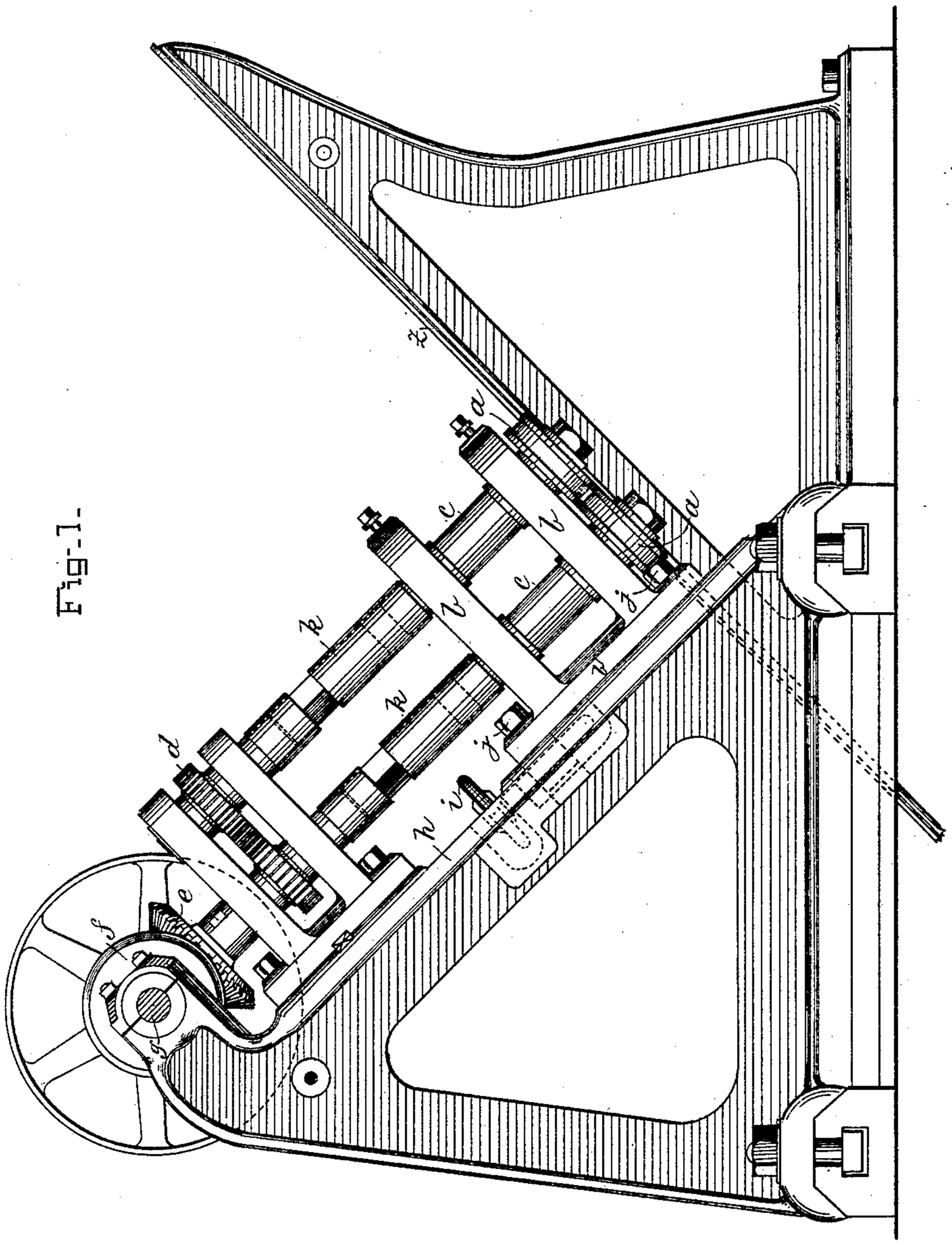
(No Model.) 4 Sheets—Sheet 1.

T. V. ALLIS.

ROLLING MACHINE FOR WIRE RODS AND STRIPS.

No. 462,388. Patented Nov. 3, 1891.

Fig. 1.



WITNESSES.

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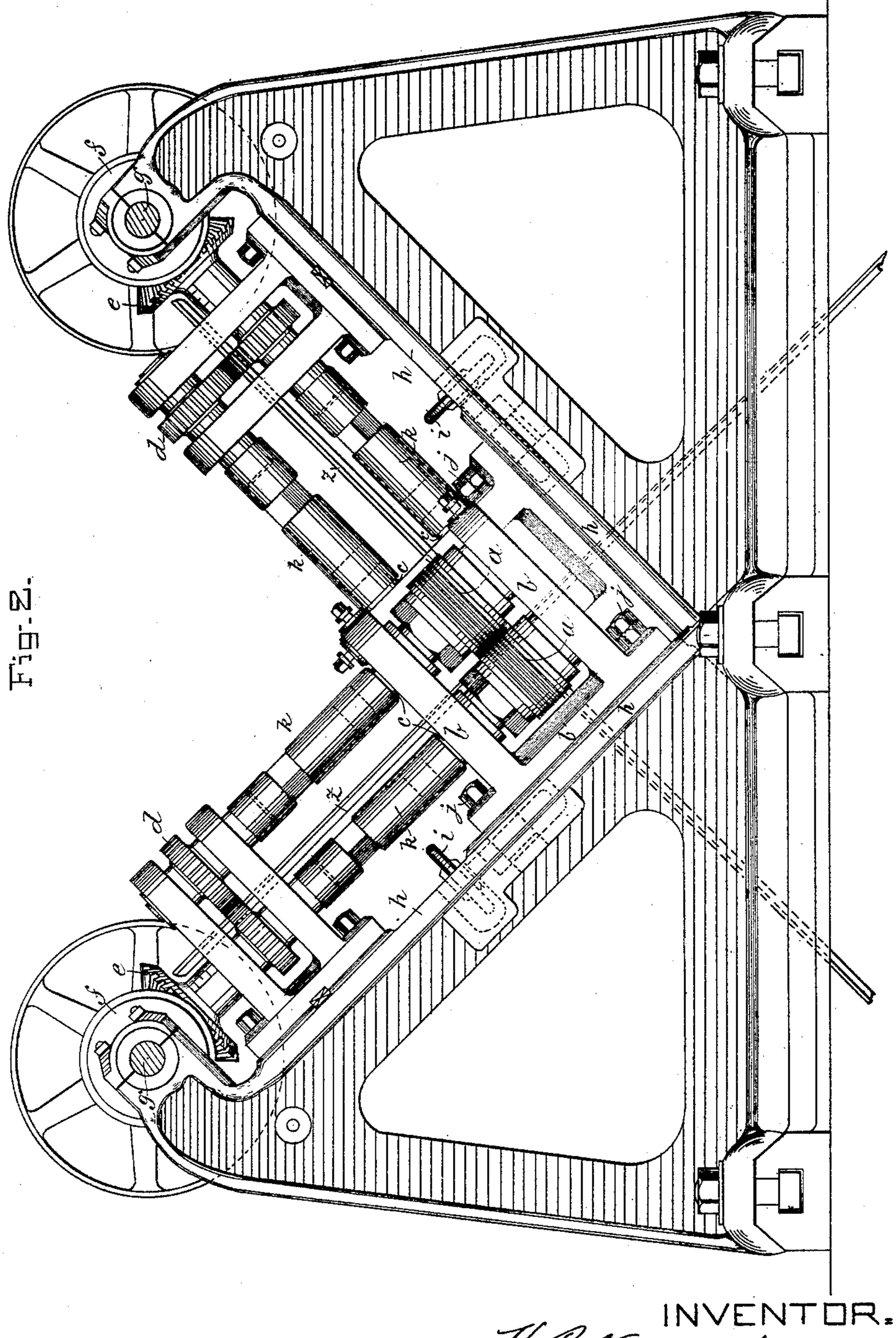

Fig. 2.

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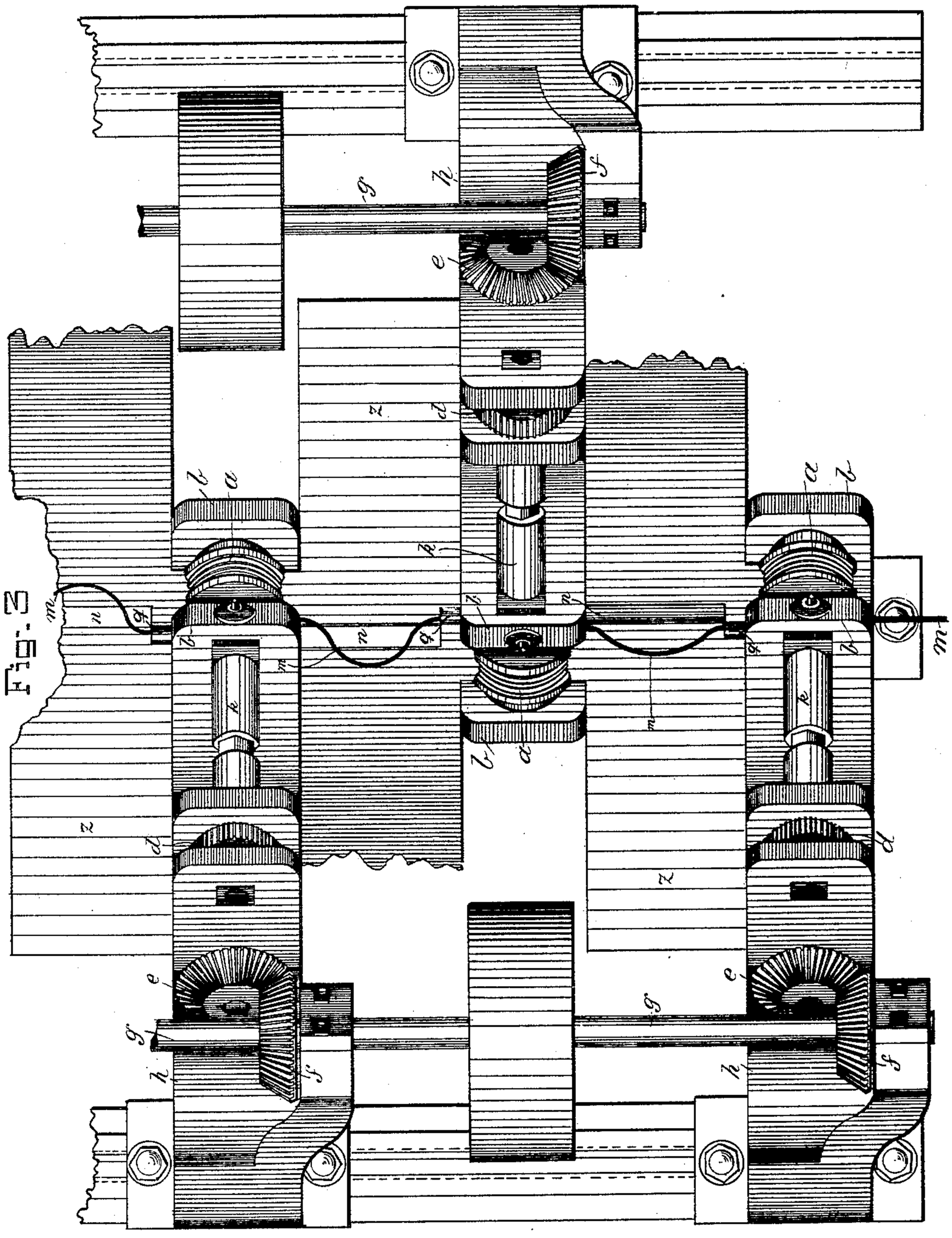

Fig. 2.

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(No Model.) 4 Sheets—Sheet 4.

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ROLLING MACHINE FOR WIRE RODS AND STRIPS.

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Fig. 4.

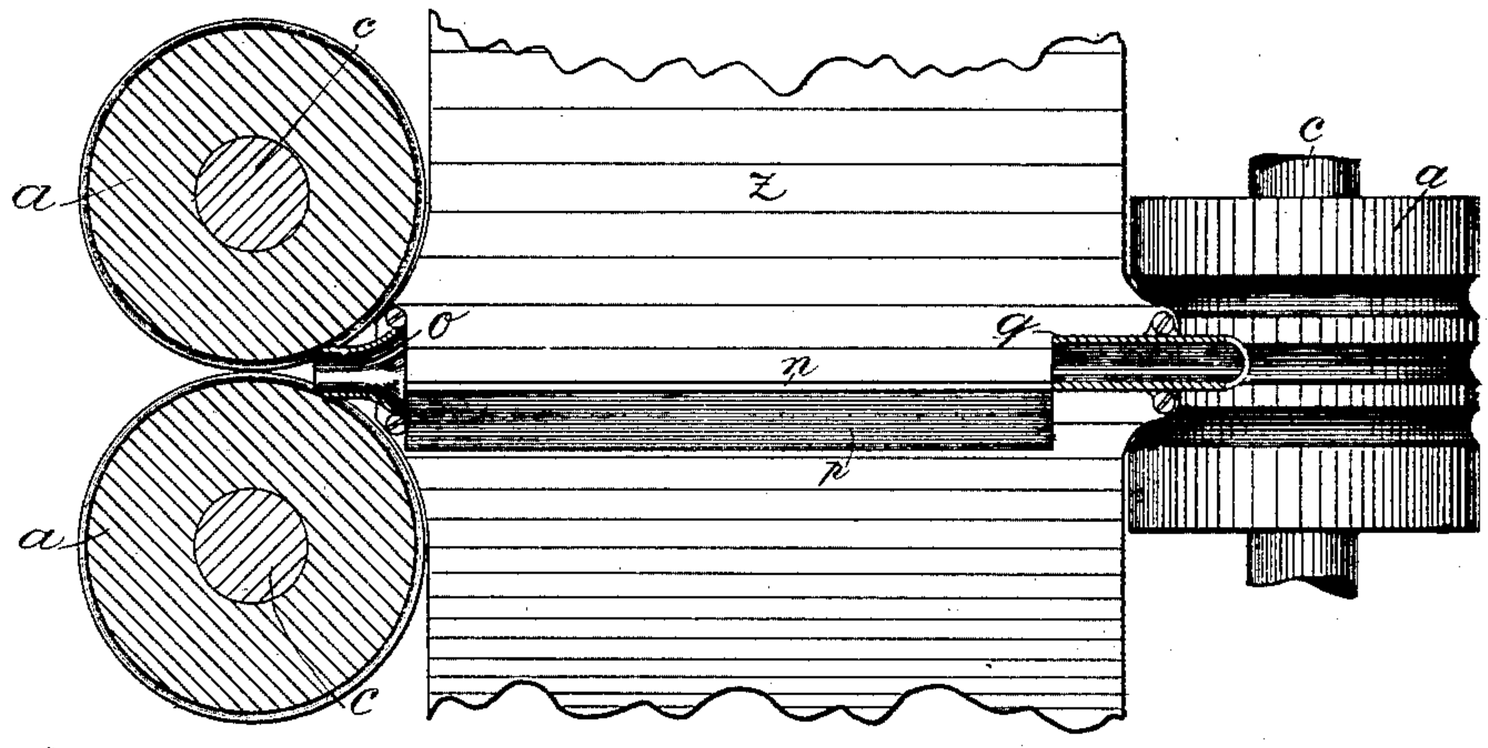
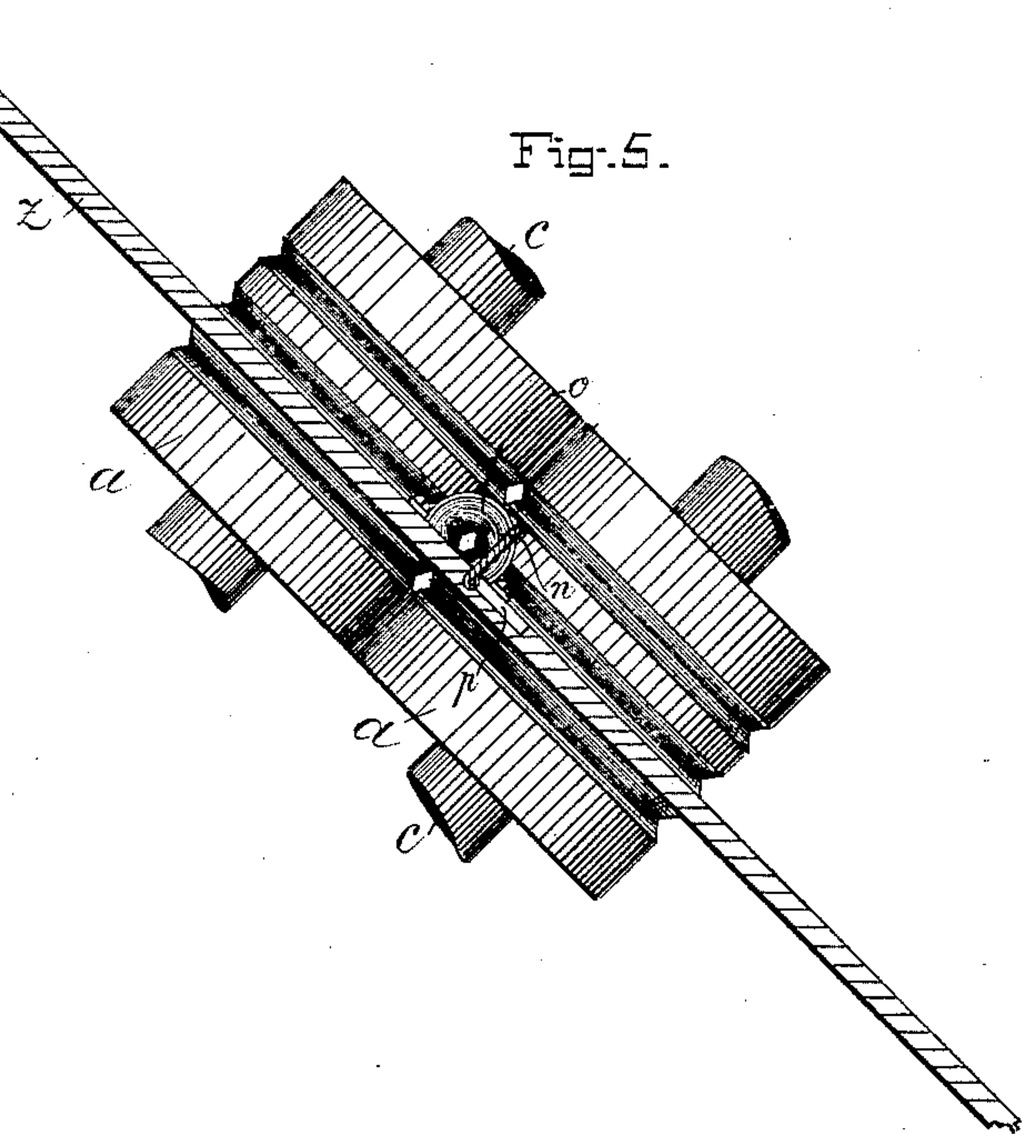


Fig. 5.



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UNITED STATES PATENT OFFICE.

THOMAS V. ALLIS, OF NEW YORK, N. Y.

ROLLING-MACHINE FOR WIRE RODS AND STRIPS.

SPECIFICATION forming part of Letters Patent No. 462,388, dated November 3, 1891.

Application filed September 23, 1889. Renewed April 1, 1891. Serial No. 387,203. (No model.)

To all whom it may concern:

Be it known that I, THOMAS V. ALLIS, a citizen of the United States, and a resident of New York city, in the county and State of New York, have invented new and useful Improvements in Wire Rod and Strip Rolling-Mills, of which the following is a specification.

This invention comprises improvements in continuous-train rolling machinery for rolling wire rods, wire, and flat strips; and its objects are, first, to provide a better arrangement of continuous rolling-mills in which the pairs of rolls are arranged in planes inclined transversely to the longitudinal direction of the train, also in placing them at reverse angles successively; second, to provide for inclined tables located between each consecutive pair of rolls for loops or slack portions of the rods, wire, or strip to run out upon, and, third, to dispose the rolls in such a manner that the journals and other moving parts of the train may not be injured by the escaping scale and water.

Some of the more important difficulties of the present arrangements of this class of machinery which my improvements overcome are, first, great nicety of adjustment and expense of keeping the machinery in order; second, finning of round rods or wire for a certain length at each end, which, being imperfect, has to be cut off and wasted; third, the very expensive delays and damages to machinery which often occur in the present system of continuous rolls arranged in close proximity with closed guides and little or no provision for the escape of the rod or wire when the same becomes stalled.

There are also other advantages, some of which will appear as the invention is more fully described farther on, reference being made to the accompanying drawings, in which—

Figure 1 is an end elevation of a train for band or strip rolling as I arrange it for the escape of scale, water, and other matter and for the application of a loop-guide table, which is also shown in end elevation. Fig. 2 is an end elevation of a train in which the successive pairs of rolls are placed at right or approximately right angles. Fig. 3 is a plan view of the arrangement of Fig. 2. Fig. 4 is a transverse section of a pair of rolls, side view of part of a guide-table, and one of another pair of rolls, and longitudinal sections of the discharging-guide of one pair and the entering-guide of the succeeding pair of rolls; and Fig. 5 is a front elevation of a pair of rolls to which the material runs from the table and a vertical section of the table.

In the common arrangement of continuous rolling-mill trains the rolls are all placed closely together—from twenty-two to thirty-two inches apart—and are so speeded that each succeeding pair takes up a little more than the preceding pair delivers. Thus the metal under action of the tension of several pairs of rolls is stretched; but short portions of each end are not stretched, and others are more or less stretched, according to the pull or draft of any one or two pairs of rolls.

In determining the correct reducing draft for the finishing end of continuous rolling-mills an allowance is made for the diminution of the sectional area of the rod through thus stretching. The larger end portions due to this allowance not reduced by stretching overfill the grooves of the rolls, making fins on that portion of the rod not in the grasp and subject to the pull of the next pair ahead or behind. It is therefore not until the rod is fully under the influence of this stretching process that its section is reduced to the extent that it does not overfill the groove and the fins disappear. The same occurs at the last end of the rod and wherever it is not under stretching tension of two pairs of rolls. Several feet of the rod at each end thus finned have to be cut off and wasted. This is due to the plan of running the metal in a direct course from pair to pair of rolls placed in close proximity and relying on stretching the metal between the different pairs of rolls as the simplest expedient available to avoid slack and to compensate for uneven draft, it being impossible to gage the rolls so nicely that they will feed to each pair in a perfectly-straight line the exact amount required for their reduction. Again, the accuracy and nicety to which the rolls have to be turned and kept adjusted that they may all thus work in unison, none drawing too little or too much, require the close attention of very

expert and trained mechanics, which makes the mill impracticable for the average iron-master.

The disadvantages of the twist-guide which is used for turning or edging the rod as it passes from pair to pair of horizontal rolls commonly used is the rapid wearing of the guide, necessitating frequent renewal, and through its wear the uncertainty of turning and holding the rod securely in the proper position for entering the roll-passes. Failing in this function, the rod falls to one side, stalls the train, and an accident occurs.

The alternate horizontal and vertical arrangement of rolls has not been favorably received because of its expensive and inconvenient arrangement and difficulty of adjusting the several roll-passes of a series to one common center when necessary to change from one worn-out pass to a fresh one. Moreover, the lubricant runs out of the vertical journals, and all the gearing, shafting, and bearings connected with the upright rolls are placed in a pit directly under the train, which is very objectionable on account of escaping scale and water, which naturally causes excessive wear and cutting of working parts. The all-horizontal arrangement of rolls is therefore at the present time the most favorite for continuous rolling-mill trains; but this necessitates the use of the twist-guide for turning or edging the rod, and therefore the consecutive pairs of rolls must be located close together, for the reason that there is not sufficient stability in a small red-hot rod to remain in any fixed position unless rigidly held in so short a grasp that it cannot turn over or double back upon itself, and, as before stated, the arrangement of rolls in close proximity with the closed twist-guides allows of little or no escape of the rod when stalled or caught in any way. Split ends or fins are often the cause of serious disasters in these mills. The means by which I propose to surmount these obstacles are as follows:

First. To place my rolls on a base inclined laterally to the lengthwise direction of the train with the rolls downward and the couplings and gearings above, which brings all my gearing and bearings in accessible positions and where they are not liable to be injured by scale and slivers of metal, and by such arrangement the lubricants remain in the bearings.

Second. I locate each pair of rolls at a sufficient distance apart to allow the formation of a loop between them. By this means I avoid any stretching in the reduction of the metal, as my rolls are so timed that each receiving pair does not take up quite as much as the preceding pair delivers, (the reverse of the present continuous system.) The result is a loop, and thereby the avoidance of extreme nicety of roll turning and maintenance, and the loop facilitates the escape of a stalled rod or piece.

Third. That the varying loops formed between each consecutive pair of rolls may be perfectly supported and directed, I interpose a table between said pairs of rolls, which is at right angles, or approximately so, to the axis of the rolls inclined, as aforesaid, upon which the loops run out and back or up and down as they lengthen and contract.

Fourth. For rolling rods of round, square, or kindred forms I make the lateral incline of my rolls alternately in reverse angles to the lengthwise direction of the train. By this means I avoid the use of twist-guides for turning or edging the rod or piece, as each successive pair of rolls is located at the proper angle for the pass-grooves to receive the rod or piece in its correct position without being turned or edged, and as the rod passes from one pair of rolls to another without having to be turned or twisted I avoid immense friction and am enabled to locate the pairs of rolls at a sufficient distance apart to admit of the formation of a loop between them, and instead of the closed guide of the common arrangement above referred to am enabled to use an open guide when a guide is required.

Fifth. That each loop may be properly supported as it becomes longer or shorter I place a table between each consecutive pair of rolls at right or approximately right angles to the axis of the receiving pair of rolls, the table being continuous and in one inclination where the rolls are all at one angle, but in sections alternately reverse to each other where the pairs of rolls are in the reverse order.

In the manufacture of wire rods, wire, and light flat strips there are great advantages in and I propose to arrange such rolls on a base inclined laterally to the lengthwise direction of the train, with the rolls proper at the lower side of the base, the rolls either being all in one plane or alternately in oppositely-inclined planes and the inclination of the base being preferably forty-five degrees to the level plane; but they may be varied as to the inclination.

In Fig. 1 I represent the front elevation of a train for rolling plain flat strips in which all the rolls have to be in the same plane because the form of the strip to be produced does not admit of the reverse arrangement; nor does it require to be rolled alternately on the sides and edges, as it is necessary to roll rounds, squares, and kindred shapes. *a* represents the rolls proper; *b*, the housings; *c*, the roll-shafts; *d*, the gears connecting the shafts of the two rolls; *e* and *f*, the bevel-wheels, and *g* the main shafts, from which, it is to be understood, all the rolls of the train (the rest not seen) are to be driven. *h* is the inclined base, which in the mill for strips supports all the rolls of the train for the reasons above given. The rolls are at the lower extremities of the shafts, and in this case they overhang the housings, which may sometimes be preferred. For rolling strips

the rolls may have pass-grooves or not; but for other forms the rolls have a series of pass-grooves, and are adjustable lengthwise to bring different passes of the different pairs in alignment with each other or with a fixed guide, and especially where the pairs of such rolls are placed at right angles to each other, as I have represented them in Figs. 2 and 3. For this purpose and for adjusting the plain rolls relatively to the guide-table, described farther on, the rolls are mounted between two housings *b*, formed together on a base *b'*, which is adjustable along the main base *h* for such alignment of the different passes by an adjusting-screw *i*, with clamping-bolts *j* to secure the base firmly after being adjusted, and the roll-shafts are coupled with the gear-shafts by wabbler-couplings *k*, allowing of such adjustment. For such rolls the inclined base is made in the corresponding duplex arrangement of alternately-opposite inclines, with the rolls at the lower sides and with a driving-shaft at the upper extremity of each range of the duplex base.

It will be seen that in the arrangement of Fig. 1 all the scale, water, oil, or other matters commonly falling from the rolls escapes directly from all the working parts, and likewise in the arrangements of Figs. 2 and 3, except as to the lower journals of the rolls, leaving all the rest clear of such matters, so that the gearing is much less obstructed, wears better, and is far cleaner, all of which is important in such rolls which are required to run at a high speed. Besides these advantages of the inclined arrangement of the rolls it enables the use of correspondingly but reversely inclined guide-tables *z* for the loops *m* of strips or rods between the rolls in such arrangement and relation to the rolls as will receive the loops, and on which the loops will run out and back to the pass of the next pair without any care or attention, supported only by said table, said loops either running upward or downward from the rolls, according as it may be preferred to have them or as they may happen to turn, and said tables being extended either or both ways from the feed-line, as shown. This feature of the invention is alike applicable to rolls all in one plane, as in Fig. 1, or in reverse planes, as in Figs. 2 and 3, and whether the rolls be at the lower side of the inclined bases, arranged in the V shape herein shown, or at the upper side of a single inclined base, or of a double reversely-inclined ∧-shaped base, as they may be. Whichever way the rolls are arranged in this respect, the guide-table is inclined perpendicularly, or nearly so, to the axes of the rolls, to which the material passes from it and is in the planes of the pass-grooves of said rolls or of the lower sides thereof, so that the material lying on the surface of the table and running thereon toward the pass will be gaged correctly for entering the pass. This makes the table parallel, or nearly so, with the axes of the preceding rolls when the successive pairs of rolls are reversely inclined, whether in the V or ∧ shaped arrangement, and the tables between the successive pairs of rolls are also reversely inclined alternately; but in the train having all the rolls in the one inclination the tables are all inclined one way.

It will be seen that loops of moderate length will run upward from the line of feed just about as well as downward, so that when it is inconvenient or impracticable to extend the loop-table downward it may be extended upward.

Between each pair of rolls is an open guide-way *n*, along which the free end of the rod, wire, or strip is directly guided from one pair of rolls to another at the beginning and before the loop forms. It receives the end of the rod as it issues from the funnel or other receiving guide *q*, commonly employed close in the angle of the delivery side of the rolls for directing and conducting the issuing end to the funnel guide *o* in the angle of the receiving side of the next pair, its purpose being to control the end before said end is within the grasp of the next pair of rolls, after which it is of no special use, and it may either remain in its position or be removed. If it remain, the loop may form upward on the guide-table, or even downward by looping over the upper edge of the guide. If it is to be removable, it may consist of the thin flat plate jointed at one edge to the table, as I have represented it in the drawings, so as to turn downward onto the surface of the table, or it may drop into a recess *p* and rest therein flush with the surface, and it may have any approved shifting and fastening devices for controlling it. In Fig. 3 I represent this guide as remaining in position, with the loop running upward between the first and second pair of rolls; but in the rest of the figure the guide is represented as turned down into recess *p* and the loops as running downward. It will be seen that the table from which the loop passes into the next pair of rolls being in the plane of the pass-grooves of said rolls—that is, at right angles to the axis of said rolls—the loop will return from its divergent course on the table to the line of feed naturally, so that after the rolls are threaded no guide is needed, except the short bell-mouth always required to hold the somewhat flattened rod edgewise to the pass receiving it, as will be understood by reference to Fig. 5. This will be understood by looking at Fig. 2 and considering the table which is seen in full lines at the left hand above the rolls the one from which the rods feed to the second pair of rolls, the axes of which are at right angles thereto, and it will also and perhaps more clearly be understood if, for the purpose of illustration, the rod or strip be considered as feeding from the table in Fig. 1 to the rolls in front of it. As to this figure, the rod or strip may be considered as feeding in either direction; but as to the others the arrangement requires the feeding to be from the front.

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

1. A continuous train of rolls in which the rolls are arranged on a base inclined transversely to the longitudinal direction of the train, with the rolls proper at the lower side of the base, substantially as described.

2. A continuous train of rolls in which the rolls are arranged on a base inclined transversely to the longitudinal direction of the train, with the rolls proper at the lower side of the base and the roll-coupling pinions connected with their upper ends, the driving power being applied at the upper side of the inclined base, substantially as described.

3. A continuous train of rolls in which the rolls are arranged on a base inclined transversely to the longitudinal direction of the train, with the rolls proper at the lower side of the base and the wabbler couplings and roll-coupling pinions connected with their upper ends, the driving-power being applied at the upper side of the inclined base, substantially as described.

4. A continuous train of rolls in which the pairs of rolls are placed alternately in oppositely-inclined planes transversely to the lengthwise direction of the train and the rolls proper are located at the lower sides of the inclines, substantially as described.

5. The combination, with a continuous train of rolls located on a base inclined transversely to the lengthwise direction of the train, of a loop-guide table in the plane of the feed-line and inclined reversely to the inclination of the roll-train, substantially as described.

6. The combination, with a continuous train of rolls in which the pairs of rolls are alternately in opposite inclined planes transversely to the lengthwise direction of the train, of loop-guide tables between the pairs of rolls and in the plane of the feedway and inclined reversely to the axis of the rolls to which the loops run from said tables, said tables being parallel with the plane of the pass-grooves of said rolls, or substantially so, as described.

7. The combination, with a continuous train of rolls located on a base inclined transversely to the lengthwise direction of the train, of a loop-guide table in the plane of the feed-line and inclined reversely to the inclination of the rolls, and an open guideway between the pairs of rolls, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 20th day of September, 1889.

THOMAS V. ALLIS.

Witnesses:
WILFRED B. EARLL,
W. J. MORGAN.