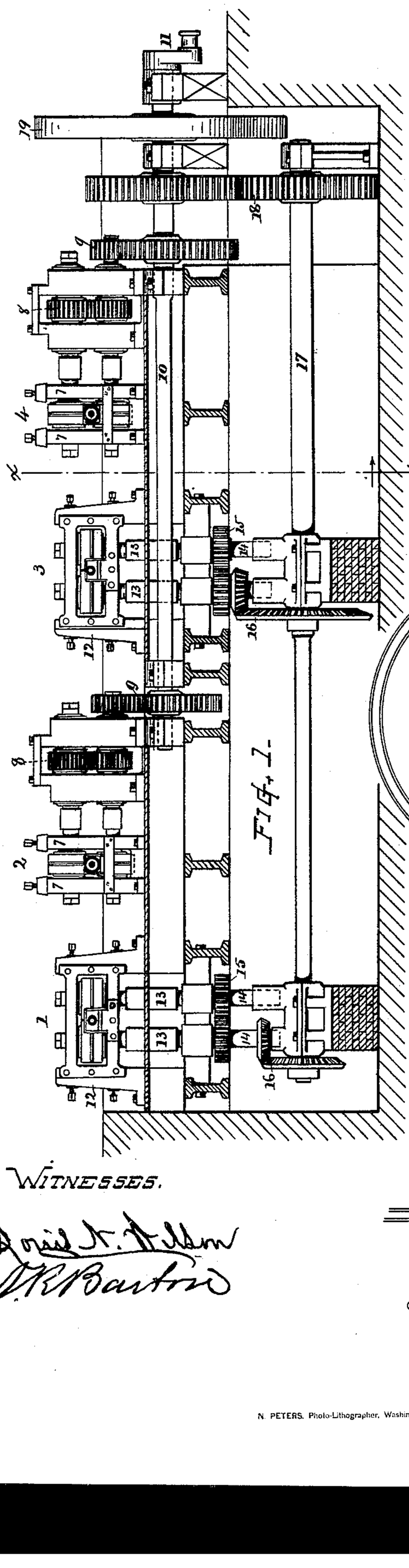

FIG. 1.

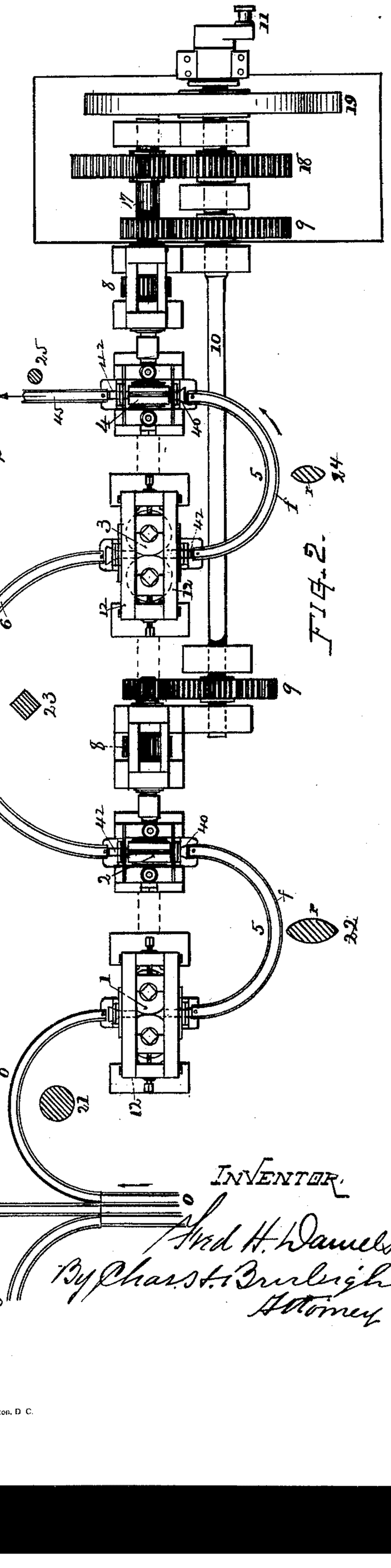

FIG. 2.

WITNESSES.

David N. Wilson

D. R. Barton

INVENTOR.

Fred H. Daniels

By Chas. A. Burleigh

Attorney

(No Model.) 4 Sheets—Sheet 2.

F. H. DANIELS.

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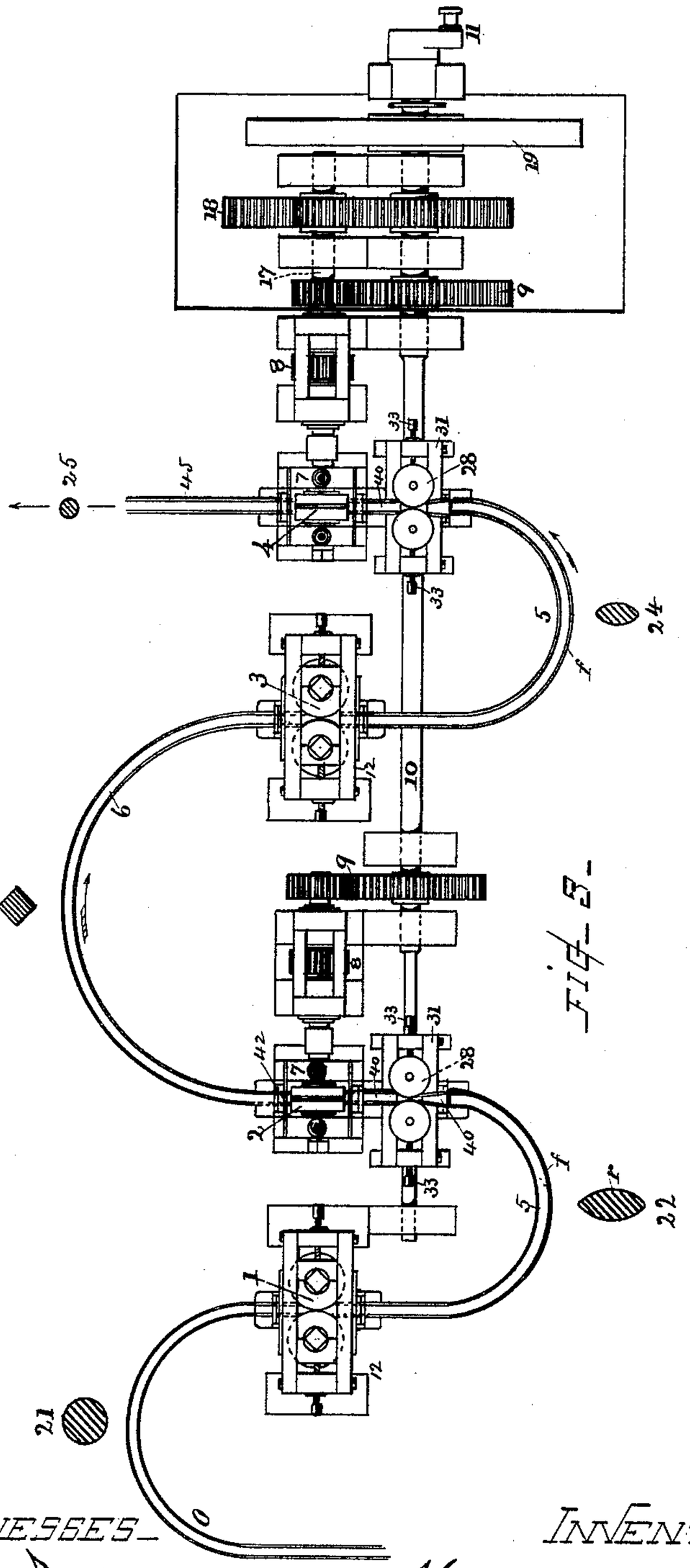

FIG. 5.

WITNESSES—

David H. Wilson

A. R. Barton

INVENTOR—

Fred. H. Daniels

By Chas. H. Burleigh

Attorney

(No Model.) 4 Sheets—Sheet 3.

F. H. DANIELS.

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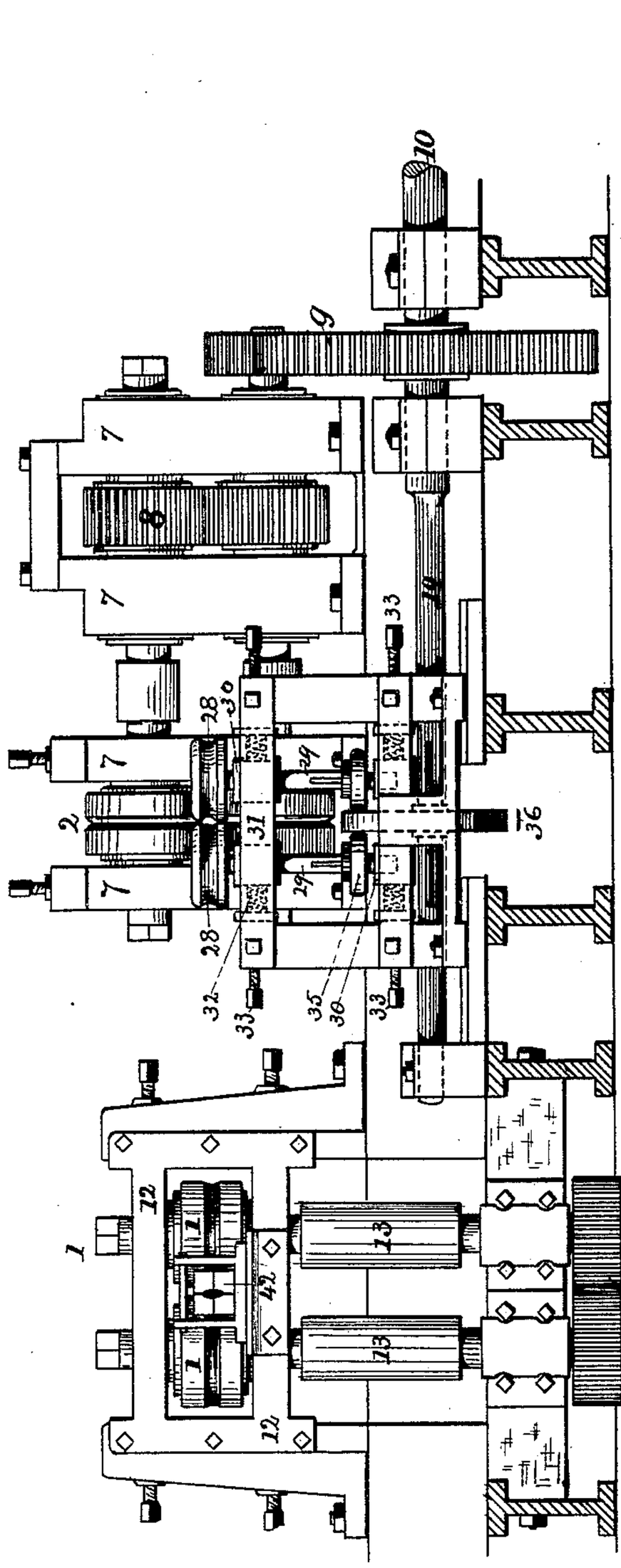

FIG. 1.

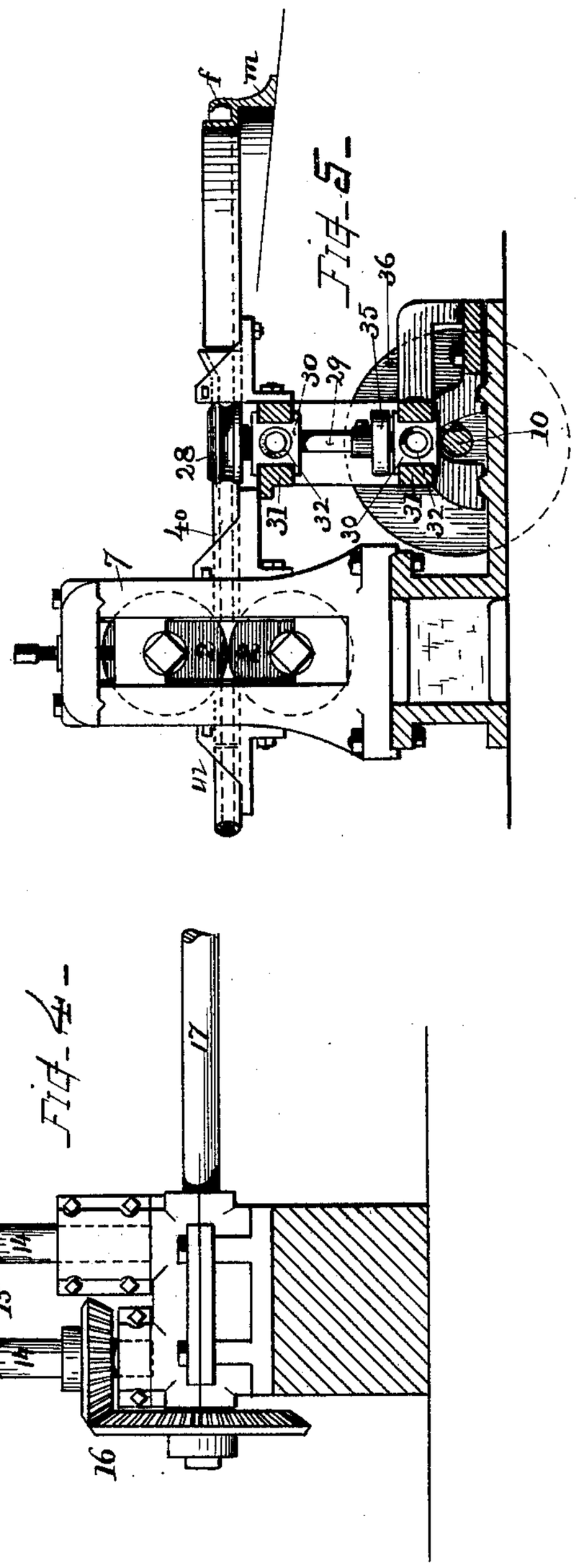

FIG. 2.

FIG. 3.

FIG. 4.

WITNESSES.

Louis K. Fraser

W. R. Bartow

INVENTOR.

Fred H. Daniels

By Chas. H. Burleigh

Attorney

(No Model.) 4 Sheets—Sheet 4.

F. H. DANIELS.

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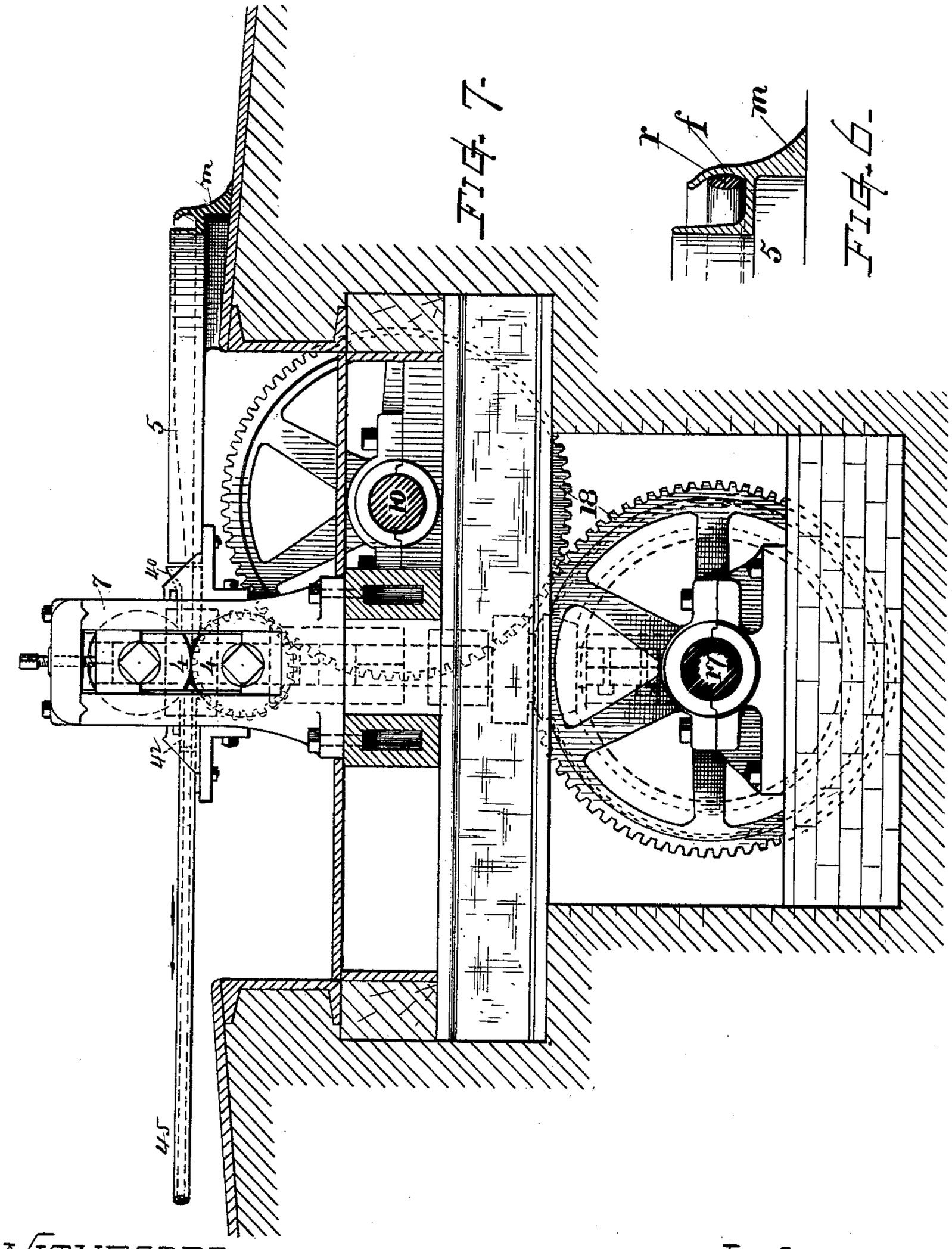

FIG. 7.

FIG. 8.

WITNESSES.

David N. Wilson

D. R. Barton

INVENTOR.

Fred H. Daniels

By Chas. H. Burleigh

Attorney

UNITED STATES PATENT OFFICE.

FRED H. DANIELS, OF WORCESTER, MASSACHUSETTS.

WIRE-ROD-ROLLING MILL.

SPECIFICATION forming part of Letters Patent No. 407,176, dated July 16, 1889.

Application filed January 31, 1889. Serial No. 298,289. (No model.)

To all whom it may concern:

Be it known that I, FRED H. DANIELS, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Wire-Rod-Rolling Mills, of which the following, together with the accompanying drawings, is a specification sufficiently full, clear, and exact to enable persons skilled in the art to which this invention appertains to make and use the same.

In the production of iron or steel wire rods as heretofore practiced all rolling-mills which are in successful operation work on one of the two following-named principles, viz: In one class the rod is passed from one pair of rolls through the next pair in the form of a loop, the overfeed expanding in loops as the rod passes from one pair to the succeeding pair. In short, the rod is not taut between the pairs of rolls. In the other class the rod is kept taut from one pair to the succeeding pair, there being no provision for any overfeed. Each of these methods of rolling has certain disadvantages not incident to the other. The disadvantages of the method in which the rod is kept taut are that it is practically impossible to produce a rod of correct or practically uniform area in cross-section throughout its entire length, the reduction being due not solely to the rolling operation, but partially to the deviation of the rod caused by the pull of each pair upon that portion of the rod which extends from it to the preceding pair. The disadvantages of the other plan relate to the practical difficulty of automatically guiding the rod from pair to pair and yet allowing an overfeed.

The object of my present invention is to provide a rolling-mill having the advantages of both of these classes and without the disadvantages of either.

In the drawings, Figure 1 is a sectional view in elevation of a rolling-mill, illustrating the nature of my invention. Fig. 2 is a plan view of the same. Fig. 3 is a plan view showing a rolling-mill of similar construction provided with feed-rolls for the oval sectional rods in front of the reducing-rolls. Fig. 4 is an elevation of portions of the same, drawn on a somewhat larger scale. Fig. 5 is a transverse vertical section showing the arrangement of the feed-rolls in relation to the repeater-guide and reducing-rolls. Fig. 6 is a section of the repeater-guide for carrying the oval-shaped rods. Fig. 7 is a transverse vertical section at line $x\ x$, Fig. 1, with dotted lines indicating the relative position of the preceding rolls with vertical axes.

In my improved rod-mill the several pairs of rolls 1 2 3 4 are so disposed as to permit the rod to loop out between the pairs of rolls; but in accordance with my invention the pairs of rolls having the oval-pass grooves, or which impart an oval section to the rod, are placed with their axes at right angles to the axes of the other pairs of rolls. Thus in the rolling-mill shown the first pair of reducing-rolls 1, which receive a round or square section and reduce it to an oval section, are vertical. The second pair 2, that reduce this oval to a square section, are horizontal, and so on, alternating through the series, the final pair 4 making a round section or imparting the finished shape. By thus disposing the pairs of rolls which form the ovals I am enabled to carry the oval rod around a curve by bending it only in the direction of its shorter diameter and without twisting it, and can thus practically and successfully work it for automatic feeding into the succeeding pair of rolls by means of a repeater-guide 5, having its rim fitted for supporting the oval.

As will be clear to all skilled in the art, by "oval" I mean all cross-sections which are long one way and short the other, and by "square" I mean all cross-sections whose length and width are substantially the same.

The rolls 2 and 4 are provided with the usual housings 7, couplings and connecting-gears 8, and are operated by gearing 9 from the upper main shaft 10, to which power and motion are imparted by an engine connected with the crank 11 or by any other sufficient motor.

The rolls 1 and 3 are mounted in pairs in suitable housings 12, and are connected by their couplings 13 with upright arbors 14, geared together, as at 15, and operated by beveled gears 16 from the lower main shaft 17, located within a pit beneath the bed of the mill, substantially as illustrated, or by any arrangement of gearing suitable for imparting

equivalent rotative action to said rolls. The lower shaft 17 is operated from the upper shaft 10 by gears 18; or, if in any case more convenient, the motor can be connected to shaft 17 and shaft 10 be driven therefrom by the gears 18. The motor-shaft is best provided with a balance-wheel 19. The relative size and shapes of the rod at the different stages of its reduction at corresponding positions in the mill are shown at 21, 22, 23, 24, and 25.

The semicircular guides or repeaters 6, that lead from rolls 2 to rolls 3, may be of the usual well-known construction, while the semicircular guides or repeaters 5, that connect rolls 1 and 2 and rolls 3 and 4, are made as indicated in Figs. 6 and 7, the outer rim *f* being formed to support the side of the oval-shaped rod *r*, as shown in Fig. 6, and thereby bind the rod without twisting it. The portion below the repeater-trough on the outside is best rounded upward, as at *m*.

In front of the reducing-rolls 2 and 4, which receive the oval sections, I in some instances employ pairs of feed-rolls 28, the purpose of which is to force the oval end of the rod *r* into the bite of the reducing-rolls always at right angles with the axes of the rolls. These feed-rolls 28 are mounted on upright shafts 29, supported by suitable journal-boxes 30, that move or slide on their frame 31, and are pressed toward each other by springs 32. The springs are preferably provided with set-screws 33 or means for adjusting the spring-tension to cause the feed-rolls to take hold upon the rod with greater or less friction. The feed-roll shafts 29 are operated by gearing from the main shaft 10 or from a suitable countershaft, if in any case preferred. This gearing preferably consists of friction-wheels 35, adjustably fixed on the feed-roll shafts 29 and peripherally engaging with the sides of a friction disk or wheel 36, that is longitudinally adjustable upon the shaft 10. This construction affords facility for varying the speed by adjustment of the wheels 35 up or down on shafts 29, and also for lateral adjustment of the wheel 36 and feed-roll-housing frame 31, to bring the groove of the feed-rolls 28 into line with the groove or any particular groove in the reducing-rolls. These feed-rolls are so speeded that after they have fed the rod through the end 40 of guide 5 to rods 2 or 4 they cease in part to be feed-rolls and become auxiliary rotating guides, the rod being pulled by the rolls 2 or 4 between the rolls 28. The entering guides 40 and exit-guides 42 for the several pairs of rolls may be constructed substantially in the usual form.

In the present instance I have illustrated the rolls as all disposed with their passes in substantially the same horizontal plane; but this is not essential, since the respective pairs of rolls can be arranged as may be convenient for gearing or to accommodate other constructive details.

In operation the rod (as it comes from a prior reduction and in cylindrical or other regular form) is led by a guiding-conductor 0 or entered by an attendant into the pass of the first pair of rolls 1, which reduce it to an oval section, as 22. The end of the oval-shaped rod as it issues from the rolls 1 is bent without twisting and directed around the curve within the outer rounded lip *f* of the first repeater 5 and automatically passes between the second pair of reducing-rolls 2, which second pair receive the oval with its longer diameter up and down in the bite—*i. e.*, at right angles with the axes of the rolls. These rolls 2, which have squared grooves, reduce the rod to a square section, as 23, and the end advances through the square repeater 6 to the next pair of reducing-rolls 3, which again impart an oval section, as 24, and this oval is by the second oval repeater 5 in a manner similar to that above described directed and automatically fed to the reducing-rolls 4, the grooves in which give the round or finished form to the product, as at 25. The rod is then conducted to a reel and wound into a coil or otherwise disposed of. In the present instance I have shown a train comprising four pairs of reducing-rolls; but in practice any desired number of pairs (more or less) can be employed, according to the amount of total reduction to be made in the rods, the arrangement and operation of the mechanism being substantially the same through the series as for the successive pairs of rolls herein shown and described.

The improved rolling-mill herein described is eminently adapted for the purpose of a finishing train in a mechanical plant for making small-sized rods from heavy blooms, and I have in separate application for Letters Patent shown and described a rolling-mill plant embracing a series of such rolling-mill trains combined with other mechanical appliances for producing and reeling wire rods in an economical and expeditious manner.

What I claim as my invention to be secured by Letters Patent is—

1. A wire-rod-rolling train composed of a series of pairs of rolls arranged in sets, each set consisting of two pairs of rolls having, respectively, oval passes and square passes, and disposed with the axes of one pair at right angles with the axes of the other pair, and an overfeed-guide connecting each pair of rolls with the succeeding pair, the rolls and guides being arranged and operating substantially as described.

2. A rolling-mill having a pair of rolls in which the rod is given a square section and another pair of rolls in which the rod is given an oval section, in combination with an overfeed-guide that automatically and without twisting conducts the oval rod from the rolls which give it an oval section into the pairs of the rolls which give it a square section, the oval-pass roll being arranged axially at right angles with the square-pass rolls, all substantially as and for the purpose set forth.

3. A rolling-mill composed of a series of

rolls disposed in pairs for successive reductions of the rod by back and forth feeding, and having the successive pairs of rolls disposed with the axes of each pair relatively at right angles to the axis of the next preceding pair, substantially as described.

4. In a rolling-mill, the combination, with a pair of rolls 1 and a pair of rolls 2, of the overfeed-guide 5, said guide and rolls being arranged, as described, to prevent twisting the rod while bending it, the whole combination being and operating substantially as described.

5. In a wire-rod-rolling mill, the combination, with the oval-pass reducing-rolls, of guide 5, the inner surface of its flange shaped, as shown, to match the side of a rod of oval section and curved from end to end, substantially as set forth.

6. A rod-rolling mill having a series of pairs of reducing-rolls, the alternate pairs having oval passes, in combination with a guide for directing an oval rod from one pair to another pair of rolls, and a pair of yielding feed-rolls that form a part of the guide and also advance the rod to the reducing-rolls, substantially as described.

7. In a wire-rod-rolling mill, the combination, with two pairs of reducing-rolls, of a semicircular overfeeding repeater-guide 5, for conducting the end of the rod from its place of issue from one pair of reducing-rolls to the place of entry to the other pair of reducing-rolls, and a pair of feed-rolls 28, disposed in the line of said repeater-guide near its delivery end, substantially as and for the purpose set forth.

Witness my hand this 29th day of January, A. D. 1889.

FRED H. DANIELS.

Witnesses:
CHAS. H. BURLEIGH,
ELLA P. BLENUS.