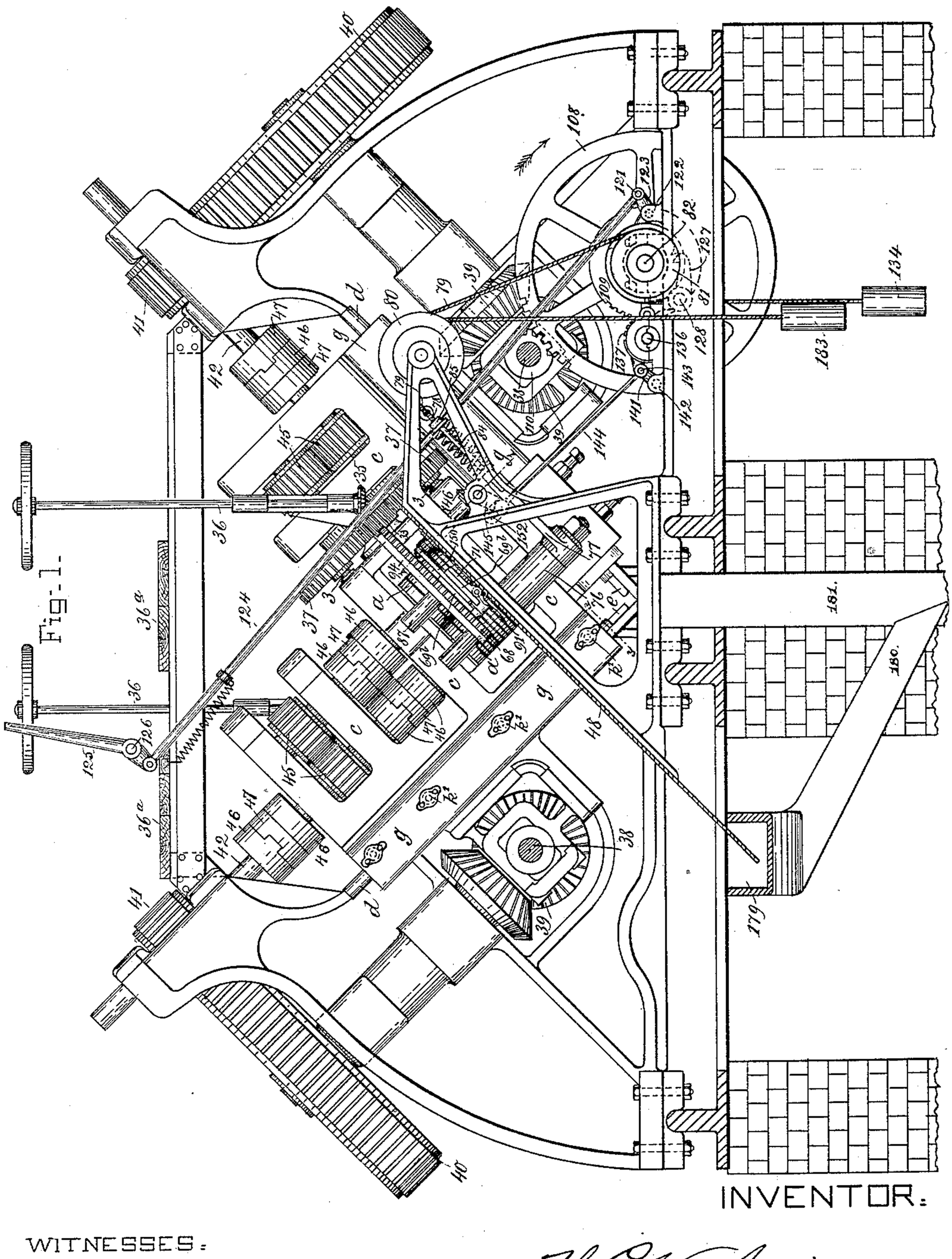
(No Model.) 20 Sheets—Sheet 1.

T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig. 1.



WITNESSES:

Ernst Lundgren

J. H. Templin.

Thos V Allis

By A P Thayer.

atty.

(No Model.) 20 Sheets—Sheet 2.

T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

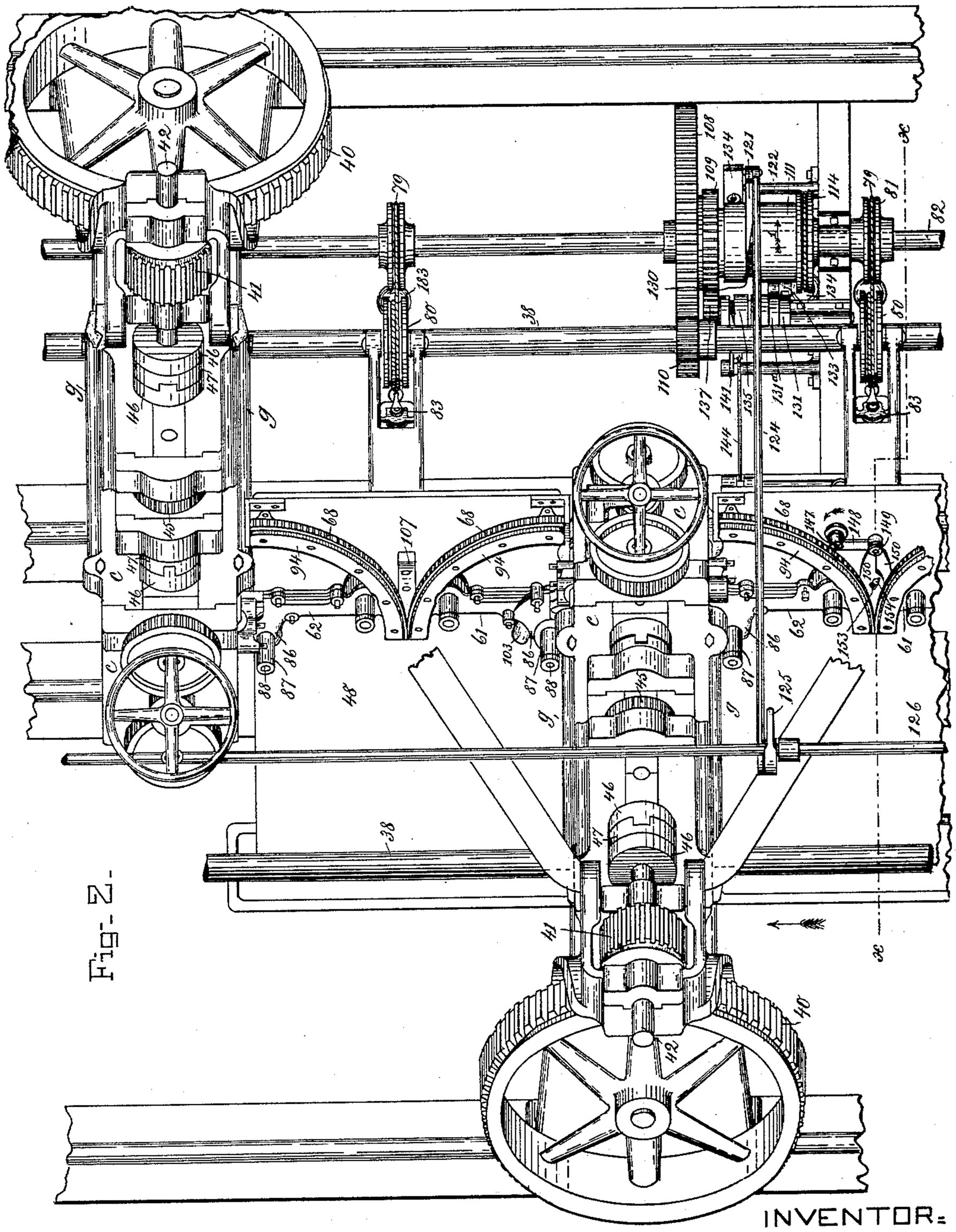


Fig. 2.

WITNESSES:
Ernst Lundgren
J. H. Templin.

INVENTOR:
Thos V Allis
By A O Thayer
atty

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T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig: 51.

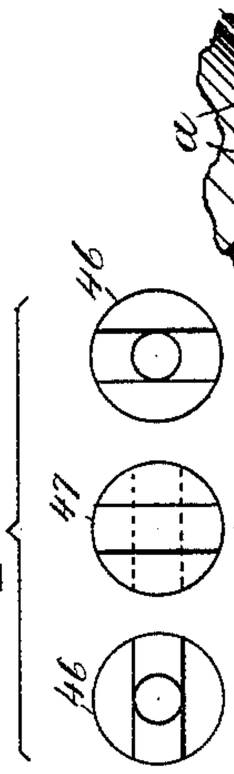


Fig: 52.

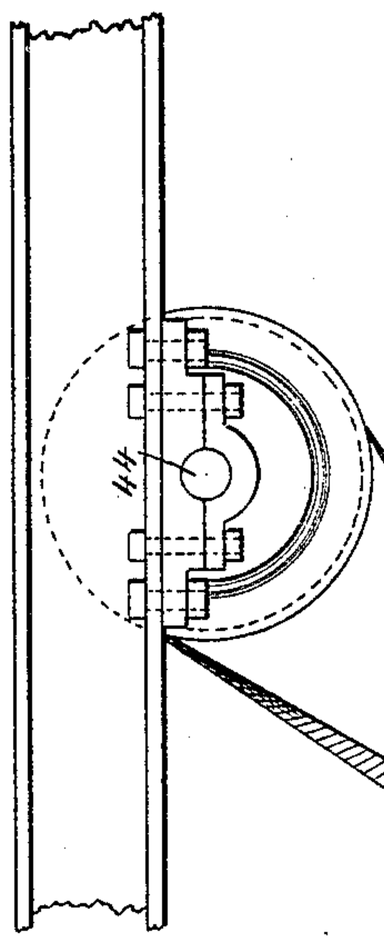


Fig: 50

WITNESSES:

Ernst Lundgren

J. L. Templin

INVENTOR:

Thos V Allis

By A O Thayer.

Atty.

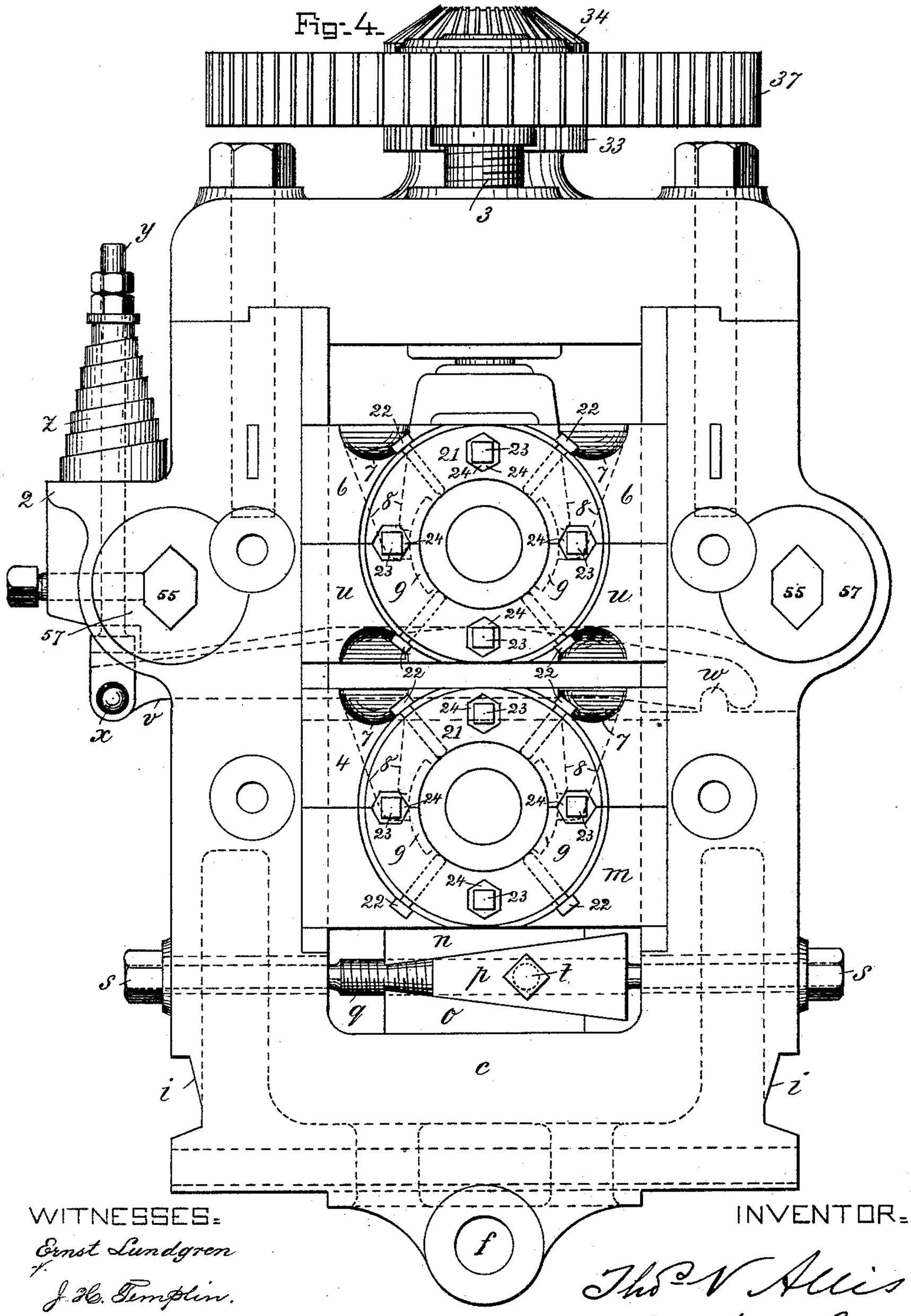
(No Model.) 20 Sheets—Sheet 4.

T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig. 4.



WITNESSES:

Ernst Lundgren

J. H. Templin.

INVENTOR:

Thos V Allis

By A P Thayer

atty

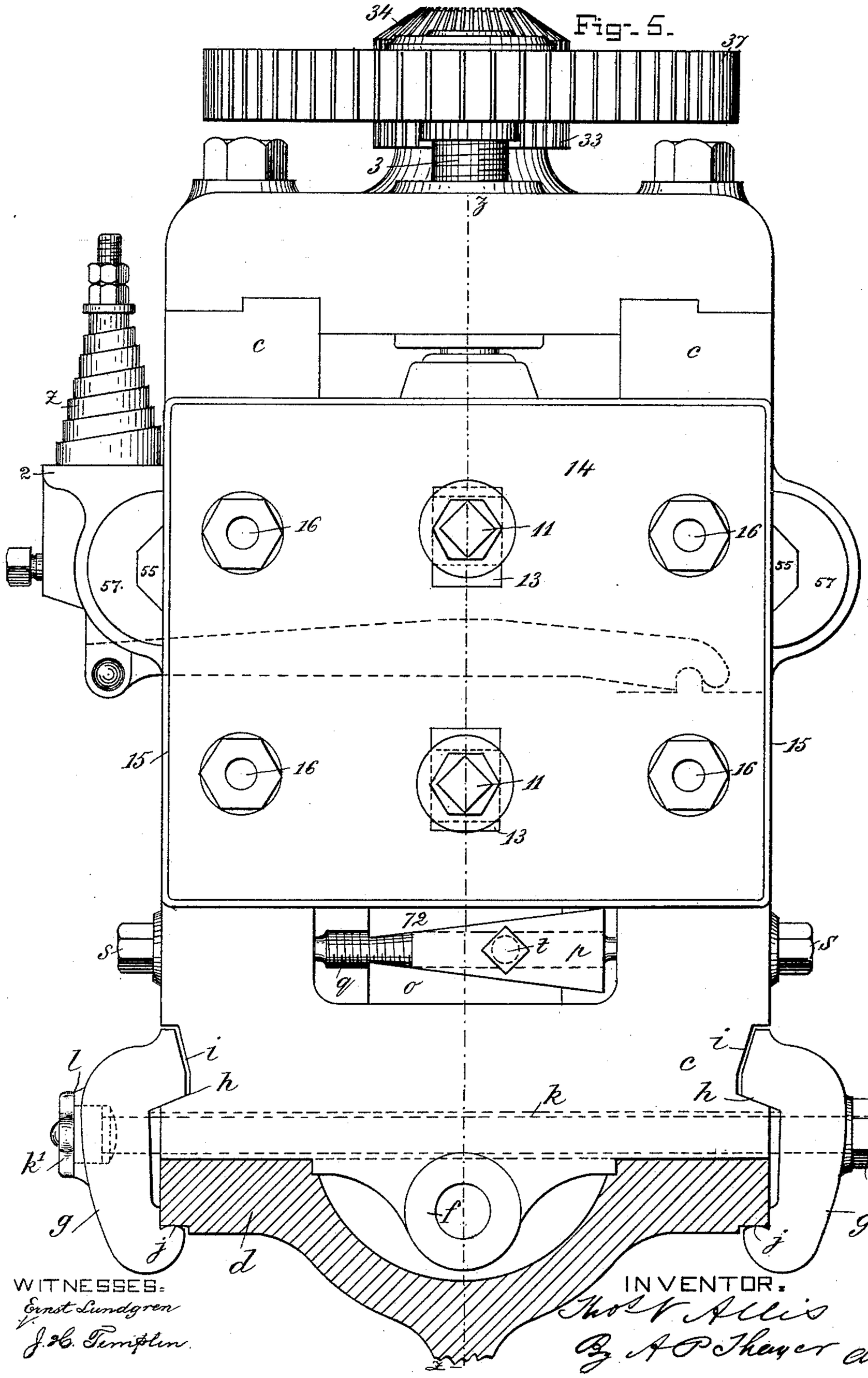
(No Model.) 20 Sheets—Sheet 5.

T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig. 5.



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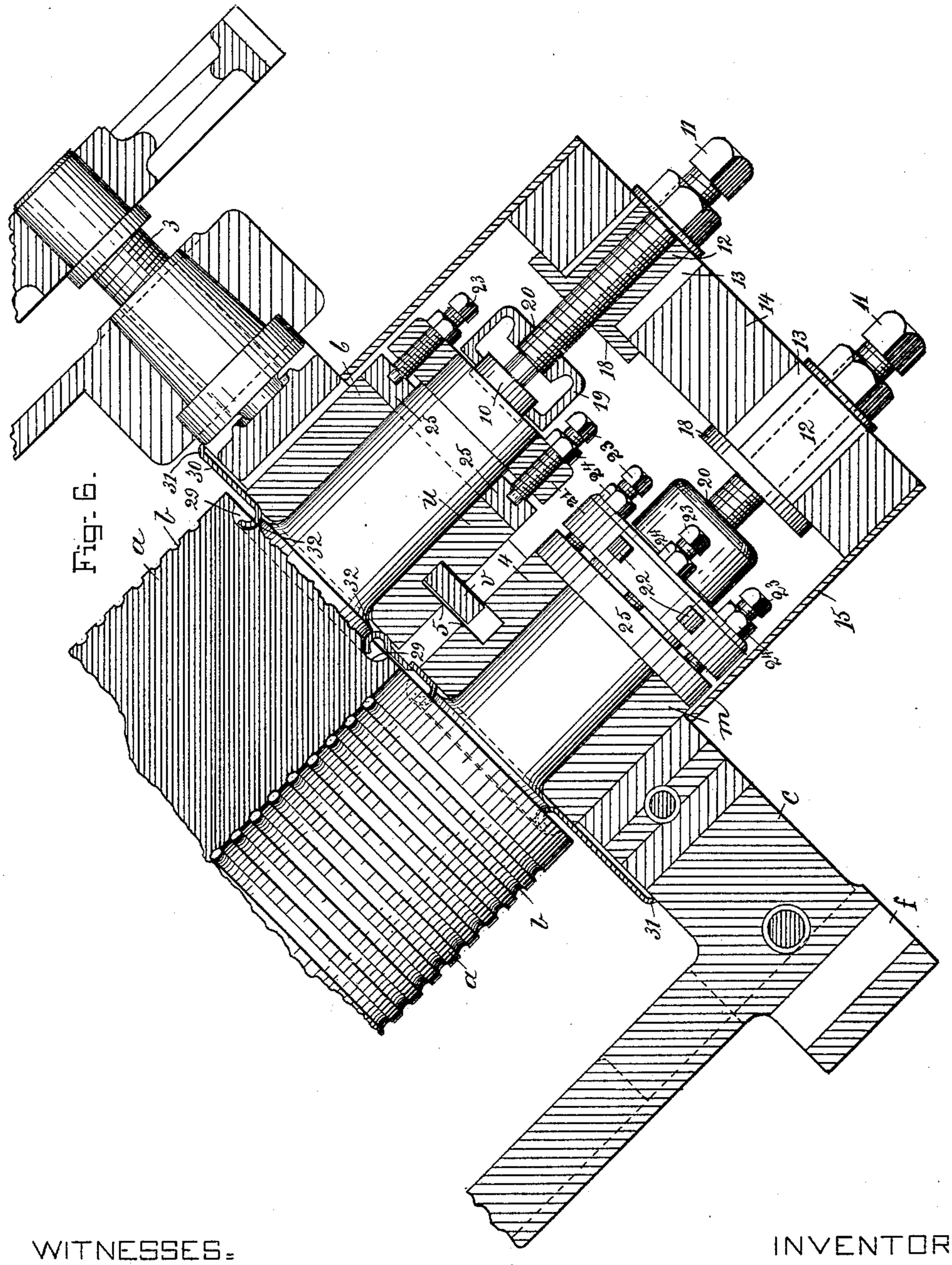
T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig. 6.



WITNESSES:

Ernst Lundgren

J. H. Templin.

INVENTOR:

Thos. V. Allis.

By A. P. Thayer.

Atty.

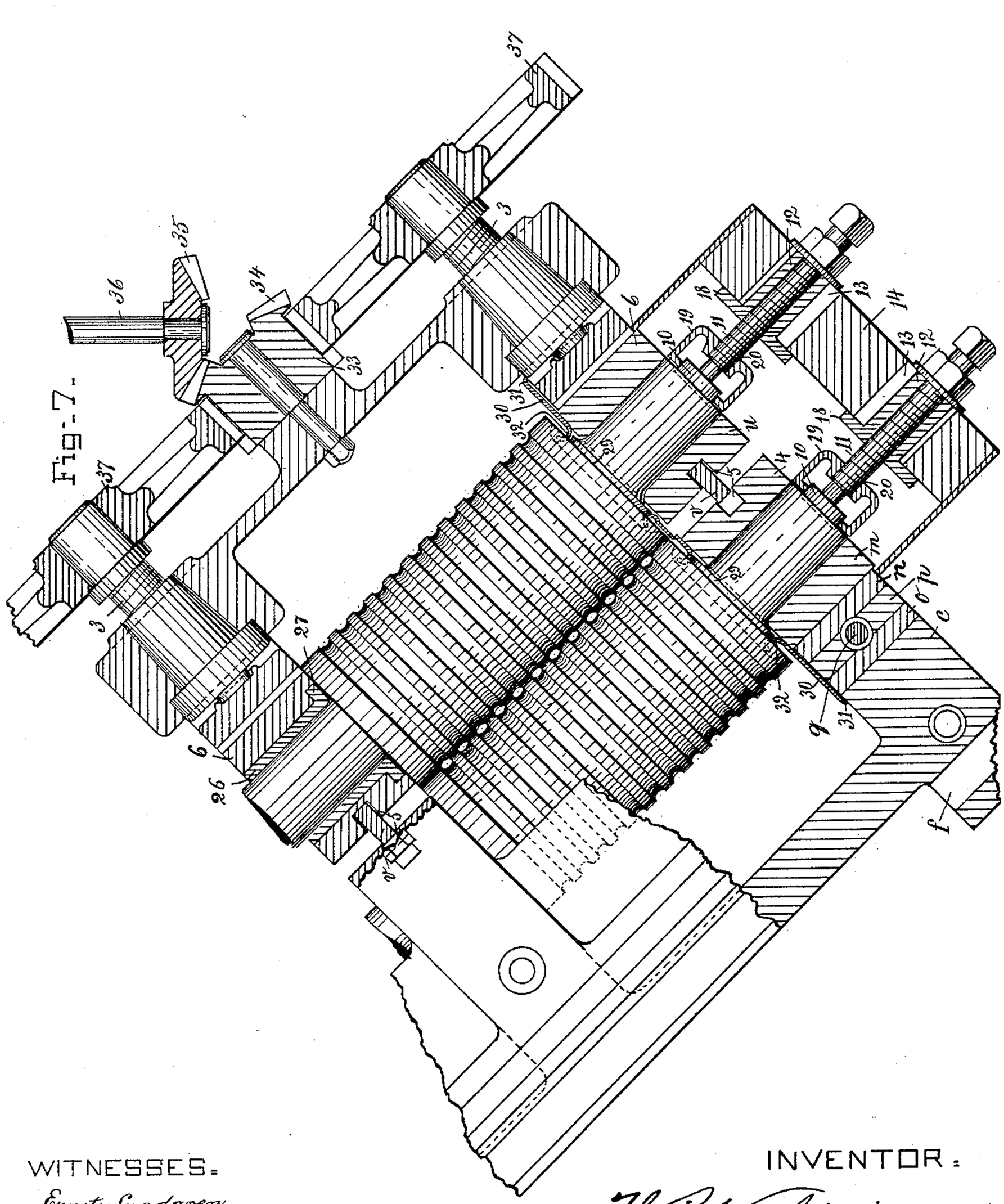
(No Model.) 20 Sheets—Sheet 7.

T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig. 7.



WITNESSES:

Ernst Lundgren

J. H. Templin.

INVENTOR:

Thos V Allis

By A P Thayer

atty

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T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

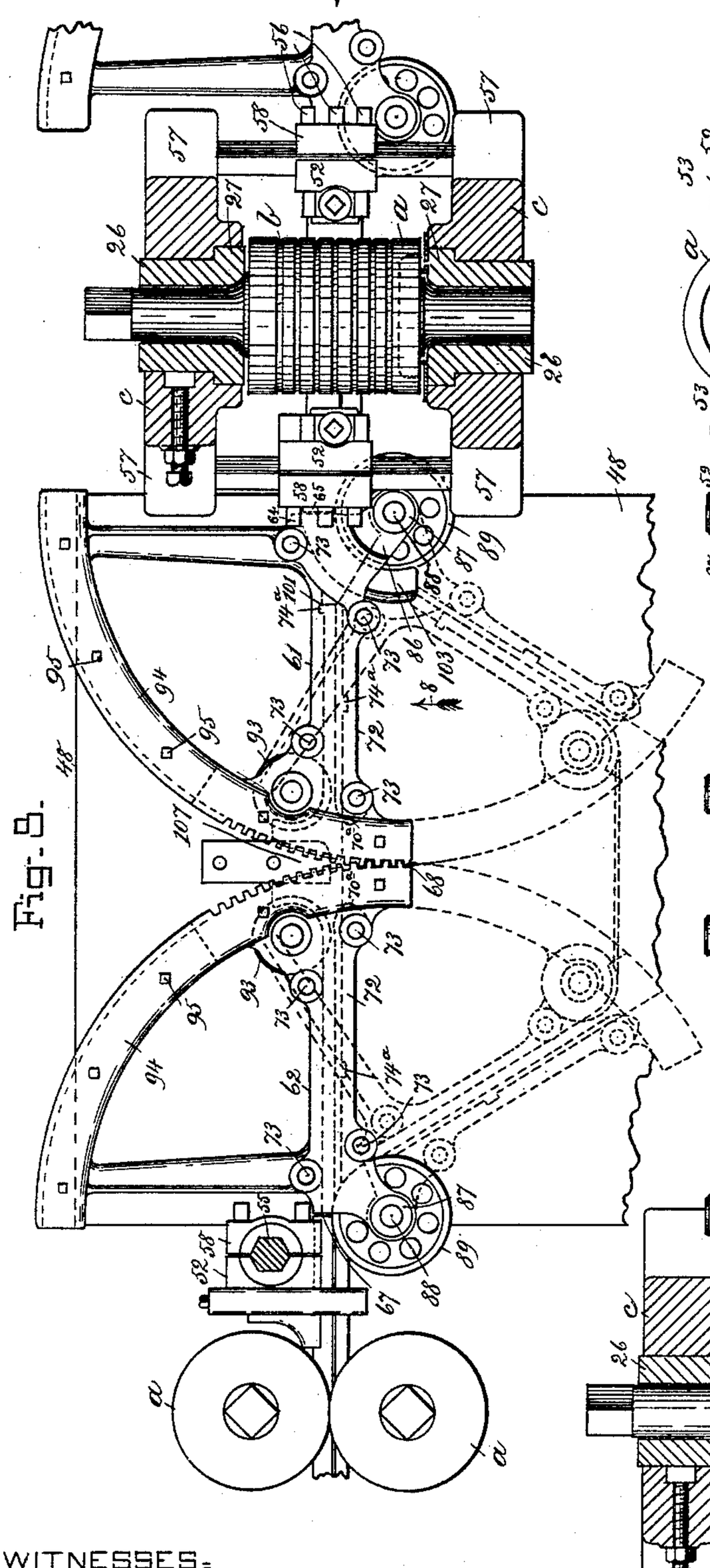

Fig. 8.

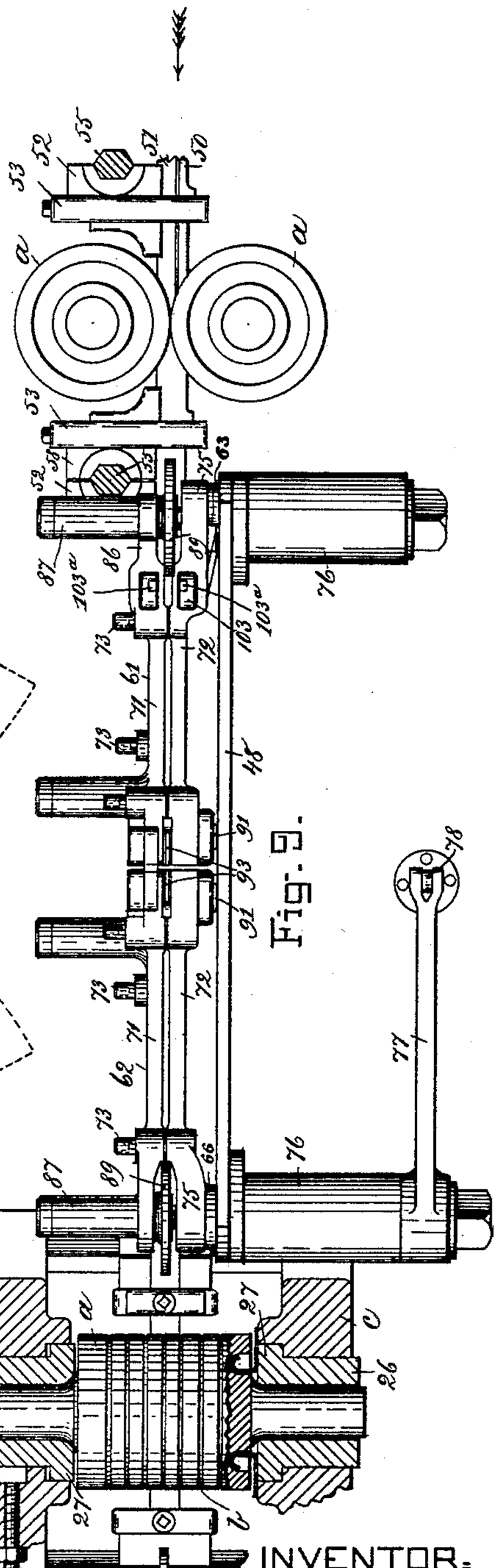

Fig. 9.

WITNESSES:
Ernst Lundgren
J. H. Templin

INVENTOR:
Thos V. Allis
By A. P. Thayer
Atty

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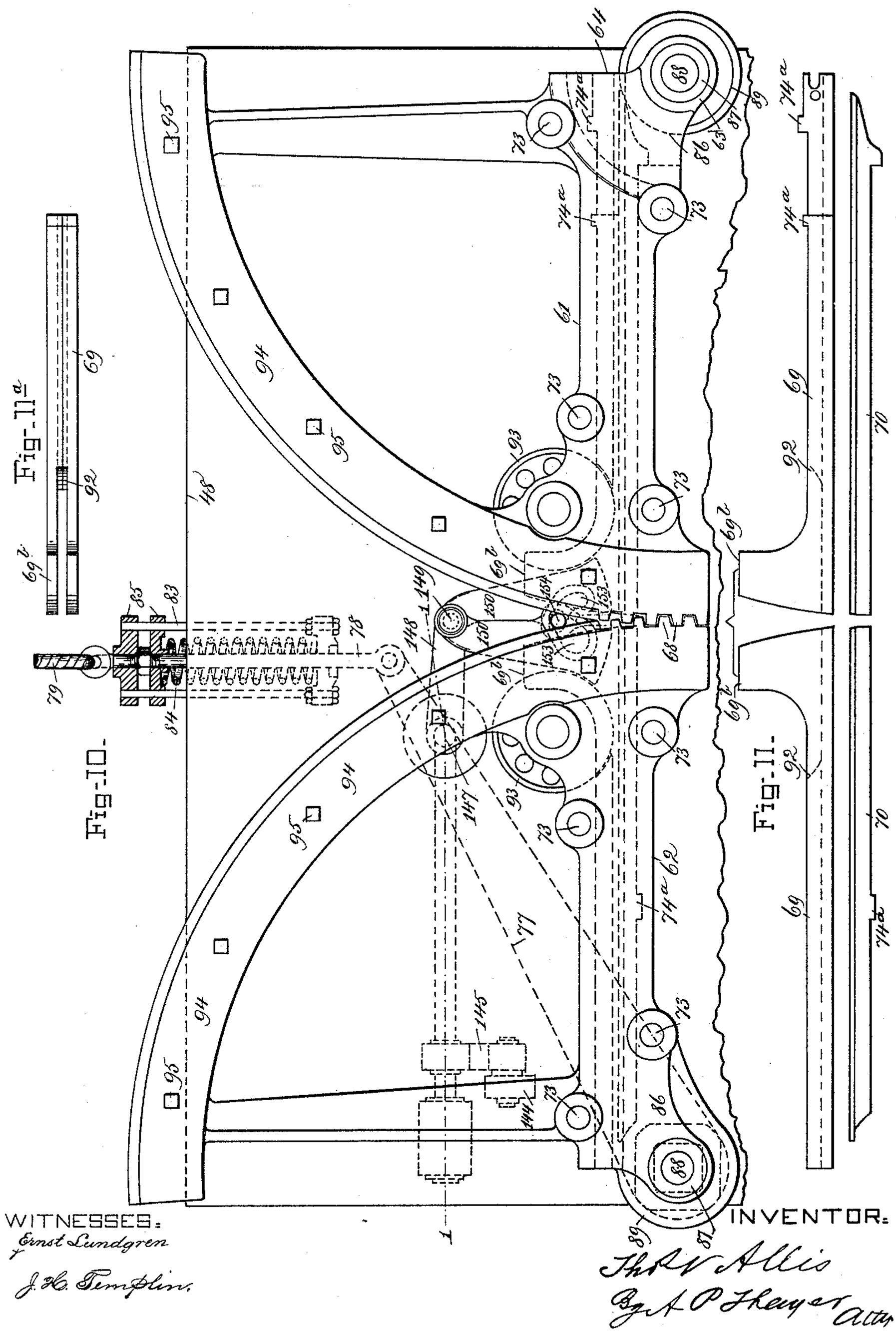
T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.



WITNESSES:
Ernst Lundgren
J. H. Templin.

INVENTOR:
Thos V Allis
By A P Thayer Atty

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T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig. 14.

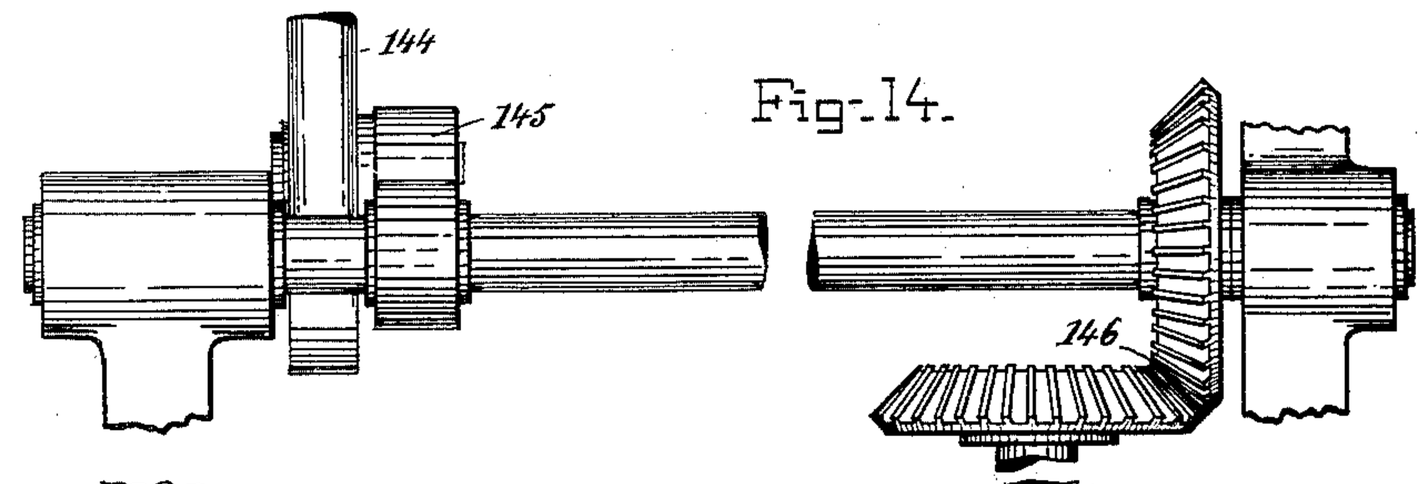


Fig. 12.

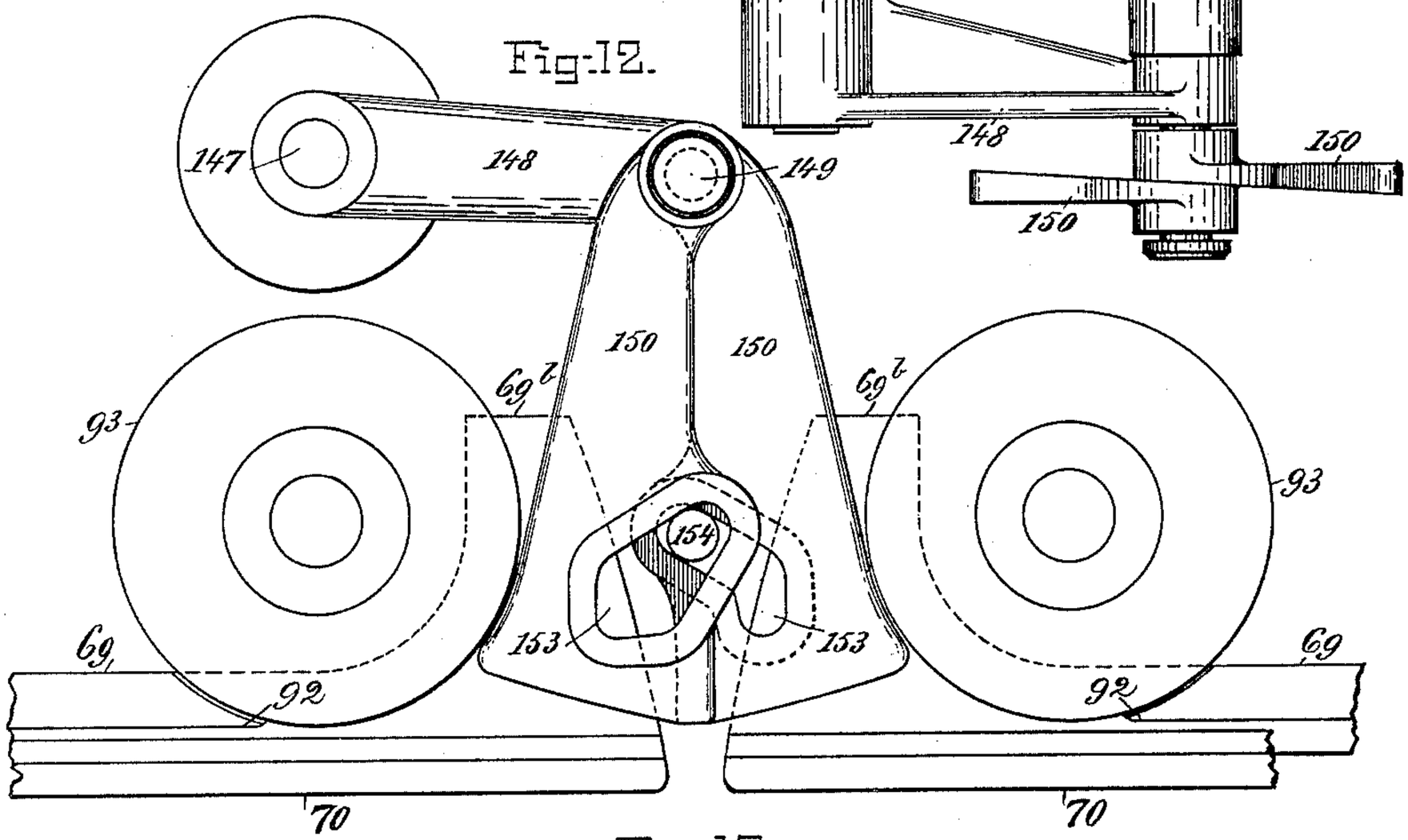
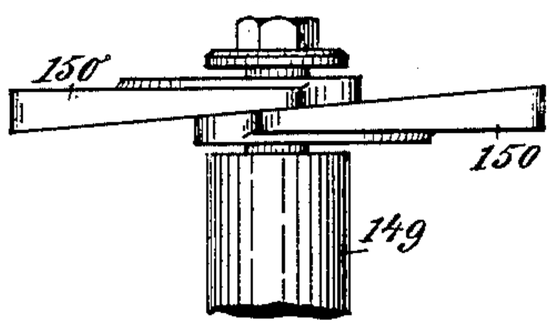


Fig. 13.



WITNESSES -

Ernst Lundgren

J. H. Templin.

INVENTOR:

Thos V Allis

By A P Thayer.

Atty.

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T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig-15.

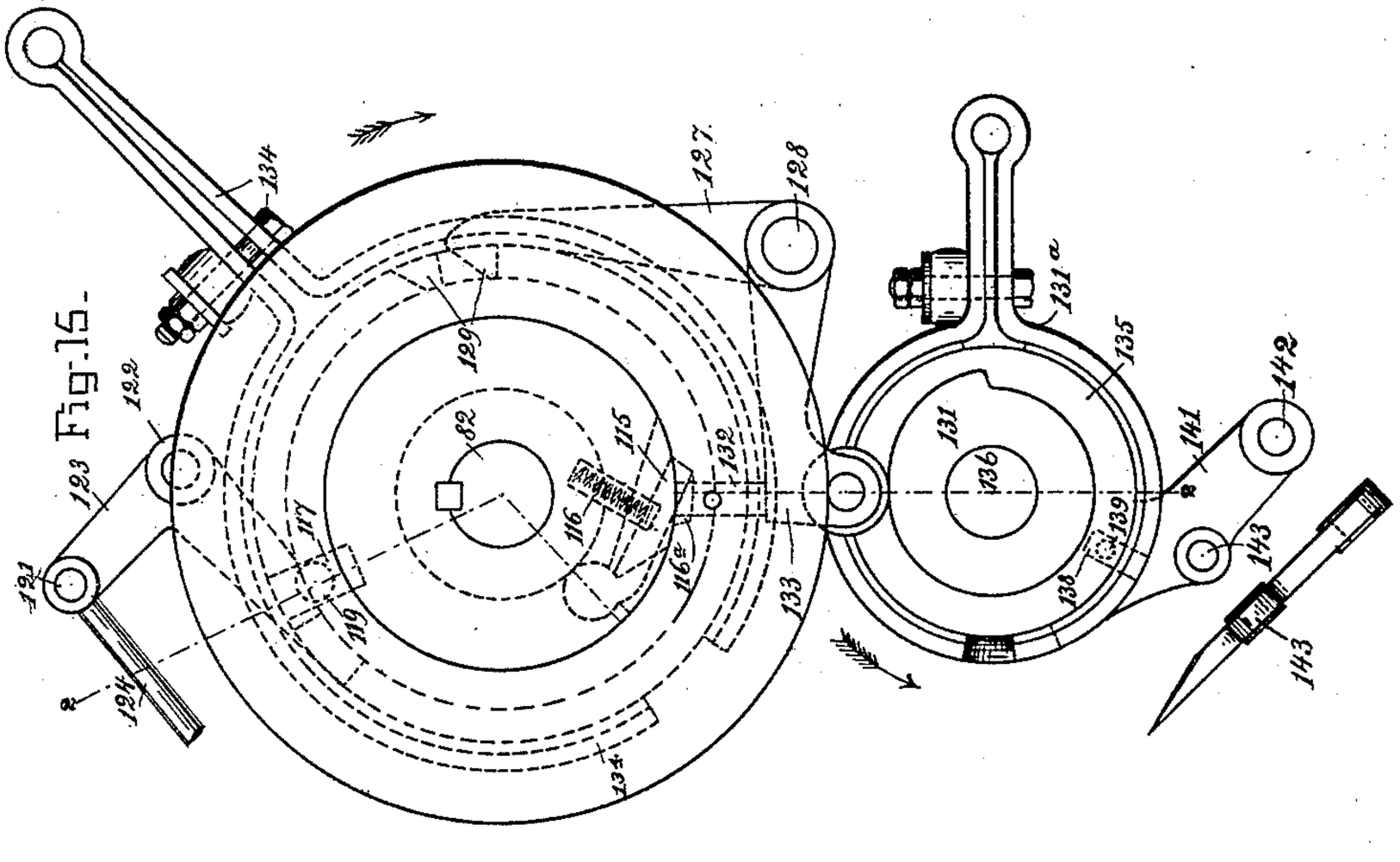
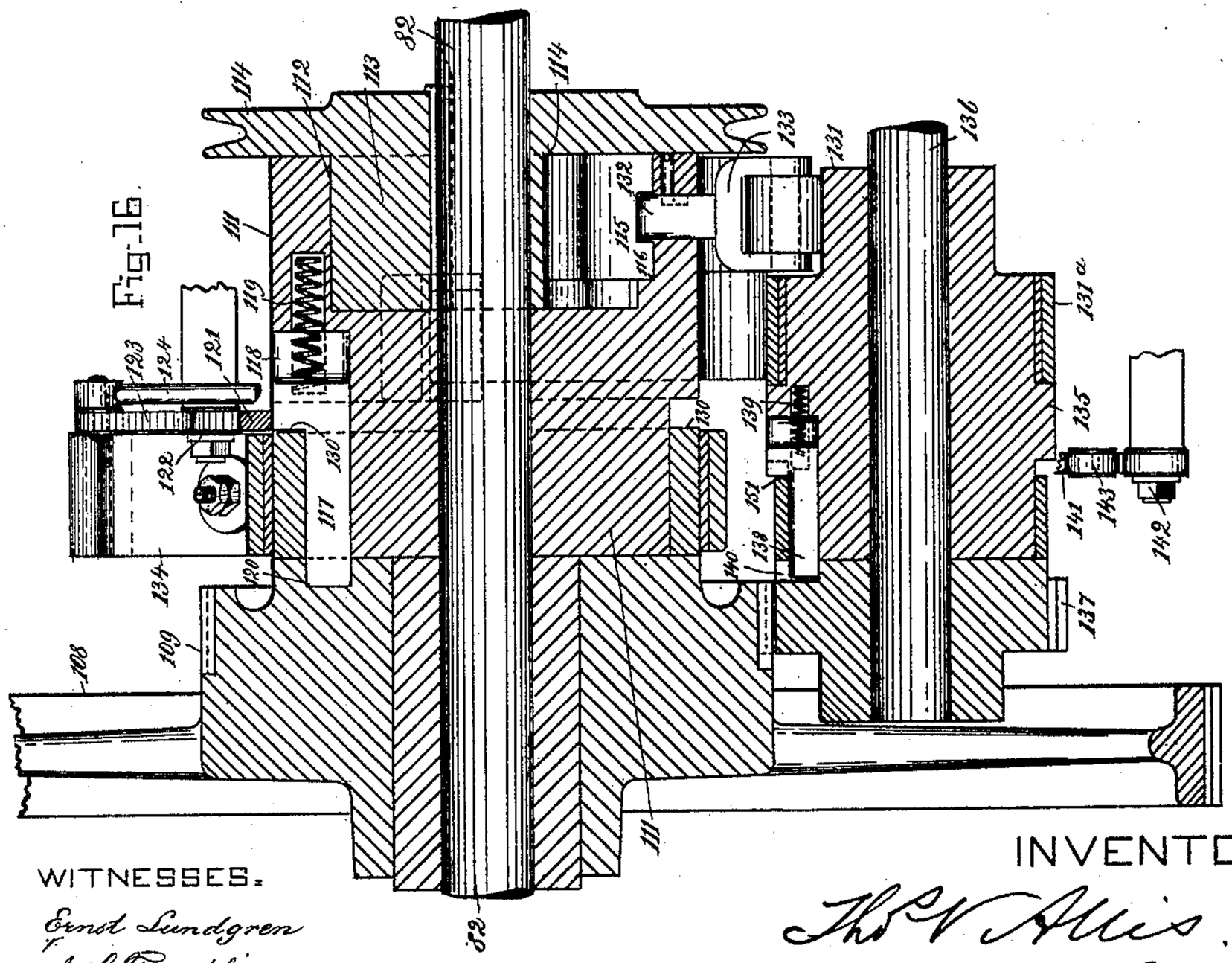


Fig-16.



WITNESSES:

Ernst Lundgren

J. H. Templin.

INVENTOR

Thos V Allis.

By A P Thayer.

Atty.

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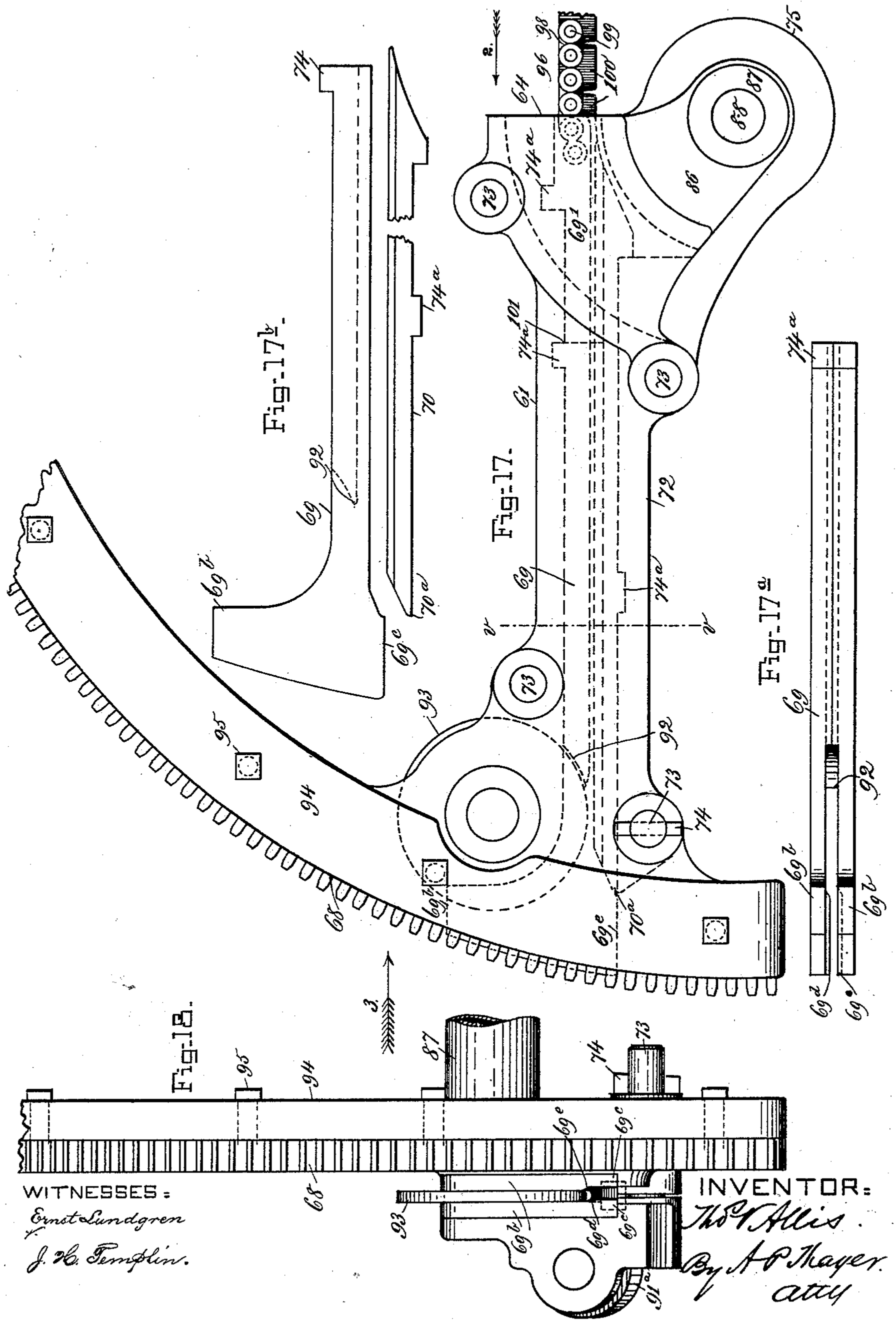
T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.



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T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig-21.

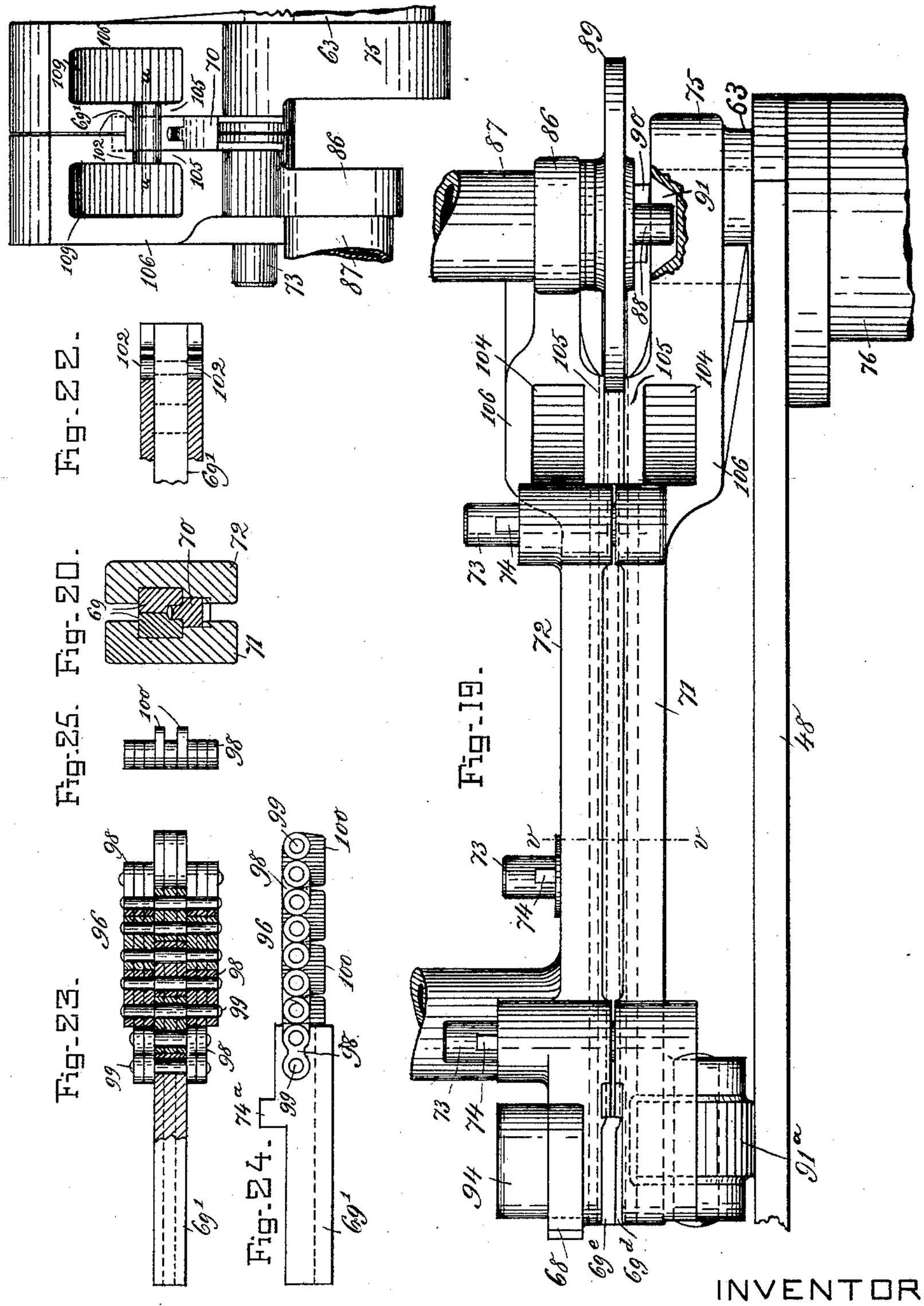


Fig-22.

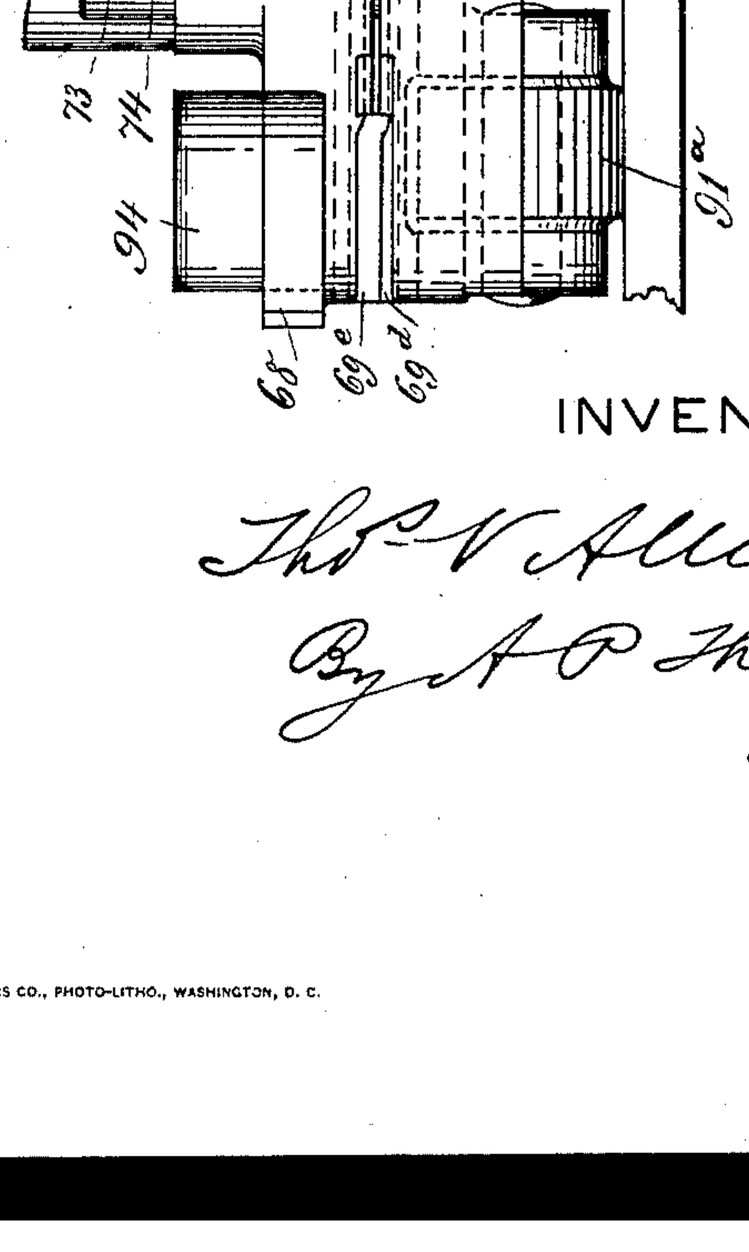
Fig-20.

Fig-25.

Fig-23.

Fig-24.

Fig-19.



INVENTOR.

WITNESSES:
Ernst Lundgren
J. H. Templin.

Thos. V. Allis.
By A. P. Thayer.
atty.

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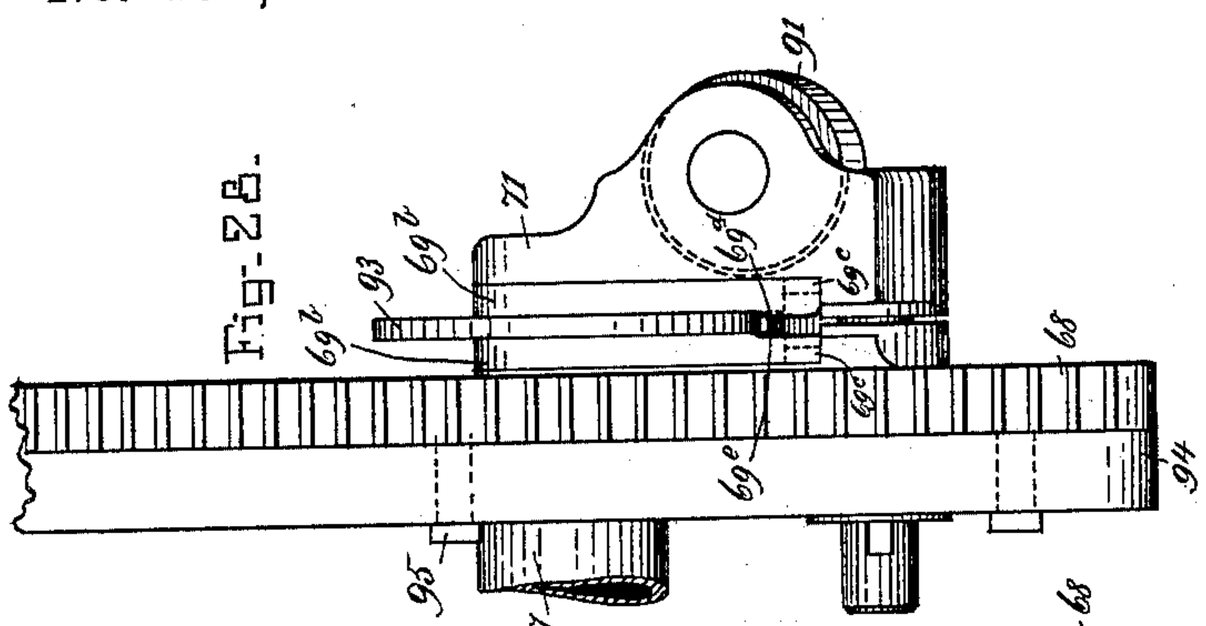
T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig. 28.



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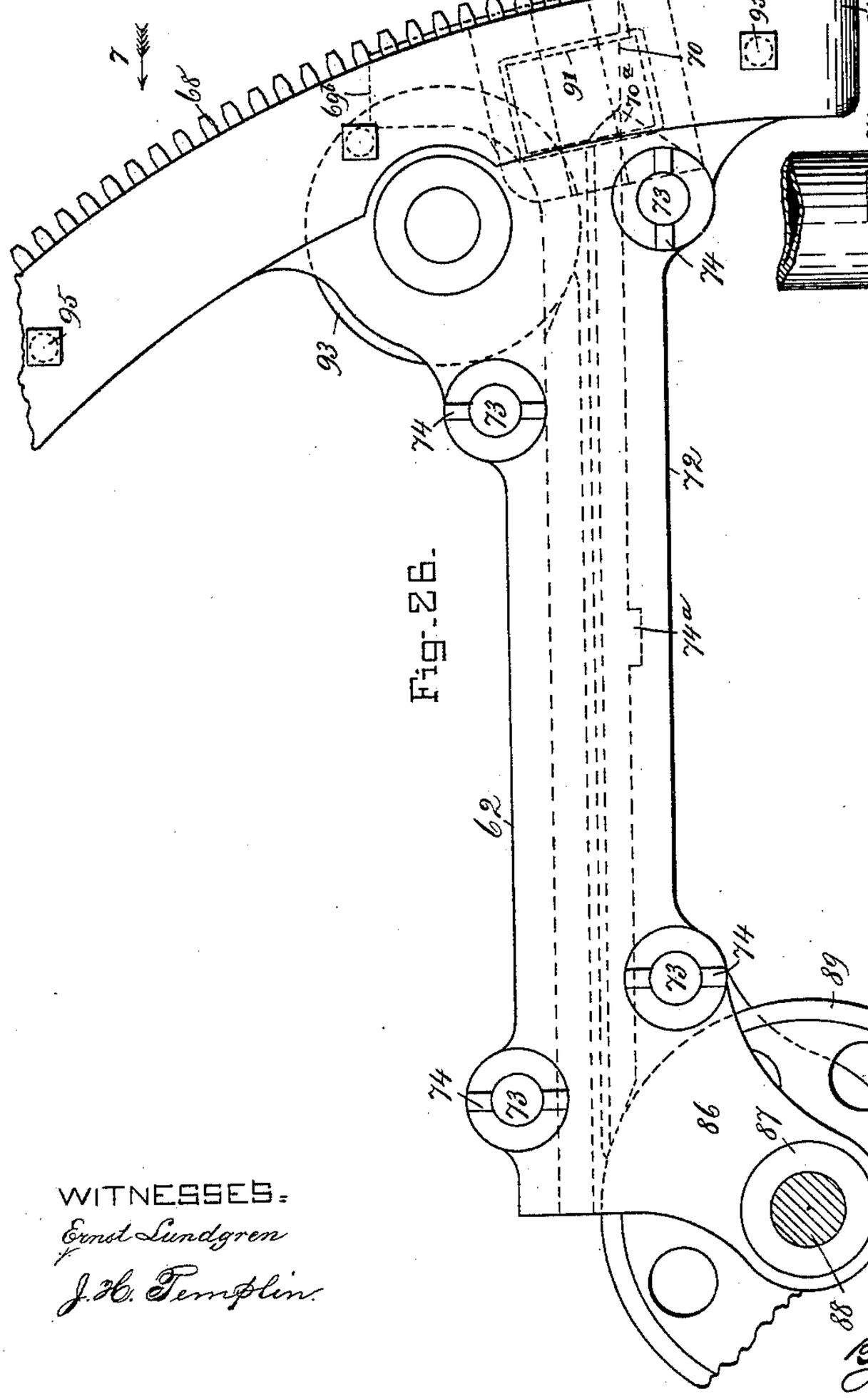

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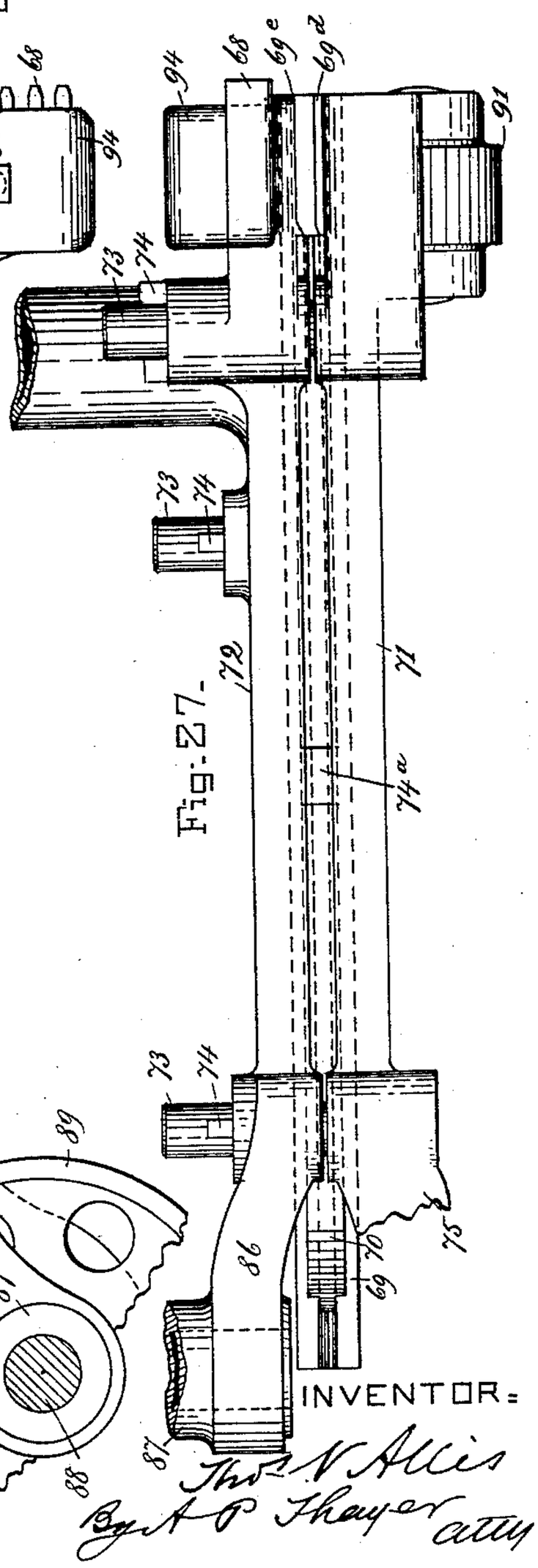


WITNESSES:
Ernst Lundgren
J. H. Templin

INVENTOR:
Thos. V. Allis
By A. P. Thayer atty

(No Model.) 20 Sheets—Sheet 15.

T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig-21.

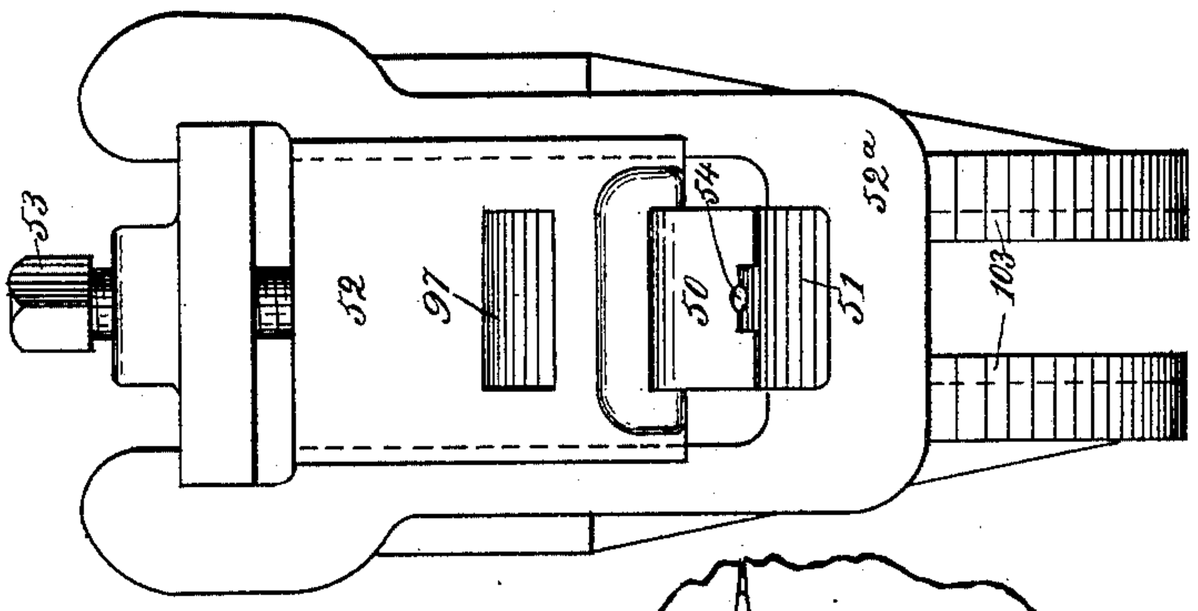
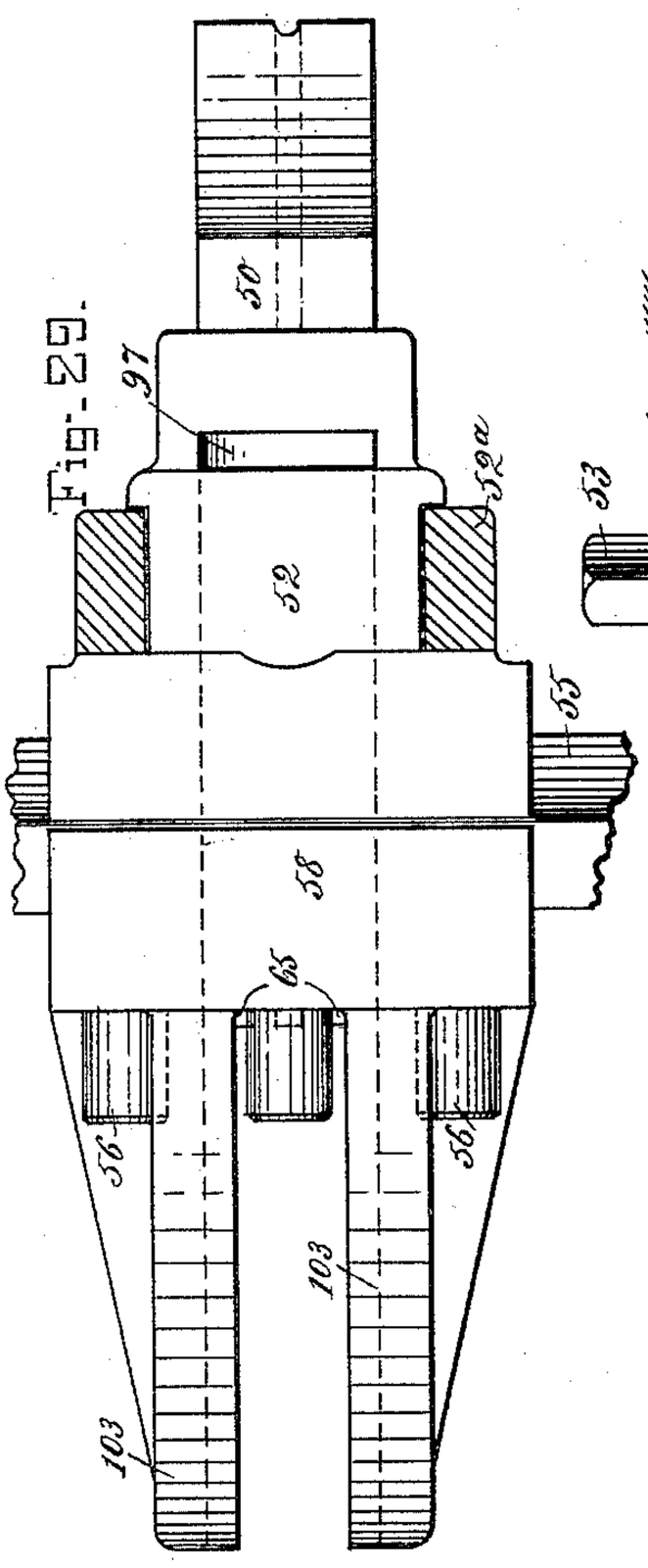


Fig-29.



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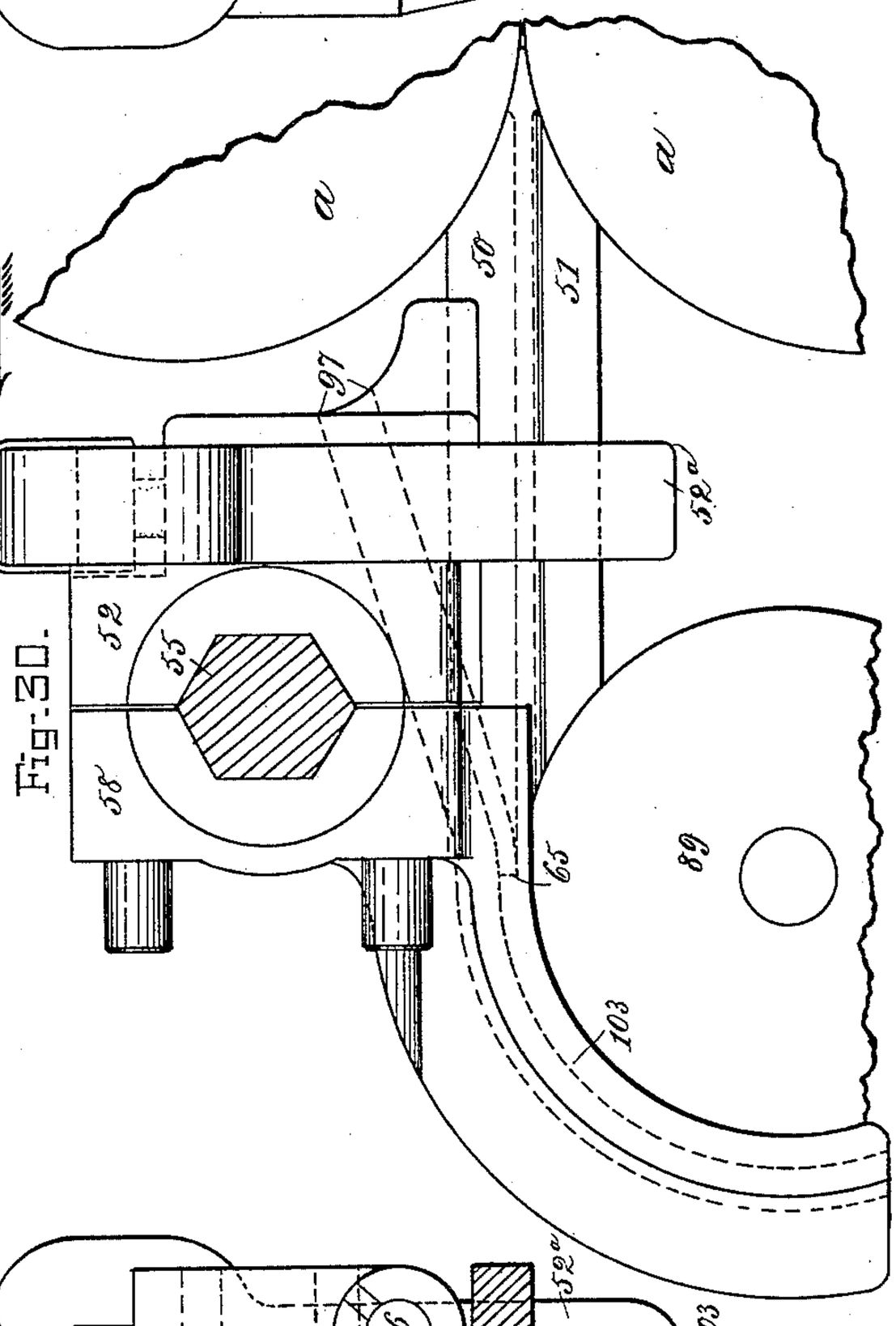
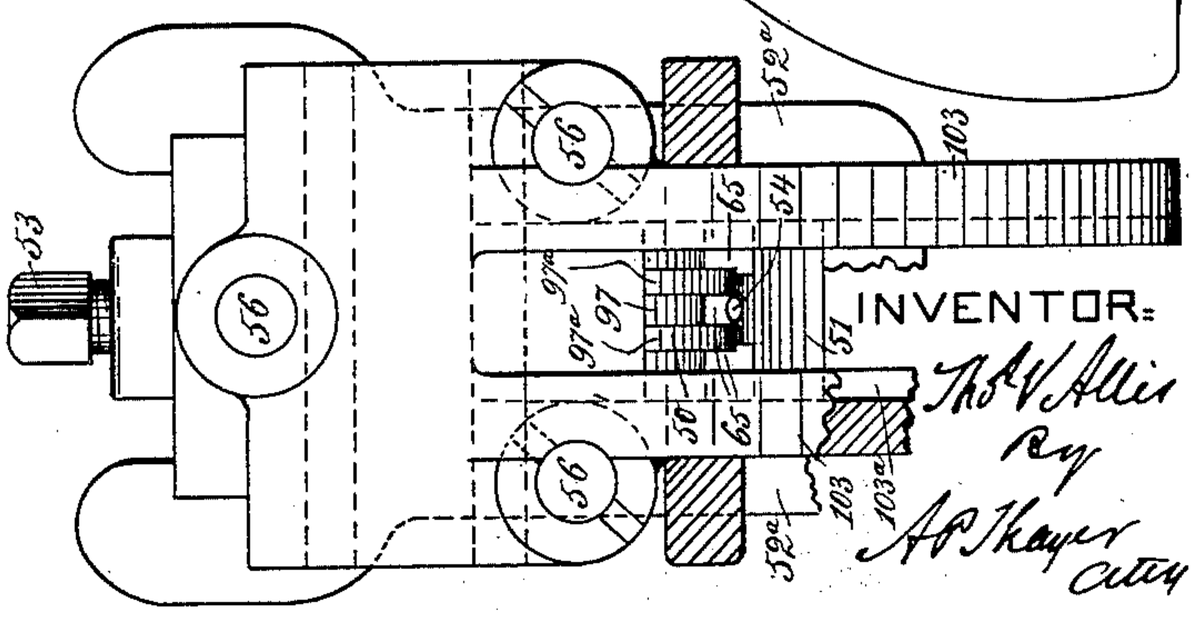


Fig-22.



WITNESSES:

Ernst Lundgren

J. H. Templin.

INVENTOR:

Thos V Allis

by

A. P. Thayer

Atty

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T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig. 33.

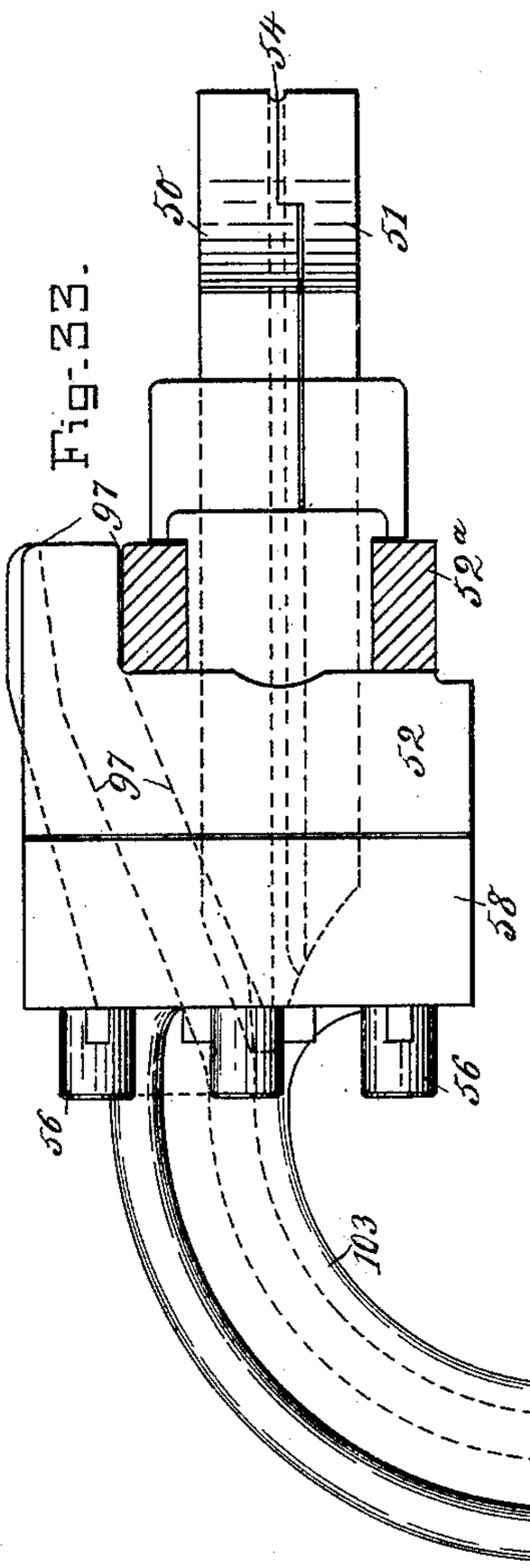
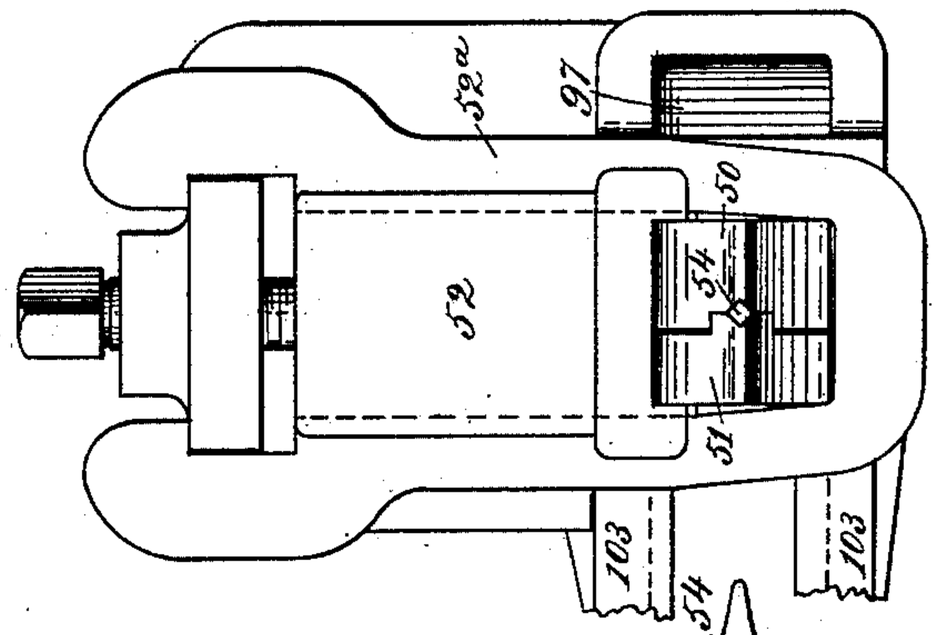


Fig. 35.



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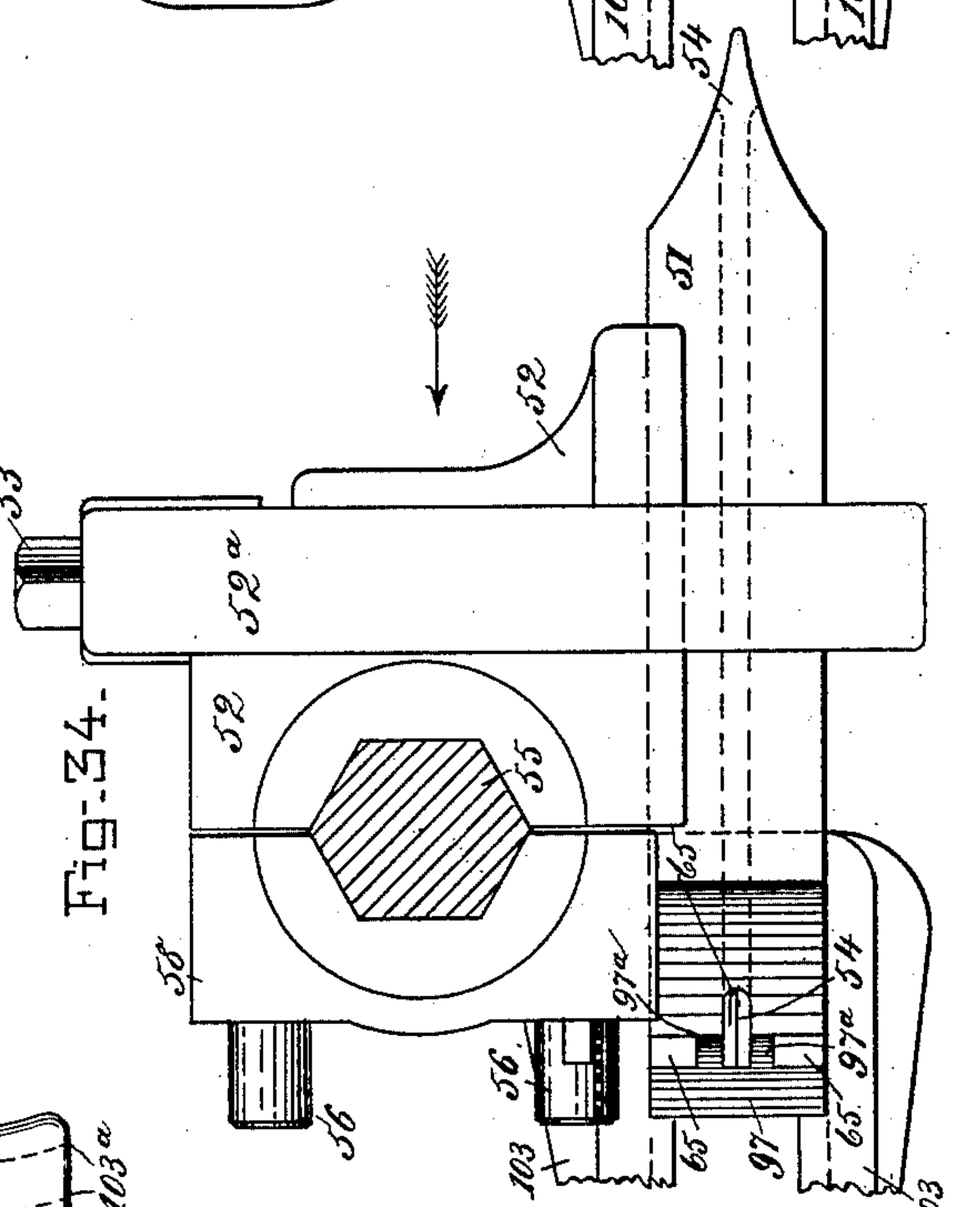
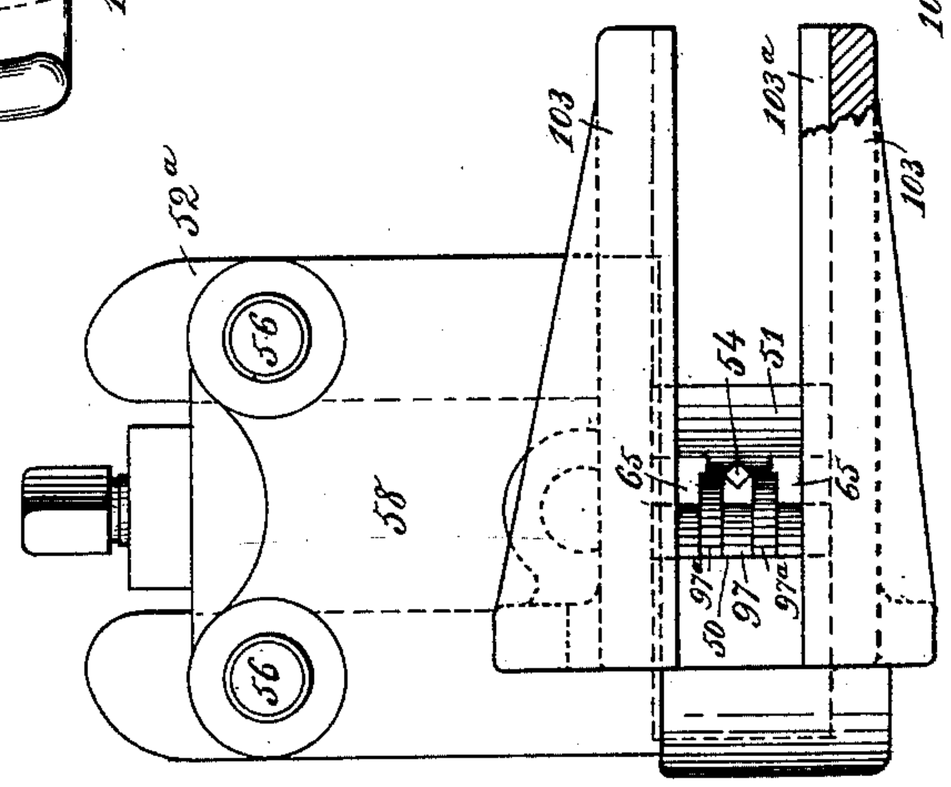


Fig. 36.



INVENTOR:
Thos V Allis.
By A P Thayer.
Atty.

WITNESSES:
Ernst Lundgren
J. H. Templin.

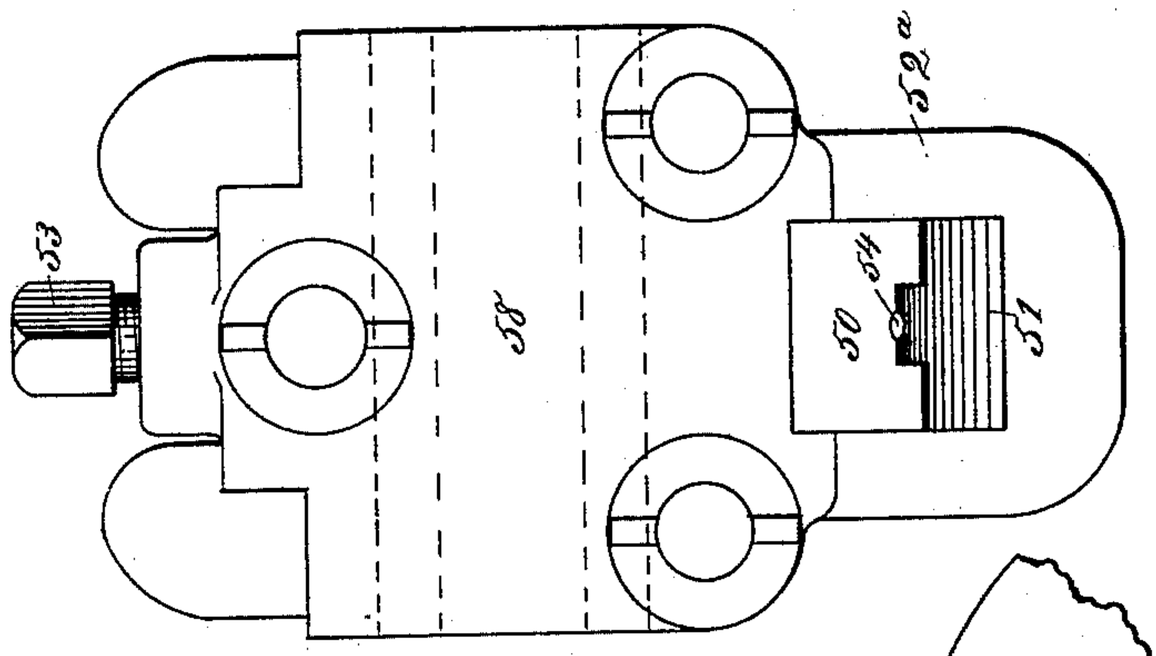
(No Model.) 20 Sheets—Sheet 17.

T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig. 29.



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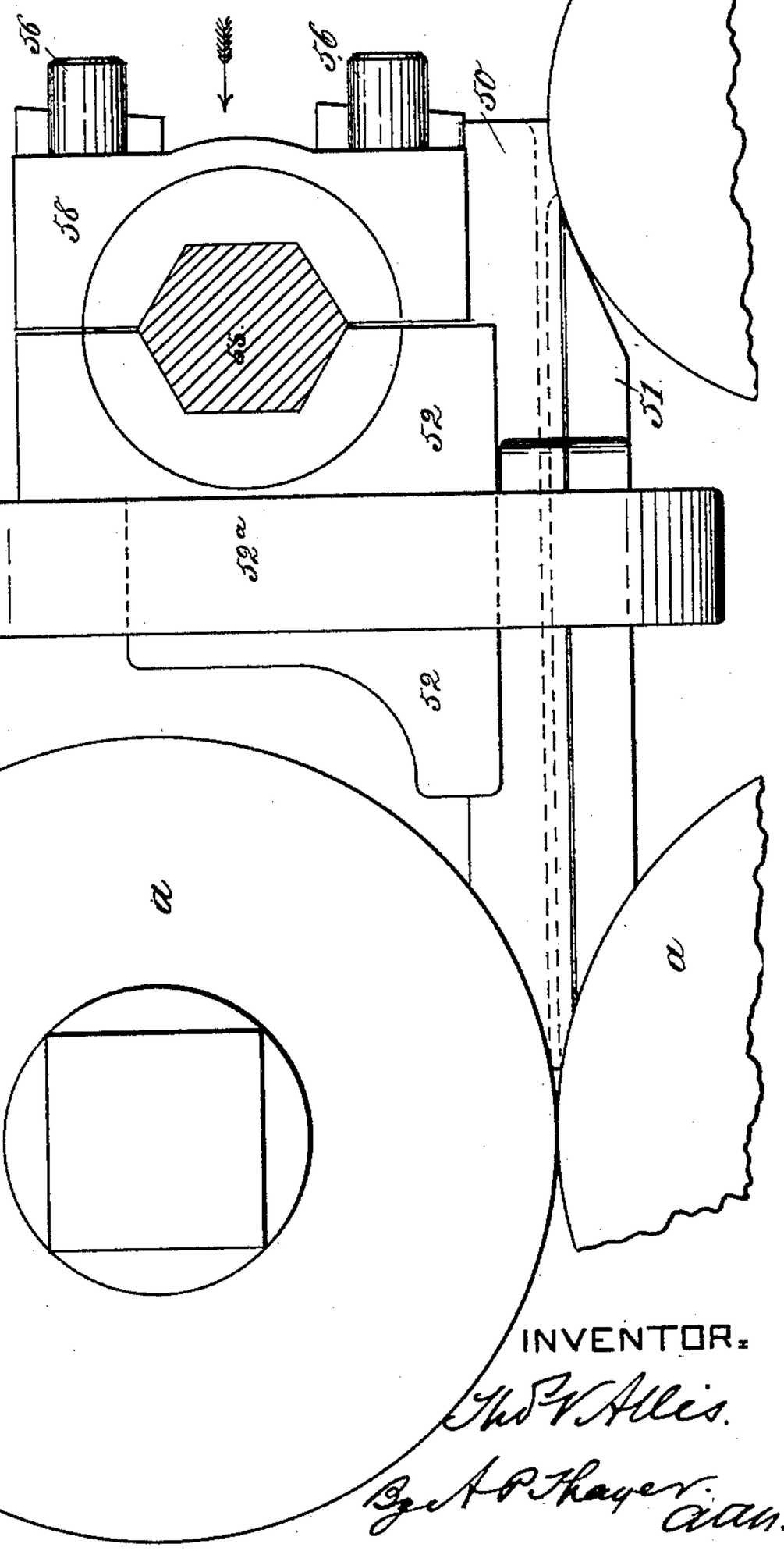

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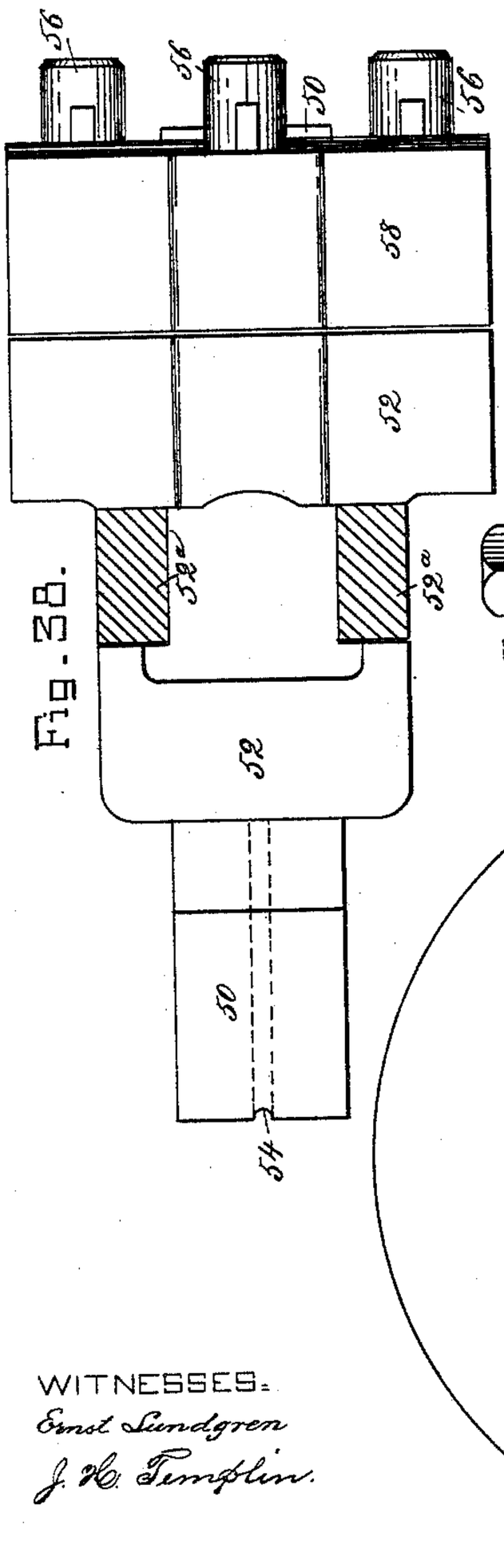


WITNESSES:
Ernst Lundgren
J. H. Templin.

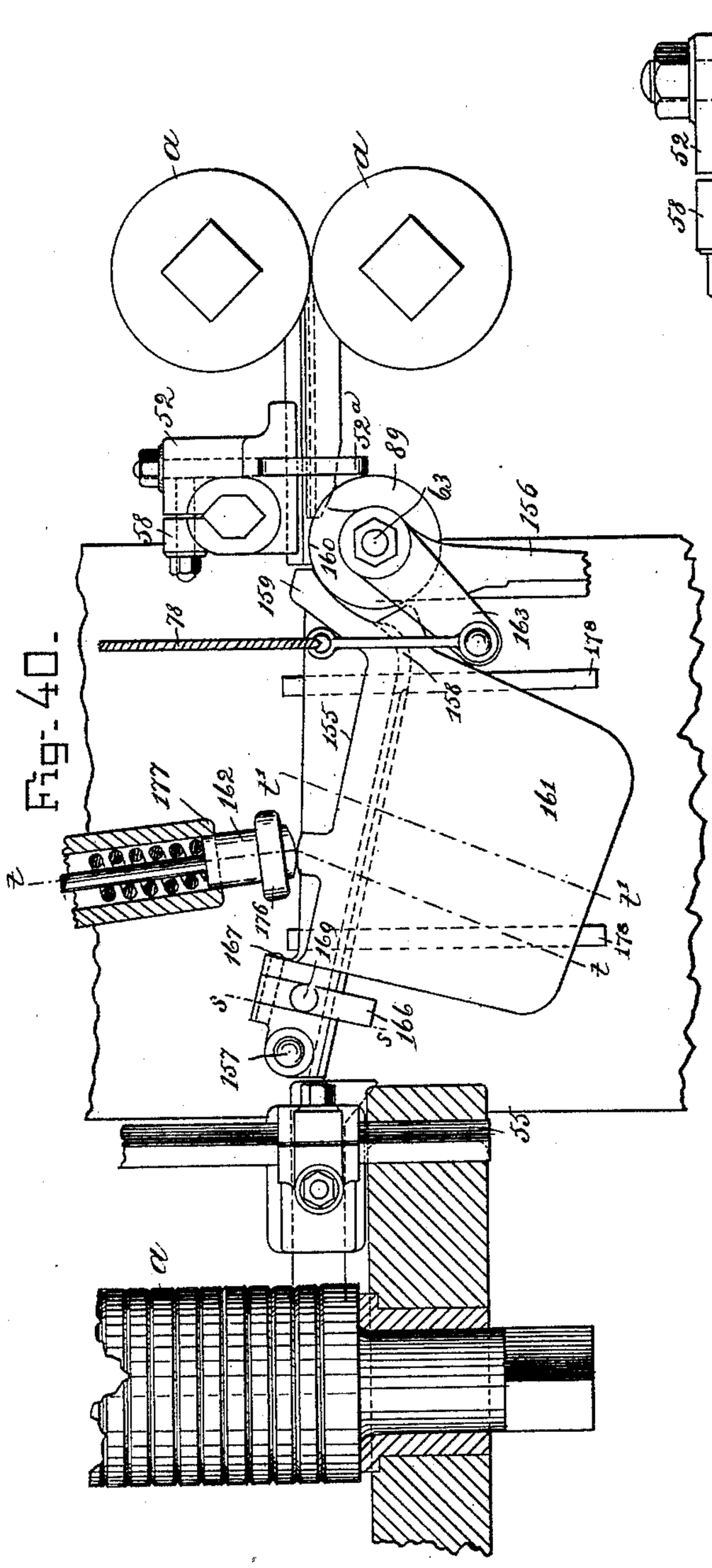
INVENTOR:
Thos V. Allis.
By A. P. Thayer & Son.

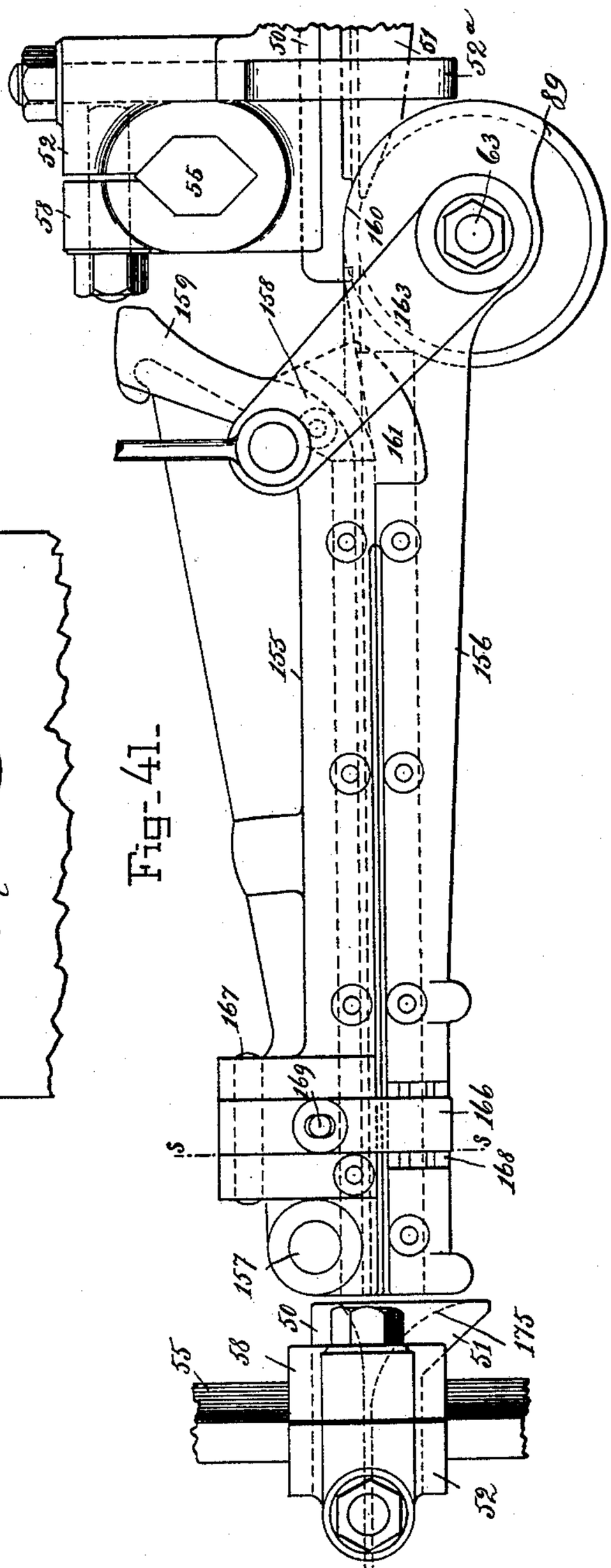
(No Model.) 20 Sheets—Sheet 18.

T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.





WITNESSES=

Ernst Lindgren

J. H. Templin.

INVENTOR=

Thos. V. Allis.

By A. P. Thayer.

atty.

(No Model.) 20 Sheets—Sheet 19.

T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig. 43.

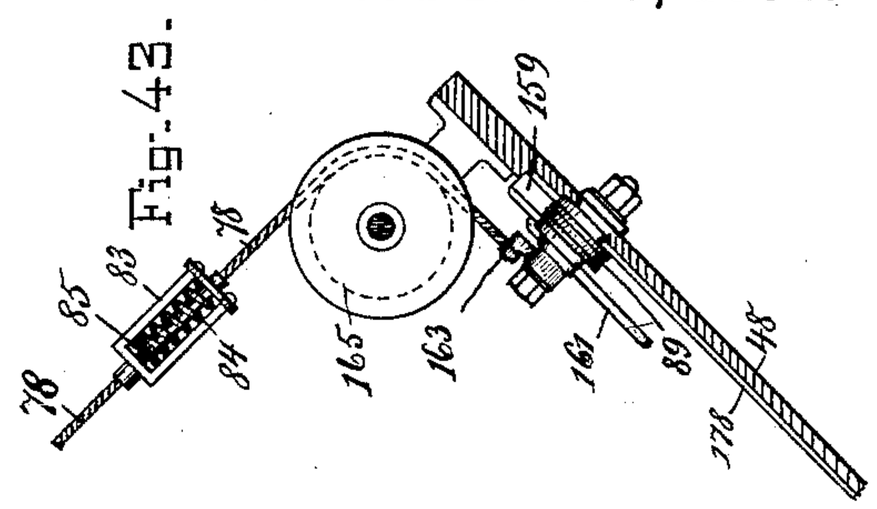
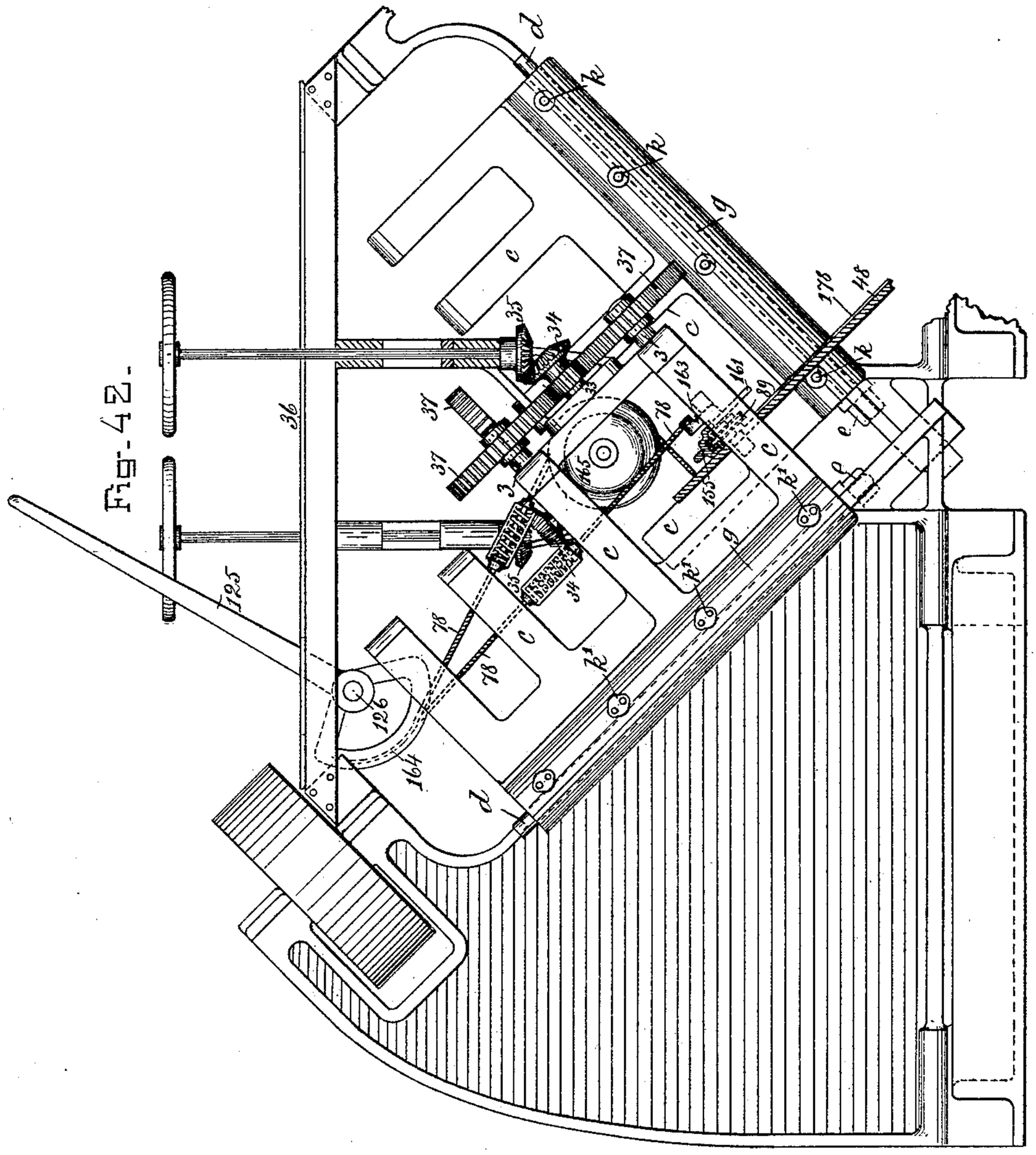


Fig. 42.



WITNESSES:
Ernst Lundgren
J. H. Templin.

INVENTOR:
Thos V Allis.
By A O Thayer.
Atty.

(No Model.) 20 Sheets—Sheet 20.

T. V. ALLIS.

ROLLING MILL FOR RODS OR WIRE.

No. 462,676. Patented Nov. 3, 1891.

Fig. 45.

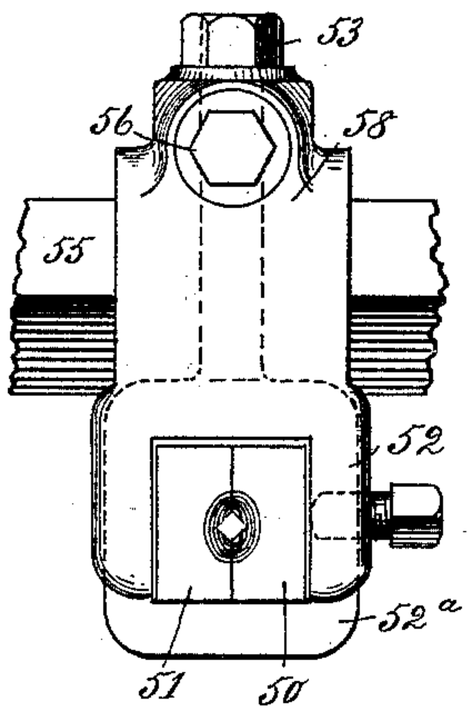
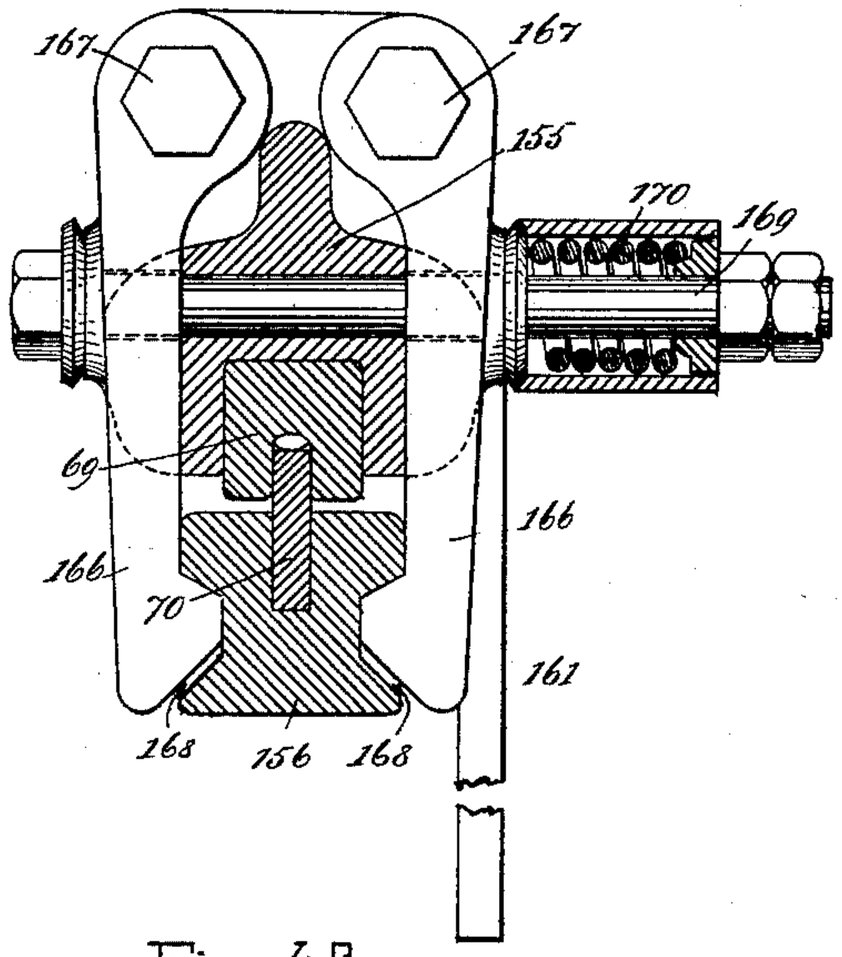


Fig. 44



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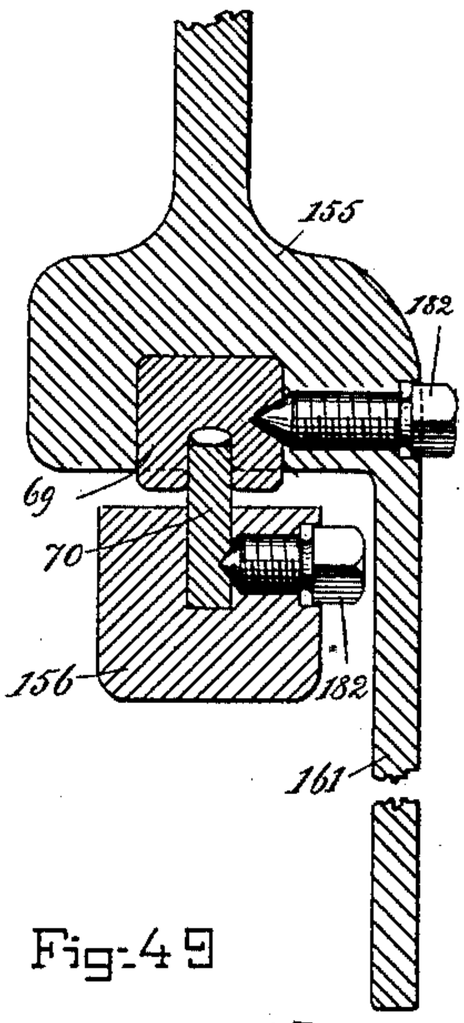

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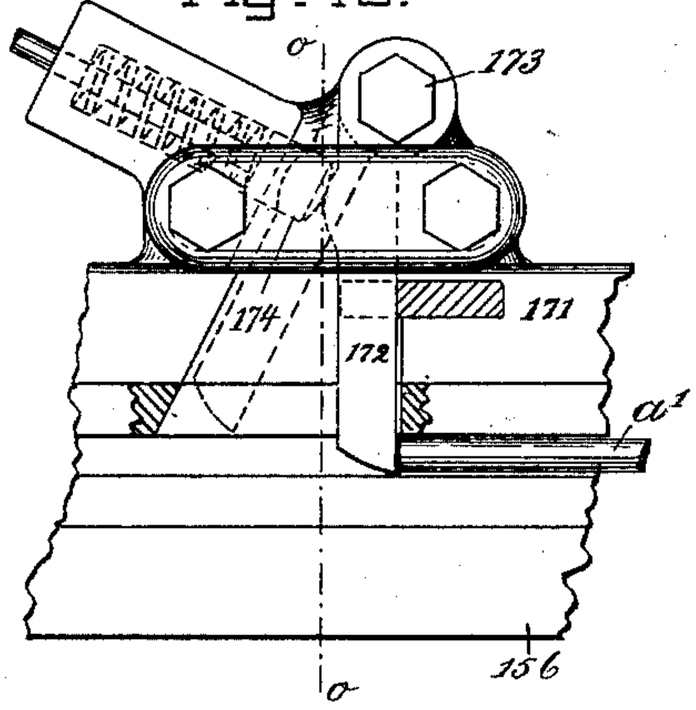


Fig. 49

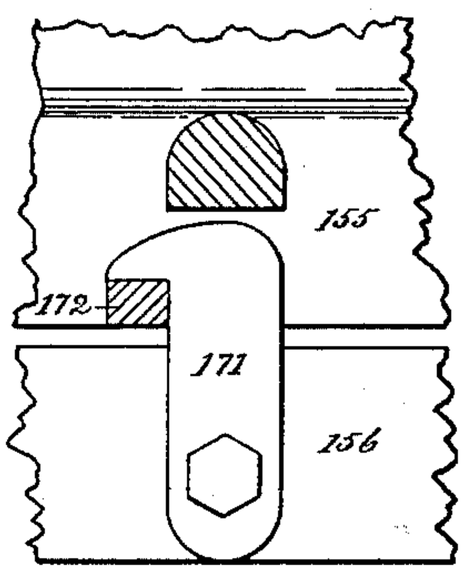
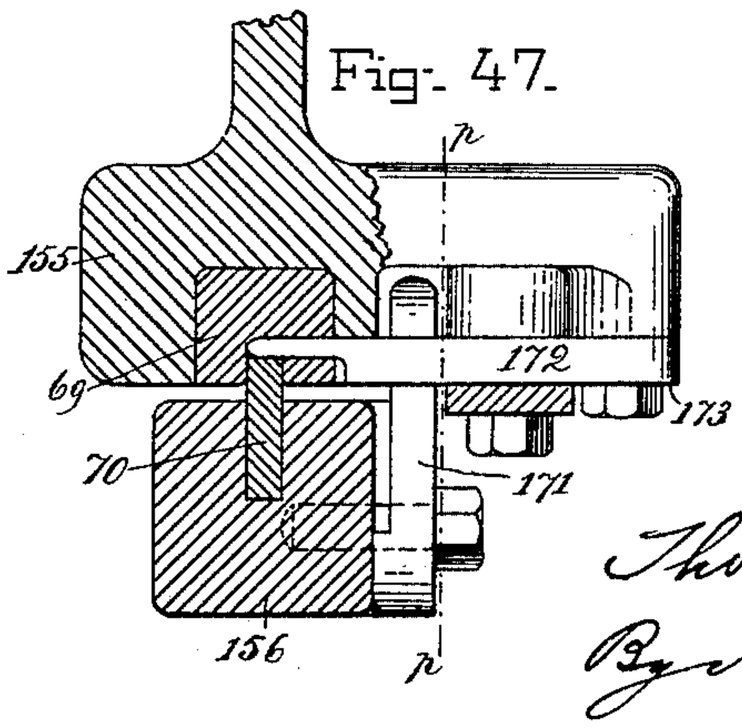


Fig. 47.



WITNESSES:

Ernst Lundgren

J. H. Templin.

INVENTOR:

Thos V Allis.

By A P Thayer.

atty.

UNITED STATES PATENT OFFICE.

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

ROLLING-MILL FOR RODS OR WIRE.

SPECIFICATION forming part of Letters Patent No. 462,676, dated November 3, 1891.

Application filed November 26, 1890. Serial No. 372,681. (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 Wire-Rolling Mills, of which the following is a specification.

This invention relates to rolling-mills for reducing wire rods and wire, the rolls being arranged in a continuous line or train for passing the material from one pair of rolls to another in the same line of feed for gradual reduction in a number of rolls, the successive pairs of rolls being placed in longitudinal planes at right angles to each other alternately at an angle of about forty-five degrees to the base, and so gaged for relative speed that each pair of rolls delivers the rod or wire slightly faster than the succeeding pair takes it up, and a variable loop-guide is employed between the pairs of rolls to compensate by its variations for the unequal giving and taking of the rolls, which cannot be perfectly regulated by the speed of the rolls.

The essential feature of the invention consists in improved contrivances of guides for conducting the rods or wires between the pairs of rolls, which guides direct the rods or wires in a straight line from pair to pair of rolls when entering in the beginning of the operation and while there is no excess of length between the pairs of rolls, and when such excess occurs to automatically deflect and loop the rod or wire in a lateral direction of greater or lesser extent, according as the excess demands, to keep the rod or wire taut and prevent stalling or kinking.

The invention also consists in further improvements in the construction, arrangements, and combinations of various other parts of the mill, all as hereinafter fully described and claimed, reference being made to the accompanying drawings, in which—

Figure 1 is an elevation of the mill as seen looking in the direction of the line of feed, with parts in transverse section on line *x x*, Fig. 2. Fig. 2 is a plan view showing two pairs of rolls, the rest of the train being omitted to avoid unnecessary repetition in the drawings. Fig. 3 is an end elevation in general outline, showing modified forms of gears for applying the driving power. Fig. 4 is an end elevation of the roll-housings on an enlarged scale, the cap for inclosing and protecting the lower journals of the rolls and also for supporting the lower end thrust-bearings and adjusting-screws being removed. Fig. 5 is an end elevation of roll-housings, same as Fig. 4, with the said cap for inclosing and protecting the lower journals of the rolls and supporting the end-thrust bearings applied and with the roll-housing supporting-base in transverse section on line *y y*, Figs. 1 and 3. Fig. 6 is a section of part of a roll-housing and part of a roll, and side view of part of another roll on line *z z*, Fig. 5, also on an enlarged scale. Fig. 7 is a section also, on line *z z*, Fig. 5, showing modifications of the roll-bearings and adjusting devices. Fig. 8 is a side elevation of guides employed between the pairs of rolls for directing the rods or wires both in the straight line and in the laterally-divergent course of the loops, with dotted lines indicating the operation of the guides in controlling the loops, said guides and one pair of rolls being represented in vertical elevation, with the housings of said rolls sectioned accordingly, and with the next succeeding pair of rolls in end elevation, the housings being omitted. Although these parts occupy oblique planes in the machine, they are thus shown in this figure, and, together with other devices, are correspondingly represented in other figures following, for simplifying the drawings. Fig. 9 is a plan view of the apparatus of Fig. 8 inverted, as indicated by the arrow of Fig. 8, the roll-housing of Fig. 8 being omitted, and a horizontal section of the housing omitted in that figure is shown in this. Fig. 10 is a side elevation of the guides and parts of tripping apparatus used therewith between the first and second pairs of rolls of the train for automatically tripping and releasing all the guides of the train from the catch, holding them up in the direct line of the feed prior to the forming of the loop by the effect of the lateral thrust of said loop, which forms between these rolls, said loop being a little in advance of the rest in forming. Fig. 11 represents side views of the liners as constructed for the first pair of loop-guides, detached, with the upper and lower parts of the liners separated from each other. Fig. 11ª is a plan view of one of the

upper liners. Fig. 12 is a side elevation, Fig. 13 an inverted plan, and Fig. 14 a section on line 1 1, Figs. 1 and 10, showing the tripping devices of Fig. 10 in detail and enlarged. Fig. 12 also shows some of the parts of the guides. Fig. 15 is an enlarged detail of the apparatus for holding the guides up in the right line of the feed, releasing them to control the loops, and returning them to and retaining them in the said right line, as seen in end view at the right hand of Fig. 1 and as indicated by the arrow 1, Fig. 2. Fig. 16 is a horizontal section of Fig. 15 on line 2 2. Fig. 17 is a side view of the swinging guide, to which the rods or wires enter from the rolls, on a larger scale, to show the construction more clearly. It also shows part of an extensible chain-guard to close the gap opened by the swinging guide. Fig. 17[a] is a plan view of the lower liner as made for all the guides except the first pair. Fig. 17[b] is a side elevation of the two liners as made for all of said guides except the first pair. Fig. 18 is an end elevation of the guide of Fig. 17, as seen looking in the direction of arrow 3 of Fig. 17. Fig. 19 is a plan of the same inverted. Fig. 20 is a transverse section on line *v v*, Figs. 17 and 19. Fig. 21 is an end view of said guide, as seen looking in the direction of arrow 2, Fig. 17. Fig. 22 is a detail of said guide in section on line *u u*, Fig. 21, showing provision for said chain-guard to guide the rod or wire along the gap which opens when the guideway swings downward with the loop. Fig. 23 is a horizontal section, Fig. 24 a side elevation, and Fig. 25 an end view, of said guard. Fig. 26 is a side view of the swinging guide, from which the rods or wires pass to the next pair of rolls. Fig. 27 is a plan view of the same inverted. Fig. 28 is an end elevation of the same, as seen looking in the direction of arrow 7. Fig. 29 is a plan view, with a part in section, of a stationary guide through which the rods or wires enter the swinging guide, as constructed when the crosswise direction of the rolls from which the rods enter said guide is parallel to the plane in which the guides swing. Fig. 30 is a side elevation of said guide and cross-section of the supporting-bar. Fig. 31 is an end elevation of said guide, as seen in the direction of the arrow, Fig. 30. Fig. 32 is an end elevation of the same, as seen in the reverse direction of said arrow. Fig. 33 is a plan view and section of the clamping-yoke of the stationary guide through which the rods or wires enter the swinging guide, as constructed when the lengthwise direction of the rolls from which the rods enter said guides is parallel to the plane in which the guides swing. Fig. 34 is a side elevation of the same and cross-section of the supporting-bar. Fig. 35 is an end elevation of the same, as seen looking in the direction of the arrow, Fig. 34. Fig. 36 is an end elevation of the same, as seen looking in the reverse direction of said arrow. Fig. 37 is a side elevation of the stationary guide through which the rods or wires pass to the next pair of rolls after leaving the swinging guide, and a cross-section of the supporting-bar. Fig. 38 is a plan view and section of the clamping-yoke of the same. Fig. 39 is an end elevation of the same as seen in the direction of the arrow at Fig. 37. Fig. 40 is a side elevation of a modified form of the swinging guide as when controlling a loop. It also shows the rolls from which the rods or wires pass into said swinging guide in cross-section; also, a side elevation of the stationary guide between said rolls and the swinging guide; also, a plan view of the stationary guide leading from the swinging guide to the next pair of rolls, and it also shows part of the latter rolls in plan view and section of part of the housing. Fig. 41 is a side elevation of substantially the same guides as in Fig. 40, but modified in one of the details, and on a larger scale and without the rolls. Fig. 42 is an end elevation of the machine in part and with a part in section, illustrating the application of the guides of Figs. 40 and 41. Fig. 43 is a detail, partly in section, further illustrating the application of the guides of Figs. 40 and 41. Fig. 44 is a transverse section of the guides of Figs. 40 and 41 on line *s s*. Fig. 45 is an end elevation of the stationary guide, as for the entry of the rods to the first pair of rolls. Fig. 46 is a transverse section of the guide of Fig. 40, line *t' t'*, as when the parts are closed up in the straight line of feed. Fig. 47 is a cross-section of the guide, as in Figs. 40 and 41, on line *o o*, Fig. 48, showing a modified form of devices for automatically releasing the guide from the devices, holding it up in the straight line, and allowing it to swing when the loop begins to form. Fig. 48 is a plan view of part of the upper portion of the guide inverted and showing the tripping devices of Fig. 47. Fig. 49 is a detail of Figs. 47 and 48 in section on line *p p*, Fig. 47. Fig. 50 is a diagram showing the different forms and relative arrangements of the successive pass-grooves. Fig. 51 represents face views of the coupling-driver of the roll-shafts.

The rolls *a* are arranged in successive pairs at a suitable distance apart, crossing each other in the feed-line at right angles and respectively in the opposite inclined planes of forty-five degrees to the base or thereabout, with the driving shafts and gears extended upward from the feed-line along said inclined planes, the rolls having a series of pass-grooves *b*, and are mounted in housings *c*, that are adjustable along the inclined base-supports *d*, on which they are mounted to shift the rolls from time to time to bring new passes into the feed-line as others are worn out, to avoid frequent removals of the rolls. The housings *c* are fitted with an adjusting-screw *e* in the nut *f*. Said nut has a bearing in the base, in which it is confined by collars for shifting the housings from time to time. For clamping said housings fast when adjusted I have provided the clamp-plates *g*,

having the bevel-faced flanges *h* along one edge, engaging in the correspondingly-shaped grooves *i* in the sides of the housing-bases, and other flanges *j*, engaging under the edges of the base-supports *d*, so that when screwed up by the clamping-bolts *k* said housings will be very securely fastened. The heads of these clamp-bolts are confined by the caps *k'*, against which they act, as at *l*. A simple means of slacking said plates is by a slight blow on the other end of the bolts, when the nuts are slacked thereat for loosening them when the housings are to be shifted. This is a simpler and more efficient fastening device than the holding-down bolts commonly used for such purposes. There are not so many to be unscrewed and screwed up when the housings are to be shifted. The lower rolls have their journal-bearings *m*, resting on the stationary wedges *n*, between which and other stationary wedges *o*, resting on the base of the housings *c* at the ends, are adjustable wedges *p*, having an adjusting-screw *q*, extending through them and to the sides of the housing, where they are fitted with heads *s*, by which they can be turned with a wrench for adjusting the wedges to set the said lower rolls to the proper height. The wedges *p* have a set-screw *t* in each to secure the adjusting-screws against turning by the jarring of the mill. The bearings *u* of the upper rolls are seated on the levers *v*, pivoted on one side of the housing at *w* and at the other side projecting outward a little beyond the side of the housing and suspended by the pivot *x* and bolt *y* from strong coiled springs *z*, seated on the projecting lugs 2 of the housings, to support said rolls, so that they will not settle down closer to the other rolls when the rods run out, and thus obstruct the entry of the ends of the new rods between them, there being a slight space between the rolls in the working condition. At the same time the springs permit the adjustment of the upper rolls by the screws 3.

The bearings *u* and the caps 4 are slotted at 5 to provide space for the supporting-lever *v*. I provide said caps 4 and also the caps 6 of the upper rolls with grease-pockets 7, opening outward at the outer sides of said caps and extending downward and communicating with cavities in the bearing-surfaces of said caps and the bearings also, as shown by the dotted lines 8 and 9, Fig. 4, in which suet and other like lubricant in solid and pasty condition may be packed from time to time for effective lubrication of the journals.

Owing to the inclined arrangement of the rolls, and also to adjust them lengthwise for insuring the matching of the pass-grooves properly, the end-thrust bearings 10 are provided for the lower ends, which bearings are supported on the ends of the adjusting-screws 11, and these screws are supported in the nut 12, located in the slots 13 of the bottom plate 14 of the box-cap, of which 15 represents the side, which is placed with the open end against the outside of the housing and secured thereto by the bolts 16, for supporting said screws and also for inclosing these and also other bearings for controlling the upper thrusts and protecting them from scale and the like. The nuts are adjustable in the slots 13 to shift as the rolls do, and they are secured against the thrusts of the screws by their flanges 18. The journals of the rolls are recessed at the ends for receiving the thrust-bearings 10, and said bearings project at the outer ends into oil-boxes 19, screwed at 20 onto the screws, so as to be set close against the ends of the journals to be supplied with a substance for lubricating the thrust-bearings.

To hold the rolls from lengthwise movement in the other direction, they are fitted with rings 21 on the ends projecting beyond the bearings and secured by set-screws 22 or other approved means, in which rings there are other set-screws 23, with suitable check-nuts 24, by which the thrust-bearing rings 25 are set against the bearings *m u* and caps 4 6 of the rolls, so as to effectually prevent lengthwise movement of the rolls in that direction.

To protect the journals of the lower ends of the rolls from scale and other matter liable to fall in between the ends of the rolls and the bearings and caps and thus work into the boxes, I have grooved these rolls in the lower ends, as shown at 29, and fitted to the groove in the rolls the sheet-metal plates 30, having the flange 31 bearing close against the housings and having the scroll-flange 32 of the inner edge fitting the groove so as to intercept such matters and drop them below the bearings. The adjusting-screws 3 for gaging the rolls are geared by the wheels 37 with the intermediate pinion 33, having the bevel-toothed face 34, with which a bevel-wheel 35 on the vertical shaft 36 is geared to adjust the rolls from the platform 36[a], suitably arranged above the rolls for enabling them to be adjusted, and also other controlling apparatus to be operated by an attendant thereon.

For gearing the rolls with the driving-engine, I prefer to employ a line-shaft 38, extending along each side of the frame from end to end, one for each range of rolls, and geared with each pair of the said range by the bevel-wheels 39, spur-wheel 40, and the pinion 41 on the shaft 42, coupled with the lower roll, said line-shafts being geared at one end with the main driving-shaft in any approved way; but the line-shafts may be located a little more distant from the shafts 42, as at the right hand of Fig. 3, and geared thereto by belts, as 43, or a single line-shaft, as 44, may be placed on overhead beams directly over the feed-line and geared with both ranges of rolls by like belts 43. The rolls of each pair are geared together, as usual, by the wheels 45; but instead of using the usual wabbler-coupling for connecting the rolls and driving-shafts for allowing the lateral shift of the rolls I have provided a coupling con-

sisting of the hubs 46 on the shafts to be coupled with an intermediate disk 47, connected to the hubs, respectively, by a transverse tongue or groove of one intermeshing with a corresponding tongue or groove of the other, the tongues or grooves of the disk being at right angles to each other and affording the universal lateral play, permitting the running of the two shafts out of line with each other, and being a simpler smoother running device than the wabbler-coupling, and it is also a shorter connection, which is important in a machine occupying so much space.

In my pending application for patents for improvements in machinery for rolling wires, Serial Nos. 320,966, 324,724, and 332,609, I have represented different forms of guides arranged between the pairs of rolls for directing the rods and controlling the loops, the rolls being arranged in opposite inclined planes alternately for being at right angles successively, and in the present case I also employ such guides; but these are essentially distinguished from those of the prior cases in that while normally extending along the feed-line they are arranged to swing in a plane of said feed-line in guiding the loops, and they are also distinguished from the guides of said prior cases in other respects, as will duly appear. In said cases Nos. 324,742 and 332,609 I have provided inclined guide-supporting tables between the pairs of rolls, said tables being reversely inclined alternately and corresponding with the reversely-inclined rolls; but in this case, in which I also employ inclined guide-supporting tables 48 between rolls similarly reversely inclined, said tables are preferably all inclined in one plane, which is advantageous in some respects in relation to the guides, one of which is that it enables them to be in one plane, which is preferable, as will appear further on; but I also show the tables inclined reversely in some modifications of the present case. The rod enters the first pair of rolls through a fixed guide, as at 49, Fig. 3, and as shown in a larger scale in Fig. 45, which I call the "entering-guide," and which is practically the same, except as to the form of the lower part of the receiving end, as is represented in advance of the rolls in several other figures, and as shown in large scale in Figs. 37, 38, and 39, said guide consisting of the bars 50 and 51, clamped together face to face, and also clamped to the guide-holding block 52 by the yoke 52^a and clamp-screw 53, said bars being suitably grooved in the faces clamped together to form the guideway 54 for the rods, and said guide-holding block being clamped to the supporting-bar 55 by the cap 58 and bolts 56, said supporting-bar being mounted in the lugs 57 of the roll-housings. The guide-holding block is thus clamped on the supporting-bar, so that the block may be readily shifted laterally along the bar to adjust the guide for alignment with the pass-grooves and the fixed guide on the other side of the rolls, through which the rods pass to the loop-guide, which said guide I call the "leaving-guide," and which consists, essentially, of two similar bars 50 and 51, similarly grooved for the guideway and clamped together by a similar yoke 52^a and clamp-screw 53, and also clamped thereby to a similar guide-holding block 52, which is likewise clamped by bolts 56 to a supporting-bar 55, mounted in lugs 57 of the housings. These two guides are both tapered on the ends entering the angle between the rolls, as seen in Fig. 9 and various other figures, to reach as close in the angles as possible.

All the rolls of one plane have oval grooves, as 59, Fig. 50, making the passes of elliptic shape, and the others have V-grooves, as 60, making square passes. The guideways are therefore made in elliptic and square form alternately in the same order. If the rod is square to begin with, the guideway of the first entering-guide will be square, as in Fig. 45; but the pass of the first pair of rolls will be elliptic, and that will be the form of the guideway through the leaving-guide, loop-guides, and entering-guide between the first pair of rolls, as represented in Figs. 31, 32, and 39, which show the form of leaving and entering guides adapted to be placed between the rolls having the angular positions of the first and second pair. The pass in the next pair of rolls will be square and the guideways between that and the following rolls will be square, as in Figs. 33, 34, 35, and 36, which show the form of leaving-guide adapted to be placed between the rolls having the angular positions of the second and third pair. In the elliptic passes the rods are shaped almost in the complete form of the passes, the edges being only slightly deficient, as indicated by the dotted lines in the elliptic pass 59 of Fig. 50; but in the square passes 60 they are either made square, or in case the spaces in the angles do not fill, particularly at the edges of the grooves, as shown by the dotted lines in the square pass, they are made practically oval in shape, the greatest diameter of which is in the same plane as the greatest diameter of the elliptic passes, suitably for being compressed flatwise therein, while the elliptic shapes are compressed edgewise in the square passes.

It will be seen that the shapes produced in the elliptic passes will only bend flatwise, practically, in the loops, by which the overfeed is taken care of between the pairs of rolls, and that if all the passes produced such shapes, said passes being in opposite planes alternately, the guides must swing alternately in the different planes of the short diameters of the rods, whereas the shapes produced in the square grooves having their longest diameter in the same plane as the longest diameter of the elliptic shape will likewise bend in the plane in which the elliptic shapes bend, and thus I am enabled to arrange my guides all in one plane, as before stated, which

greatly simplifies the construction and operation of the machine.

From the leaving-guide the rods enter the loop-guide and thence pass into the entering-guide of the next pair of rolls, and so on throughout the train. In the preferred form of this loop-guide it consists of two sections, as 61 and 62, arranged in pairs between each two pairs of rolls, the first section being pivoted at 63 and having its receiving end 64 abutting against the delivery end 65 of the leaving-guide when said loop-guide is in the right line of the feedway, and the second section being pivoted at 66 and having its delivery end abutting against the receiving end 67 of the entering-guide of the next pair of rolls when in the right line of the feedway, as best shown in Fig. 8, the other ends of said loop-guide sections meeting in the said feedline at the middle of the distance between their pivots. Said ends are geared together by the toothed sectors 68, so that as they swing on their pivots to control the loops they will work in unison, and one having the mechanism connected to it for returning it to the normal position preparatory to entering a new rod will return the other section likewise. These guides consist, essentially, of the hard liners 69 and 70, preferably tongued and grooved together and clamped between the suitably-grooved plates 71 and 72, as represented in Fig. 20, said plates 71 and 72 being fastened together by the studs 73 and keys 74. Hard liners are used for their greater capacity to resist the wear of the rods, and so as to be readily renewed when worn out. The part 69 of the liner is divided longitudinally to facilitate the placing of the parts in position in the grooved plates, by which they are clamped together. For example, one-half of said part 69 and the part 70 may be placed in the groove of plate 71 and the other half of part 69 in the groove of plate 72, and then plate 72, being placed on the studs 73, will close on the rest, so that taking the guide apart to renew the liners and putting it together again may be readily and easily accomplished. The liners are tongued and grooved and the guideway formed at the edge of the tongue and the bottom of the groove, because in such construction the wear at the sides of the guideway by the edges of the rods, which are very harsh, will be less than if the parting joint between the liners were coincident with the edges of the rod. The tongue-and-groove arrangement also serves a special purpose in a modified form of guide to be described further on. The liners have laterally-extended lugs, as 74^a, and the plates are correspondingly recessed in their grooves to receive said lugs for holding the liners securely against shifting lengthwise by the pull caused by the friction of the rods on them. The plates 71 of these loop-guides have the pivot-stud 63 firmly secured in the head of the lateral extension 75 of the end next to the fixed guide from or to which the rods run, which studs are supported in the sockets 76 of the table 48, one of said pivots of each pair of sections extending through said sockets and having the arm 77 suitably fitted on the projecting end to be employed for swinging the guides back to the right line of the feedway preparatory to inserting a new rod after the one before has passed through, the free end of said arm being connected to a rod 78, suspended from a rope 79, passing over a guide-pulley 80 to another pulley 81 on the shaft 82, which is caused at the proper time and by means that will be described further on to wind up the rope and swing the guides back into position for the new rod. The rod 78 is coupled to the rope 79 by the yoke 83, spring 84, and cap 85, forming a buffer to relieve the shocks when it may happen that the guides come to rest slightly before the pull on the rope ceases. The shaft 82 extends along the whole range of the train, and has a pulley 81 and rope 79 for each pair of loop-guides to return them all together and to hold them up in the right line of the feedway while the new rods are entering and until the loops begin to form. The plate 71 of each guide has a similar laterally-projecting arm 86, from which a socket 87 extends in the axial line of pivot 63, but in the opposite direction, for the support of a pivot 88, on which a guide-roll 89 for the rod is secured in the notch between the two arms 75 and 86, and so that the right line of the guideway is tangential to the periphery of said roll suitably for the rods to be carried on it when said rods are deflected from the right line in loops. The rods pass over one of the rolls of each pair of guides into said guides and over the other roll out of said guides. The rolls 89 are fastened to the projecting ends of the pivots 88 by keys 90, being applied thereto before the plates 71 and 72 are fastened together. The arm 75 of the plate 71 has a recess 91, providing space for the projecting end of the pivot 88 and the key 90. (See Fig. 19.) In the free ends of the swinging guides carrying-rolls 91^a are mounted to roll on the table 48 to relieve the pivots 63 of undue strain, and there is also an anti-friction-roll guide 93 for the rods in suitable relation to the guideway for delivering the thrusts of the guides on the rods to the best advantage for avoiding wear and friction.

To the toothed segments 68 curved plates 94, constituting weights, are attached by bolts 95 for weighting the guides to apply the proper stress to the rods for keeping the loops taut, the guides being so pivoted, as will be noticed, that they gravitate in their movements for controlling the loops. It will be seen that when the loop-guides swing out of the right line, as dotted in Fig. 8, for controlling the loop a gap opens between the abutting ends 64 and 65 of the stationary guides and said loop-guides. To prevent the rods from looping out of this gap, as they might in case the tension should be slack or in case of obstruction in the loop-

guides, I have provided the flexible chain-guard 96, attached at one end to end 64 of the loop-guide above the guideway for the rods and made to slide in and out of the chamber 97, provided for it in the block of the stationary leaving-guide, so that as the loop-guide swings downward and said gap opens said guard draws out in a suitable curve over and effectually prevents the escape of the rods from the gap. Owing to the pull of the rolls there is no such tendency of the rods to escape from the similar gap at the other end of the loop-guide, and it is therefore not provided with such a guard. This chain-guard is composed of suitable links 98 and pivots 99, and some of the links have the tapered extensions 100 on the side of the axis on which the chain curves when drawn out, which meet together at the edges in radial lines of said axis to hold the rod laterally and to prevent the chain from buckling and insure a true curved form for confining the rods in their proper course. At the entrance of the chamber 97 bar 50 has the channels 97 in the back, in which these extensions 100 slide.

The chain-guard is connected to the end of the upper guideway-liner at the receiving end of the loop-guide, which liner for a portion of its length from that end is preferably made separate from the rest, as shown by the line 101, Figs. 8 and 17, and is also preferably made somewhat narrower than the rest of the liner, as shown by the said parts represented in Figs. 22 and 23 and marked 69′. A hole is made through the liner close to the end, and the ends of the links of that end of the chain are connected therewith by their pivot 99, inserted in said hole, and the plates 71 and 72 are recessed at the ends coincidently with said hole to provide room for the ends of the links, as shown at 102, Figs. 21 and 22. This guard may be fastened to the stationary guide and the chamber for it may be in the swinging guide. To guide this flexible guard laterally, I have constructed the cap 58 of the leaving-guide block with two curved prongs 103, projecting in the same curve that the guard assumes when drawn out and on each side thereof, respectively, and having guide-grooves 103^a, in which the edges of the guard-chain run, said prongs being curved downward relatively to the block when the axis of the rolls from which the rods enter the swinging guides are at right angles to the plane in which the guide swings, as best shown in Figs. 29 to 32, and they are curved sidewise, as best shown in Figs. 33 to 36, when the rolls are parallel to said plane. The plates 71 and 72 are made considerably wider in the vicinity of these prongs than elsewhere, and the openings 104 are made through them for the prongs, which have to be so close together for so guiding the guard-chain that the limited thickness of metal remaining at 105 between the openings would not be sufficient for the requisite strength. By such wider construction the parts 105 are re-enforced by the parts 106 thus provided for outside of the prongs.

At the meeting ends of the two sections of the loop-guides the lower part 70 of the guideway-liners extend so as to meet together, or thereabout, and in the first pair of guides form a continuous lower wall of said guideway, except a very short gap, as shown in Figs. 11 and 12, along which the entering ends of the new rods pass in a direct course and from which in said first pair of guides the loops form upward at the beginning; but the upper walls terminate at 92 in all the loop-guides under the guide-rolls 93, Figs. 11^a and 12, in order that the loops may form over said rolls when the guides swing down in the loops, while the side walls are extended to the meeting point the same as the lower parts, and they are also extended upward, as at 69^b, for guiding the edges of the rods and sustaining the wear of the same as they are exposed thereto by the changing relations of the rods and the guides, due to the swinging of the guides and the looping of the rods over the rolls. This makes a gap in the upper side of the guideway from one to the other of the rolls 93, through which the entering ends of the new rods may in some cases shoot upward and escape or become stalled by striking against the roll 93 of the next guide, instead of entering the guideway below. To prevent such occurrence, I provide in all except the first pair of guides the stationary guide 107, in this space consisting of the end of a block fastened to the table and suitably shaped for said end to project into said gap and terminating in the plane of the upper walls of the guide, with the corner, under which the rods enter properly curved to direct the rods under it, and between all the loop-guides having these stationary guides to close said gap in the upper wall of the guideway I make the lower liners 70 to terminate at 70^a and shorten the lower wall of said guideway a suitable distance backward from the end, so that the loops forming between these loop-guides will be directed downward from the beginning, that being the way they are subsequently directed by the loop-guides. The purpose of having the loops first directed upward in the first pair of guides will be described further on. To prevent the entering ends of the rods from sagging in these gaps of the guideway too low for entering said guideway on the other side of the gap, and thereby being stalled, I have made the sides of the upper liner wider at the lower edge in advance of end 70^a, as shown at 69^c, and between these have provided a ledge 69^d on the lower part 69^c, along which the lower edge of the free end of the rod will have support, keeping it up in the line of the guideway, the guides, be it remembered, being in a plane of forty-five degrees, and in the opposite and upper part 69^c I have made a corresponding offset 69^e, as shown in the end view, Figs. 18 and 28, and plan views, Figs. 17^a, 19, and 27, which permits the loop to es-

cape over the ledge by a slight lateral movement, which results from the resistance that causes the loop to form. While I have represented the same ledge and offset in the receiving end of the next guide across the gap, it is not so essential and I do not limit myself to it.

For retaining the loop-guides in the right line of the feedway and holding them by the ropes 79, pulley 81, and shaft 82 until the loop forms, as before stated, and for automatically tripping and releasing them by the effect of the loop first forming between the first pair of rolls, the toothed wheel 108, having another toothed rim 109 on its hub, is fitted to turn loosely on the said shaft and is geared with the pinion 110, keyed to and always revolving with the driving-shaft 38. At one side of the hub of wheel 108 is a clutch-hub 111, which is also fitted loosely to the shaft 82. This hub has a socket 112 in the end opposite to the wheel 108, which fits over the hub 113, having the grooved pulley 114 outside of the end of the clutch-hub 111, said hub 113 and grooved pulley 114 being keyed fast to the shaft. In the face of hub 113, suitably recessed at 114, is a pawl 115, which is made to swing outward by the spring 116 and engage the clutch-hub 111 in its notch 116^a to connect said clutch-hub and the shaft 82 for turning the latter by wheel 108, when said clutch-hub is also clutched with said wheel, which is effected by the clutch-key 117, properly arranged in a slideway 118 of the hub and provided with the spring 119, which forces said key forward, so as to enter the socket 120 in the hub of the wheel whenever the tripping latch 121, pivoted at 122, is shifted out from between the head of the clutch-key and the collar 130 of the clutch-hub, so as to allow spring 119 to act. This latch has an arm 123, to the end of which one end of the rod 124 is pivoted, the other end of said rod being connected to the hand-lever 125, which is pivoted on the shaft 126, arranged above the platform 36^a, and extending the whole length of the train and having several such hand-levers at intervals along it for convenience of working the rod 124 to trip the latch 121 from any position of the attendant along the train when ready for shifting the guides into positions preparatory to entering a new rod. The shaft 82 being then set in motion so shifts the guides through the operations of the pulleys 81 and ropes 79.

The shaft 82 and pulleys 81 have to be unclutched and stopped at the moment the guides come to the right line of the feedway. A catch has then to fall in to hold up the guides until the loop begins to form between the first two pairs of rolls, and then the catch has to be tripped to allow the guides to swing out with and control the loop. For catching and holding up the guides the angle-lever 127 is arranged on the fixed pivot 128, in such relation to the clutch-hub 111 that its hook end gravitates into one or the other of the notches 129 in its periphery at the moment the loop-guides come to the line of the feedway and at the same time that the clutch-hub is disconnected from the wheel 108, which occurs when the shaft 82 has made one revolution, and is effected by the latch 121, which, after being lifted from between the head of clutch-key 117 and the collar 130 to clutch and start shaft 82, returns again to the same position immediately after the clutch has started, so that when the clutch-key comes around again the wedge-point of the latch again enters between said head and collar and again pulls out the key and stops the clutch-hub. Two notches 129 are provided in the periphery of the clutch-hub for the hook-head of the catch-lever 127, so that if the catch should not fall in quick enough to engage the first notch it will not fail of catching by the second notch. The spring-coupling by which the rope 79 is connected to arm 77 of the pivot-stem 63 of the loop-guide pulls up the guides all the same as if the hub were caught in the first notch. The shaft 82 is disengaged from the clutch-hub 111 for releasing the loop-guides and allowing them to swing in the loops of the rods by the cam 131, which thrusts the sliding pin 132 in a radial slideway of the clutch-hub 111 against the pawl 115, and lifts it out of notch 116^a of said hub by forcing the end 133 of the catch-lever 127 against the end of said pin, which is located in the part of the clutch-hub 111 that overlaps hub 113 and rests in range of said end of said lever when the clutch-hub is engaged with the hook end of said catch-lever. The shaft 82 is then free of the clutch and the loop-guides free to swing, and the weight 134, suspended from the grooved pulley 114, turns the shaft backward promptly to move the pawl 115 away from the notch 116, so that it will not fall in again when the end 133 of the catch-lever falls back on the cam. The clutch-hub is retained in the same position by the friction-brake 134 to prevent the key 117 from shifting away from latch 123 and clutching with the wheel 108, as it otherwise might be liable to do. The cam 131 is formed on the end of the clutch-hub 135, mounted on a short shaft 136, which is geared by the pinion 137 with the toothed rim 109 of the hub of wheel 108, and therefore rotates continuously. Said hub has a clutch-key 138, which is made to shift forward by a spring 139 and clutch said hub with said pinion by entering the notch 140 in the latter, when the head of the key is released from the latch 141 for rotating the cam to trip the pawl 115 and release the loop-guides. This latch is pivoted at 142 to a fixed support, and at 143 it is jointed to one end of the rod 144, which at its other end connects with the crank-pin of the crank 145, the shaft of which is geared by the bevel-wheels 146 with the short shaft 147, extending through the table 48 between the two first pairs of rolls and having the crank-arm 148 keyed fast to it. From the pin 149 in the free end of this crank-arm two

plates 150 are suspended between the faces of the guide-rolls 93 in the ends of the guides, with their lower ends terminating in the gap of the upper wall of the guideway between said rolls, to serve for preventing the ends of the rods from shooting upward, the same as the stationary guides 107 in the gaps of the rest of the loop-guides before described are provided for, and also for being thrust upward by the loop when it begins to form between said first pair of rolls to trip the guide-holding apparatus and release the guides for permitting them to swing out and control the loop, this being effected by the loop, which, being positively confined by the lower and side walls of the guides when beginning to form, is caused to bend upward against the ends of these plates, which, being arranged to be forced upward thereby, are so actuated, and by their movement actuate the crank 145 and rod 144, as to pull latch 141 out from the normal position between the head of clutch-key 138 and the collar 151, and thus permit the cam 131 to be clutched with its driving-pinion 137, which releases the loop-guides, as before described. The cam-hub is provided with a friction-brake 131^a to prevent it from overrunning when disconnected.

The rod 144 is fitted to the pin of crank 145 by a slotted hole 152, dotted in Fig. 1, allowing the crank to swing some distance before pulling out the latch, the purpose of which is to delay the tripping of the guides until the rod has entered between the rolls of the rest of the train, which is a little later between each successive pair. In this case two guide-plates 150 are employed instead of only one, as in the case of the stationary guides 107, to constitute an expanding and contracting device that will expand under the guide-rolls when down and will contract to pass up and down between the rolls. The outer edges are curved correspondingly with the faces of the rolls to permit the lower outer edges to reach under the rolls and thus more completely close the gap, which is important in consequence of the resistance which the guide imposes on the loops, which might otherwise buckle and clog in the short gaps between the guide and the guide-rolls if such gaps were left, as would be the case if a single plate only wide enough to rise and fall between the guide-rolls were used. The plates are made to overlap each other where they meet along the middle and are connected by inclined slots 153 with a guide-stud 154, projecting upward from the table 48, which expands them when shifted downward between the guide-rolls, and alone or together with the rolls contracts them when they rise up. These plates will gravitate to their normal position when the loop-guides are returned to the line of the feedway. The guide-rolls 93, striking on the projecting corners, will thrust them upward until they are closed by the guide-stud 154 sufficiently to drop between the rolls.

Instead of constructing the loop-guide in two sections, respectively pivoted near the opposite pairs of rolls and meeting at the middle of the distance between said rolls, as above described, the said guide may consist of upper and lower sections 155 and 156, respectively pivoted near the opposite pairs of rolls, but overlapping each other, and together forming the guideway the whole distance between the stationary guides when in the right line thereof. The lower section 156 is pivoted at 63 near the leaving-guide and below the feedway about the same, as is the first section 61 of the other arrangement; but the upper section 155 is pivoted at 157 above the guideway next to the entering-guide of the next pair of rolls. Section 156 swings downward away from the rods to make room for the loops, and section 155 swings down on and guides the loops which form downward over the guide-roll 89, being pressed downward by the curved breast 158 of the upper section 155, resting on the rods until the loops have acquired such development as that the prong 159 comes to rest on the cheeks 160 of the lower section 156, after which the loops, being thus properly directed in the course they should take, run freely between the table 48 and the apron 161 of the upper section of the guide, which is to prevent the loops from twisting or kinking outward sidewise, which apron may be of greater or lesser dimensions, as found needful and as indicated by their different dimensions in Figs. 40 and 41. A spring-actuated pusher 162 is represented in this example, instead of the weights of the other arrangement, as the means of applying the requisite downward stress on the rods for controlling the loops. The tension of the spring can be varied to regulate the force of the pusher. For returning the guide of this construction to the right line of the feedway there is a crank-arm 163, attached to the pivot 63 above the table in this instance, to which a rope 78 is attached, which, when the table is inclined, as in Fig. 42, extends directly to the sector-pulley 164 on the shaft 126 to raise the guides directly by hand instead of by the power apparatus of Figs. 1, 2, 15, and 16, as above described, for the loop-guide of the first arrangement. When the guide-table is inclined in the reverse direction, as in Fig. 43, the rope 78 will be extended around a guide-pulley 165 to the sector-pulley on the shaft 126. The part 156 of the guide being thus raised up for being returned to the right line of the feedway closes against the under side of the upper part 155 and raises it also, and when they reach the said line they become fastened together for being retained in that position and so as to be automatically unfastened again by the loop by the spring-actuated bevel hook-catches 166, pivoted to the upper section 155 at 167, which engage the lower section and secure it by the bevel-notches 168 in the sides of said lower part, said catches being coupled by the rod 169 and spring 170 so as to grip said lower part with sufficient power to hold

the two parts together prior to the forming of the loop, but so that when the loop begins to form, the downthrust on the lower part of the guide will force it away from the bevel hook-catches and permit the opening of the guides for the freedom of the loop. Another device for fastening these two parts of the guides and tripping them may consist of the catch-hook 171, rigidly fastened to the lower part, and the tripping-latch 172, pivoted at 173 of the upper part with a spring-pusher 174 behind it, the free end of said tripping latch extending into the guideway, so that the end of the rod a' will strike against the end tripping latch and push it out of its course, at the same time pushing it from under the hook of catch of 171, so as to release part 156 and let it fall. In this case the unlatching of the guide is effected by the end of the rod in advance of the forming of the loop and before the rod is entered between the next pair of rolls; but the rod runs so rapidly that it enters and is subject to the grip of said rolls before it becomes subject to the downward thrust of the upper part of the guide, and thus is not liable to any hinderance through the unlatching prior to the entry into the next rolls. The latch 172 remains thrust aside, as indicated in dotted line, Fig. 48, until the rod has passed, when it swings forward again, so that catch 171 locks on it when the guide is closed up. With this form of swinging guide the mouth of the entering guide to the next pair of rolls is flared deeply in the plane in which the guide swings, as shown at 175, for facilitating the return of the looped rods into the right line of the feedway by an easy curve without a guide-roll. The advantage of the tongue-and-groove arrangement of the guideway-liners in this form of guide is that the guideway does not open at the sides until the lower part has been forced away from the upper part so far that the catch-hooks have entirely escaped from the bevel notches by which they hold the lower part, as might otherwise be the case, so that the rods might be crowded out sidewise and caused to stall. In this case the liners are let into the grooved faces of the guides and fastened by set-screws 182.

Any suitable stop may be provided to stop the loop-guide in the line of the feedway when returned thereto—as, for example, the pusher 162 may serve therefor by its collar 176 being so adjusted on it that when it returns against the end of the spring holding-tube 177 the guide will be in its right position, said tube having a fixed support. An anti-friction roll may be fixed in the breast of the upper part 155 of this loop-guide, if desired.

For the loop-guide of Figs. 40 and 42 I represent the tables 48 as made with ribs 178, slightly raised above the surface of the table and faced true for slideways on which the guides swing, instead of being carried by the rolls 91^a provided for the other guides; but these guides may have rolls also, if preferred.

In Figs. 41, 42, and 45 I have represented the clamping-block 52 and cap 58 for holding the stationary guide as made in one piece with a slit through the top for springing them together by the fastening-bolt to secure them to the supporting-bar 55, and I represent the clamping-yoke in a slightly modified form; but the arrangement is substantially and practically the same as the other. At the side of each table 48 I have provided a pocket 179 to receive the droppings from the table and having a spout 180 for conducting them into the sewer 181. A weight 183 is suspended from each of the loop-guide-raising arms over the pulleys 80, to be used in case the loop-guides are too heavy, the weights 94 being removed, when reducing the wire to small sizes, for relieving it of too much strain. When not required they can be detached.

Although I have described and represented the guide-plates 150 employed for effecting the tripping of the loop-guides as placed between the first pair of loop-guides, it is manifest that they may be placed between such guides farther along in the train, and I do not limit myself in the location of the said guide-plates. They may be placed so far along the train that the slack-motion joint of the tripping devices for delaying the action of said tripping device will be unnecessary.

In my pending application, Serial No. 332,609, I have shown and claimed a laterally-reciprocating guide in combination with substantially the same contrivance of rolls, and for the like purposes of the guide claimed in this case; but the guide in this case is distinguished from the other in that it is pivoted and swings in a plane of the feed-line, as specified in the claims.

I am aware of the arrangement of one side of a fixed guide to be forced open by loops, as in the patent to Bansen, No. 113,708, and I make no claim to such device.

I am also aware that it is not new to employ horizontal tables on which the rods may be received and form loops between the successive pairs of rolls of a continuous train, as in the patent to McCallip, No. 277,044; but I have observed that the loops are apt to kink on tables so placed, and I have therefore provided the laterally-inclined tables as I have represented them, which effectually prevent the kinking, and my claim is limited to such arrangement.

I claim as my invention—

1. The combination, in a train of rolls for rolling wire rods or wire, of a pivoted loop-guide ranging in the line of the feedway between two pairs of rolls and swinging laterally in a plane of said feed-line to control the loops, substantially as described.

2. The combination, in a train of rolls for rolling wire rods or wire, of a pivoted loop-guide ranging in the line of the feedway between two pairs of rolls and swinging laterally in a plane of said feed-line to control the

loops, and a tripping-latch for holding said guide in the feed-line adapted to be detached by the rods or wires for the release of the guide, substantially as described.

3. The combination, in a train of rolls for rolling wire rods or wire, of a pivoted gravitating laterally-swinging loop-guide normally ranging in the feed-line between two pairs of rolls and swinging laterally to said feed-line to control the loops, substantially as described.

4. The combination, in a train of rolls for rolling wire rods or wire, of a pivoted laterally-swinging loop-guide normally ranging in the feed-line between two pairs of rolls and swinging laterally to said feed-line to control the loops, lever-actuated mechanism for returning the loop-guide to the feed-line, and an automatic catch device for securing the guide in said line, substantially as described.

5. The combination, in a train of rolls for rolling wire rods or wire, of a pivoted laterally-swinging loop-guide normally ranging in the feed-line between each two pairs of rolls and swinging laterally to said feed-line to control the loops, said pairs of rolls alternately arranged in oppositely-inclined planes, substantially as described.

6. The combination, in a train of rolls for rolling wire rods or wire, of a pivoted laterally-swinging loop-guide normally ranging in the feed-line between each two pairs of rolls and swinging laterally to said feed-line to control the loops, said pairs of rolls alternately arranged in oppositely-inclined planes, and said guides all arranged to swing in the same plane, substantially as described.

7. The combination, in a train of rolls for rolling wire rods or wire in which the successive pairs of rolls are alternately arranged in oppositely-inclined planes, of tables between the successive pairs of rolls, all arranged in one inclined plane parallel with one of the inclined planes of the rolls or thereabout, substantially as described.

8. The combination, in a train of rolls for rolling wire rods or wire in which the successive pairs of rolls are alternately arranged in oppositely-inclined planes, of inclined tables between the pairs of rolls and pivoted laterally-swinging loop-guides supported on said tables, substantially as described.

9. The combination, in a train of rolls for rolling wire rods or wire in which the successive pairs of rolls are alternately arranged in oppositely-inclined planes, of tables between the successive pairs of rolls, all arranged in an inclined plane parallel with one of the inclined planes of the rolls or thereabout, and pivoted laterally-swinging loop-guides between the rolls supported on said table, substantially as described.

10. The combination, in a train of rolls for rolling wire rods or wire, of swinging loop-guides between the successive pairs of rolls, consisting of two sections meeting together midway between the rolls or thereabout and pivoted at the opposite ends and swinging laterally from the line of the feedway in controlling the loops, substantially as described.

11. The combination, in a train of rolls for rolling wire rods or wire, of swinging loop-guides between the successive pairs of rolls, consisting of two sections meeting and geared together by toothed sectors midway between the rolls or thereabout and swinging laterally from the line of the feedway in controlling the loops, substantially as described.

12. The combination, in a train of rolls for rolling wire rods or wire, of laterally-swinging loop-guides between the successive pairs of rolls, a rotatory shaft extending along the train of rolls and connected to said guides for returning them to the line of the feedway and having rotation limited to the return of the guides to the line of the feedway, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

13. The combination, in a train of rolls for rolling wire rods or wire, of swinging loop-guides between the successive pairs of rolls, consisting of two sections meeting and geared together midway between the rolls or thereabout, a rotatory shaft extending along the train of rolls and connected to one each of said two sections of the guide for returning them to the line of the feedway and having rotation limited to the return of the guides to the said line of the feedway, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

14. The combination, in a train of rolls for rolling wire rods or wire, of laterally-swinging loop-guides between the successive pairs of rolls, a rotatory shaft extending along the train of rolls and connected to said guides for returning them to the line of the feedway and having rotation limited to the return of the guides to the said line of the feedway, and a clutch connecting said shaft with the driving-gear for rotating it, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

15. The combination, in a train of rolls for rolling wire rods or wire, of laterally-swinging loop-guides between the successive pairs of rolls, a rotating shaft connected to said guides for returning them to the line of the feedway, a clutch connecting said shaft with the driving-gear for rotating it, and a trip device automatically disconnecting said shaft and limiting its rotation to the return of the guides to the feedway, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

16. The combination, in a train of rolls for rolling wire rods or wire, of laterally-swinging loop-guides between the successive pairs of rolls, a rotating shaft connected to said guides for returning them to the line of the feedway, a clutch connecting said shaft with the driving-gear for rotating it, a trip device au-

tomatically disconnecting said shaft and limiting its rotation to the return of the guides to the line of the feedway, and a holding-catch automatically engaging and holding the guides in the said line of the feedway, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

17. The combination, in a train of rolls for rolling wire rods or wire, of laterally-swinging loop-guides between the successive pairs of rolls, a rotating shaft connected to said guides for returning them to the line of the feedway, a catch for holding them in said line, and a trip device for releasing said catch and permitting said guides to swing out and control the loops, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

18. The combination, in a train of rolls for rolling wire rods or wire, of laterally-swinging loop-guides between the successive pairs of rolls, a rotating shaft connected to said guides for returning them to the line of the feedway, a catch for holding them in said line, a trip device for releasing said catch and permitting said guides to swing out and control the loops, and a movable part of the guideway for the rod, subject to the thrust of the loop and connected with and effecting the action of the trip device for releasing the holding-catch, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

19. The combination, in a train of rolls for rolling wire rods or wire, of laterally-swinging loop-guides between the successive pairs of rolls, a rotating shaft connected to said guides for returning them to the line of the feedway, the continuously-rotating driving-wheel on said shaft, clutch-hub, clutch-key, and disconnecting-latch, the hub keyed fast to the shaft, pawl on said hub, and the elbow catch-lever, said clutch-hub having the notches for said pawl and elbow catch-lever, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

20. The combination, in a train of rolls for rolling wire rods or wire, of the laterally-swinging loop-guides between the successive pairs of rolls, a rotating shaft connected to said guides for returning them to the line of the feedway, the continuously-rotating driving-wheel on said shaft, clutch-hub, clutch-key, and disconnecting-latch, the hub keyed fast to the shaft, pawl in said hub, elbow catch-lever, tripping-pin for the pawl in said clutch-hub, cam for tripping said pawl and elbow catch-lever, and the clutch connecting said cam with the continuously-rotating driving-pinion, said clutch-hub having the notches for the pawl and elbow catch-lever, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

21. The combination, in a train of rolls for rolling wire rods or wire, of the laterally-swinging loop-guides between the successive pairs of rolls, a rotating shaft connected to said guides for returning them to the line of the feedway, the continuously-rotating driving-wheel on said shaft, clutch-hub, clutch-key, and disconnecting-latch, the hub keyed fast to the shaft, pawl in said hub, elbow catch-lever, tripping-pin for the pawl in said clutch-hub, cam for tripping said pawl and elbow catch-lever, clutch connecting said cam with the continuously-rotating driving-pinion, the latch for said clutch, said latch connected with the movable guide subject to the thrust of the loop, and said clutch-hub having the notches for the pawl and elbow catch-lever, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

22. The combination, in a train of rolls for rolling wire rods or wire, of the laterally-swinging loop-guides between the successive pairs of rolls, a rotating shaft connected to said guides for returning them to the line of feedway, the continuously-rotating driving-wheel on said shaft, clutch-hub, clutch-key, and disconnecting-latch, the hub keyed fast to the shaft, pawl in said hub, elbow catch-lever, tripping-pin for the pawl in said clutch-hub, cam for tripping said pawl and catch-lever, and the pulley and weighted cord connected to said hub keyed to the shaft, said clutch-hub having the notches for the pawl and catch-lever, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

23. The combination, with the shaft connected with the loop-guides for returning them to the line of the feedway, of the continuously-rotating driving-wheel on said shaft, clutch-hub, clutch-key, and latch, the hub keyed fast to the shaft, pawl in said hub, the elbow catch-lever, and the cam for tripping said pawl and catch-lever, said clutch-hub having the notches for the pawl and catch-lever, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

24. The combination, with the shaft connected with the loop-guides for returning them to the line of the feedway, of the continuously-rotating driving-wheel on said shaft, clutch-hub, clutch-key, and latch, the hub keyed fast to the shaft, pawl in said hub, the elbow catch-lever, cam for tripping the pawl and catch-lever, and the pulley and weighted cord connected to the hub keyed to the shaft, said clutch-hub having the notches for the pawl and catch-lever, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

25. The combination, in a train of rolls for rolling wire rods or wires, of the laterally-swinging loop-guides between the successive pairs of rolls, a rotating shaft connected to said guides for returning them to the line of the

feedway, the clutch-hub and driving-wheel on said shaft, and the elbow-lever for holding said shaft and guides, the tripping-cam and clutch for releasing the guides, and the movable part of the guideway for the rods connected with the tripping-cam-clutch-controlling rod and subject to the thrust of the loop, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

26. The combination, in a train of rolls for rolling wire rods or wires, of the laterally-swinging loop-guides between the successive pairs of rolls, a rotating shaft connected to said guides for returning them to the line of feedway, the clutch-hub and driving-wheel on said shaft, and the elbow-lever for holding said shaft and guides, the tripping-cam and clutch for releasing the guides, and the movable part of the guideway for the rods in one of the series of swinging guides and connected with the tripping-cam-clutch-controlling rod and subject to the thrust of the loop in said guide, said rod having the slack-motion joint with the crank-pin to delay the clutching of the tripping-cam while the entering rod reaches through the train and between the successive pairs of rolls, said shaft and guides being connected through the medium of intermediate mechanism, substantially as described.

27. The combination, with the swinging loop-guides having the gap in the guideway between the anti-friction rolls in their meeting ends, of the gap-closing plate or plates supported on the table and forming the upper wall of the guideway along the gap while the guides are in the right line of the feedway, substantially as described.

28. The combination, with the swinging loop-guides having the gap in the guideway between the anti-friction rolls in their meeting ends, of the expanding and contracting gap-closing plates adjustably supported on the table and adapted to contract for entering between the guide-rolls and to expand after entering, substantially as described.

29. The combination, with the swinging loop-guides having the gap in the guideway between the anti-friction rolls in their meeting ends, of the expanding and contracting gap-closing plates suspended by the vertically-shifting arm and connected to the guide-stud by the inclined slots for effecting their expansion and contraction, substantially as described.

30. The combination, in the swinging loop-guides, of the liners having the guideway formed between them and side plates clamped together with the liners between them, said plates grooved inside to confine the liners laterally and also notched, and the liners having the lugs fitting said notches to confine the liners lengthwise, substantially as described.

31. The combination, in the swinging loop-guides, of the liners tongued and grooved together and having the guideway formed between the edge of the tongue and the bottom of the groove and the side plates clamped together with the liners between them, said plates grooved inside to confine the liners laterally and also notched, and the liners having the lugs fitting said notches to confine the liners lengthwise, substantially as described.

32. The combination, in the swinging loop-guides, of the liners having the guideway formed between them and the grooved side plates clamped together with the liners between them, and one of the plates of each guide having the toothed sector at the free end meshing with the corresponding sector of the other guide, said guides being pivoted at the opposite ends to swing laterally in a plane of the right line of the feedway, substantially as described.

33. The combination, in the swinging loop-guides, of the liners having the guideway formed between them and the grooved side plates clamped together with the liners between them, a guide-roll between said plates at the pivoted end and in the plane of the guideway, and a guide-roll between said plates at the free ends and also in a plane of the guideway, said guide-rolls being respectively on opposite sides of the guideway, substantially as described.

34. The combination, in the swinging loop-guides, of the liners having the guideway formed between them and the grooved side plates clamped together with the liners between them, the lower liners extended to meet the corresponding liners of the other guide of the pair, the upper liners having the gap for the guide-roll, and the sides extended to the meeting point and also extended laterally along the sides of the guide-roll, substantially as described.

35. In the loop-guides arranged to swing laterally to the line of the feedway and having the gap in the lower liner of the guideway for the downwardly-forming loops, the guide-ledge on the lower side plate for guiding the entering ends of the rods across the gap, and the corresponding offset in the other side plate, permitting the escape of the loops over said ledge, substantially as described.

36. The swinging loop-guides pivoted to the supporting-table by the laterally-extended terminal arm of one of the side plates and the guide-roll of the receiving end of the guide pivoted in the corresponding arm of the other side plate and in the axis of the supporting-pivot, said arms being forked to provide suitable intermediate space for said guide-roll, substantially as described.

37. The guide-roll in the forks of the receiving end of the swinging loop-guide secured to one arm of the fork by the outwardly-projecting socket thereof, the pivot inserted through the socket and receiving the roll and a fastening-key on the end projecting into the space between the forks, the other fork having the supporting-pivot for the guide, substantially as described.

38. The combination, with the leaving-guide

and the receiving end of the swinging loop-guide, of the extensible flexible guard over the gap opened by the loop-guide, said guard attached at one end to one of the said guides and at the other end entering the socket of the other guide, substantially as described.

39. The combination, with the leaving-guide and the receiving end of the loop-guide, of the extensible flexible guard over the gap opened by the loop-guide and the curved prongs of the leaving-guide, said prongs forming side guides for the rods and the flexible guard, substantially as described.

40. The combination, with the leaving-guide and the receiving end of the loop-guide, of the extensible flexible guard over the gap opened by the loop-guide and the curved prongs of the leaving-guides to control the sides of the flexible guard, the side plates of the loop-guides having the lateral re-enforcing extensions around the guards outside, substantially as described.

41. The combination, with the leaving-guide and the receiving end of the loop-guide, of the extensible flexible guard over the gap opened by the loop-guide, said guard having the tapered flanges on the inside to control the curve of the rod and guide it laterally, said guard being attached at one end to one of said guides and the other end extending into the socket of the other guide, substantially as described.

42. The combination, with the leaving-guide, the receiving end of the loop-guide, and the upper liner of the loop-guide, of the extensible flexible guard over the gap opened by the loop-guide, said guide attached at one end to said liner and extending at the other end into the socket of the leaving-guide, substantially as described.

43. The combination, with the rolls, of the stationary guides consisting of two bars having the guideway formed in the sides clamped together, the clamping-block, clamping-yoke, and screw, and the cap and bolts clamping the said block to the supporting-bar, substantially as described.

44. The combination, with the roll-housing supports of the base-plate and with said roll-housings having the bevel-grooves along the sides of their base, of the clamping-plates hooking under the edges of the base-plate and into the grooves, and the clamping-bolts extending through said clamping-plates and roll-housing base, substantially as described.

45. The combination, with the roll-housings and lower roll-bearings, of the wedge resting on the base of the housing, the wedge on the under side of the roll-bearing, the intermediate wedge, and the adjusting-screw extending through the intermediate wedge and the housings and having heads for turning it and confining it against lengthwise motion, substantially as described.

46. The lower bearings of the upper rolls, seated on the levers having a fulcrum on one side of the housing-frame and suspended at the other side of the said frame from the supporting-springs to prevent dropping of the rolls when the rods run out, substantially as described.

47. The lower bearings of the upper roll, seated on the levers having the fulcrum at one side of the housing-frame and suspended at the other side of the said frame from the supporting-springs seated on the projecting lugs of the frame, the said lower bearings of the upper roll and the upper bearings of the lower roll being slotted to provide room for said levers, substantially as described.

48. The upper side of the roll-bearings having the grease-pockets extending from the top to and opening into recesses in the sides of the bearings, substantially as described.

49. The combination, with the rolls, of the end-thrust bearings against the ends of the rolls, adjusting-screws supporting said bearings, and the cap supporting the adjusting-screws and attached to the roll-housings, said screws laterally adjustable in said cap correspondingly with the laterally-adjustable rolls, substantially as described.

50. The combination, with the rolls, of the end-thrust bearings fitted in the recesses in the ends of the rolls, adjusting-screws supporting the said bearings, the cap supporting the adjusting-screws and attached to the housings, said screws laterally adjustable in said cap corresponding with the laterally-adjustable rolls, substantially as described.

51. The combination, with the rolls, of the thrust-bearings against the ends of the rolls, the adjusting-screw supporting the thrust-bearings and having suitable support, the collars on the ends of the journals, thrust-rings bearing against the ends of the journal-boxes, and the adjusting-screws connecting said collar and thrust-rings, substantially as described.

52. The combination of the oil-boxes with the thrust-bearings against the ends of the rolls and the adjusting-screws supporting said thrust-bearings and boxes, substantially as described.

53. The combination, with the lower journals of the inclined rolls, thrust-bearings, and adjusting-screws, of the cap attached to the housings and inclosing said journals and thrust-bearings, substantially as described.

54. The combination, with the lower journals of the inclined rolls, thrust-bearings, and adjusting-screws, of the cap attached to the housings and inclosing said journals and thrust-bearings, said adjusting-screws fitted in the cap for their support, substantially as described.

55. The combination, with the rolls having an annular groove in the lower end, of the sheet-metal scale-guards surrounding the journals and having the scroll-flanges fitting the grooves and bearing at the outer edges against the side of the housing to exclude scale and dirt, substantially as described.

56. In a train of rolls having inclined tables

between the pairs of rolls, a pocket combined with each and arranged to receive the droppings therefrom and having a spout discharging said droppings into a sewer below.

57. The combination, with a continuous train of rolls arranged alternately in oppositely-inclined planes, the apex of which is downward, and the driving-gears are above the rolls, of the platform located over the rolls, and the hand-wheels for working the roll-adjusting screws mounted thereon and geared with the said adjusting-screws, substantially as described.

58. The combination, with a continuous train of rolls arranged alternately in oppositely-inclined planes, the apex of which is downward, and the driving-gears are above the rolls, of the platform located over the rolls, the swinging loop-guides, the mechanism for returning said guides to the feed-line, clutch for engaging said mechanism with the driving-shaft, and the lever for working said clutch mounted on said platform and suitably connected therewith, substantially as described.

59. In a continuous train of rolls arranged on a base which is vertically inclined laterally to the lengthwise direction of the train, with the rolls proper located at the lower side of the base, and having the driving power applied at the upper side of said base, the combination, with the rolls of the main driving-shaft located under said bed-frame and ranging longitudinally thereof, of the counter-shaft below and parallel with the roll-shaft of each pair of rolls and gearing with said main shaft by the bevel-wheels, and the spur-wheel and pinion gearing said counter-shaft and roll-shafts at the upper side of the bed-frame and above the 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 25th day of November, 1890.

THOMAS V. ALLIS.

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