(No Model.) 4 Sheets—Sheet 1.

T. V. ALLIS.

MACHINE FOR ROLLING WIRE RODS OR STRIPS.

No. 463,697. Patented Nov. 24, 1891.

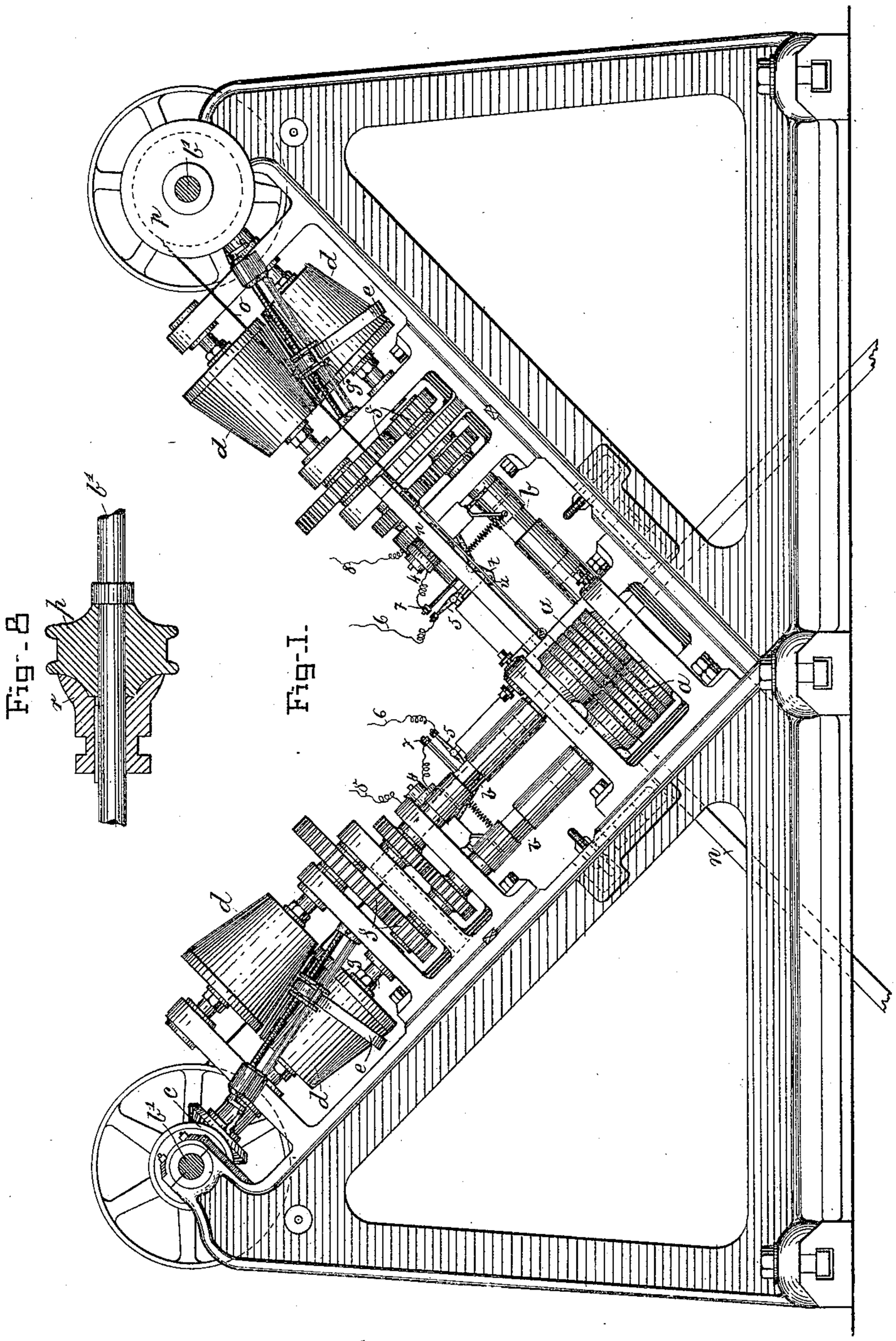

Fig. 1.

Fig. 2.

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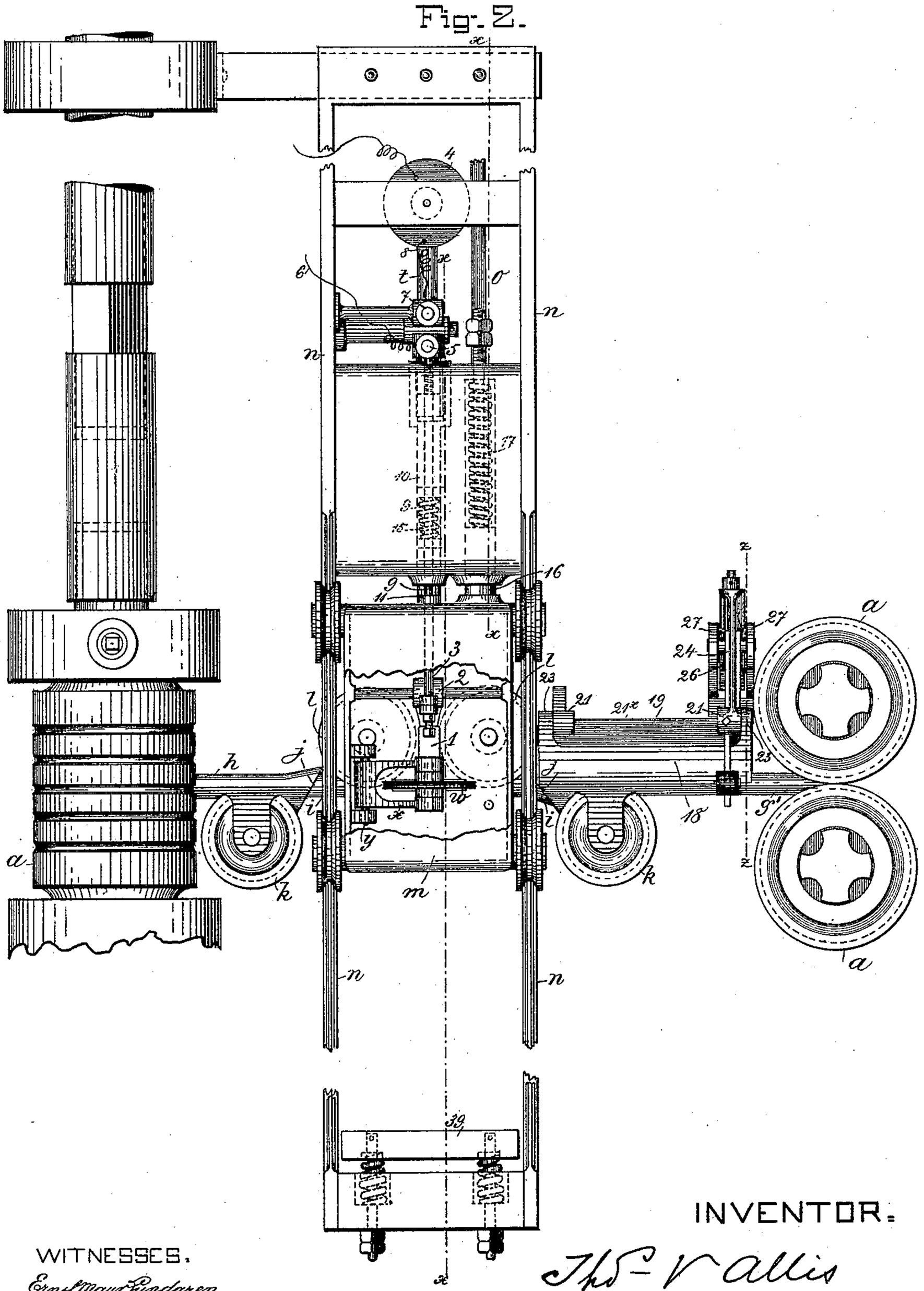
Fig. 2.



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MACHINE FOR ROLLING WIRE RODS OR STRIPS.

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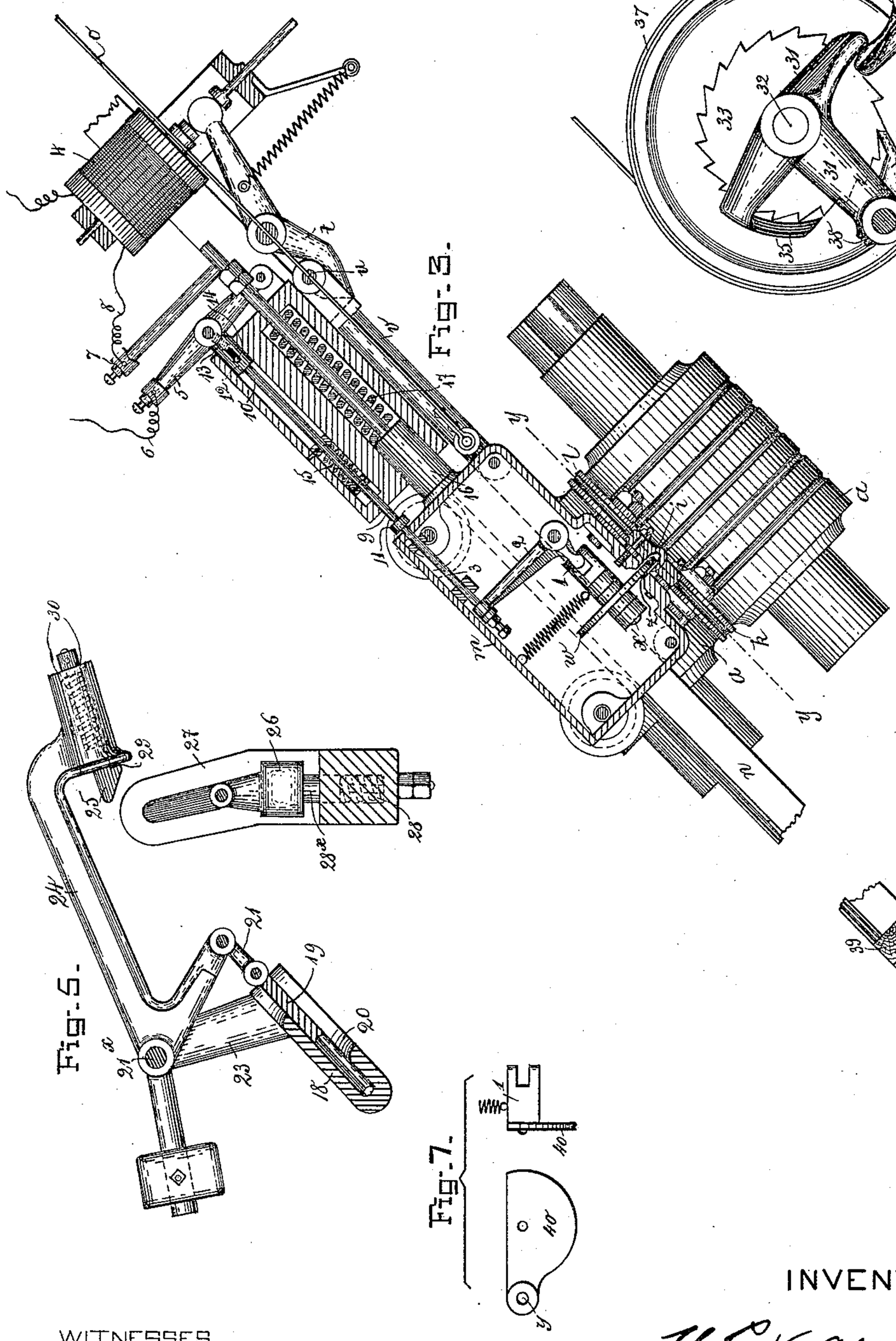

Fig. 3.

Fig. 6.

Fig. 5.

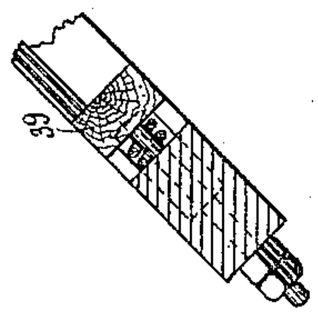

Fig. 7.

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MACHINE FOR ROLLING WIRE RODS OR STRIPS.

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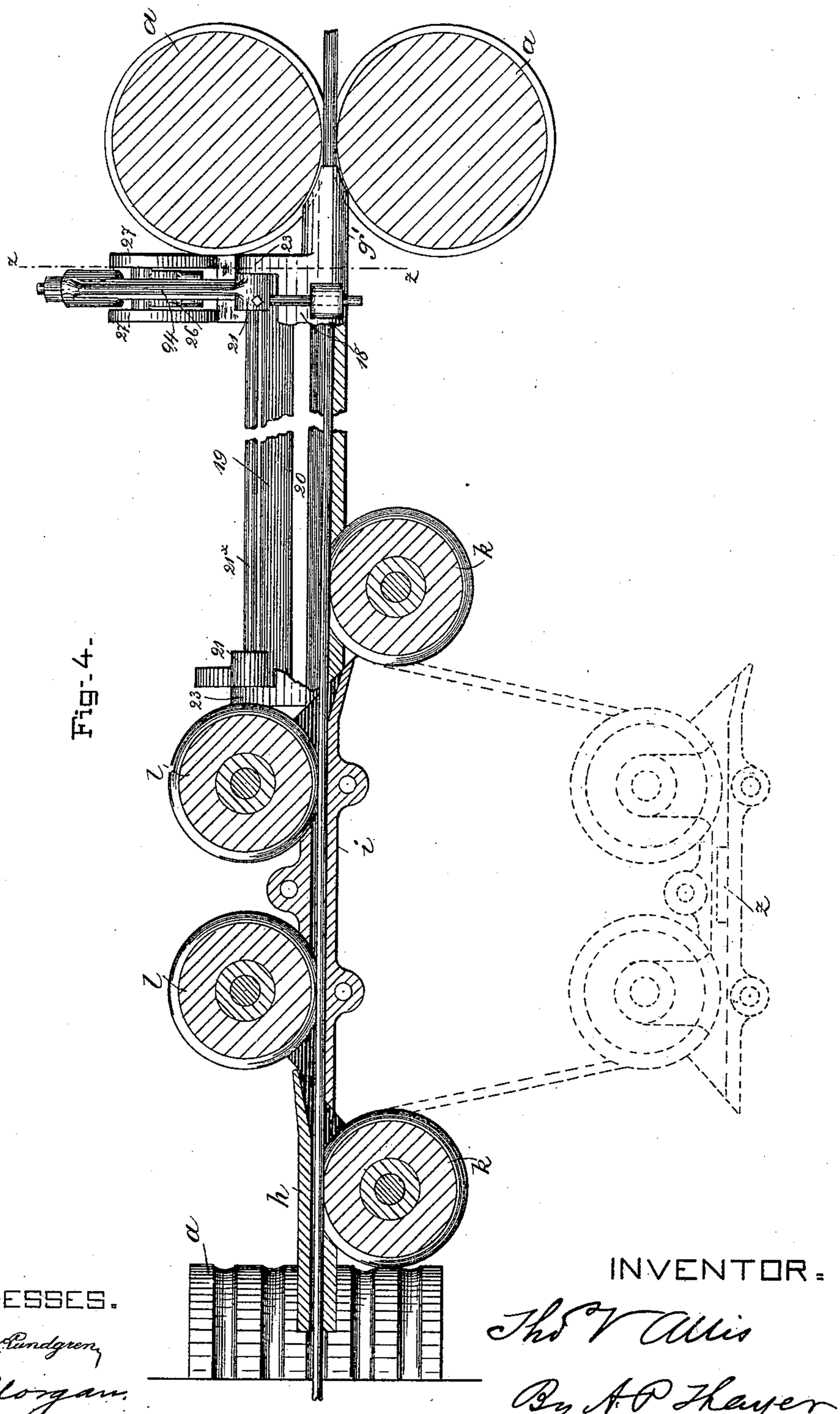
Fig. 4.



WITNESSES.

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UNITED STATES PATENT OFFICE.

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

MACHINE FOR ROLLING WIRE RODS OR STRIPS.

SPECIFICATION forming part of Letters Patent No. 463,697, dated November 24, 1891.

Application filed December 4, 1889. Serial No. 332,609. (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 or Strip Rolling Mills, of which the following is a specification.

This invention relates, essentially, to the guide apparatus in wire rod or strip rolling mills for controlling the rod or strip between the pairs of rolls in trains in which the several pairs are arranged continuously in the same line, and is more particularly applicable to trains in which the successive pairs of rolls are alternately placed in oppositely-inclined planes; but it is also useful in trains having the successive pairs all inclined in one plane, and it may with some modification be used with rolls all placed horizontally or alternately horizontally and vertically.

Another feature of the invention relates to relief apparatus for the escape of the rod or strip from the guide when stalled in advance, and another feature relates to the use of variable-friction driving-gear for the rolls.

In the accompanying drawings, Figure 1 is a front elevation of a train of rolls constructed in accordance with my invention. Fig. 2 represents some of the parts in side view in the axial lines of the rolls of one pair and at right angles to said lines of the next pair, a part of the guide-carriage being broken out in this figure. Fig. 3 is a longitudinal sectional elevation of some of the apparatus of Fig. 2 on line *x x*. Fig. 4 is a central transverse section of some of the apparatus of Figs. 2 and 3 on line *y y*, Fig. 3, with a part in dotted lines illustrating the operation of the guide. Fig. 5 is a detail of relief apparatus for the rod or strip when stalled, partly in side view and partly in section on line *z z*, Figs. 2 and 4. Fig. 6 is a side elevation of a modified form of apparatus that may be used to release the guide from the check in which it is held to allow the entry of the rod between the rolls and permit said guide to act when the loop forms. Fig. 7 represents a form of device that may be substituted for the roller employed in the automatic detaching device for the guide-carrier. Fig. 8 is a detail of the guide-carrier-elevating apparatus.

In an application for a patent for improvements in wire-rolling machinery filed August 16, 1889, Serial No. 320,966, and now pending I have represented a roller-guide which vibrates on a swinging arm for controlling the wire or rods between the consecutive pairs of rolls and which works in the plane of the pass-grooves to which the wire or rod runs from said guide and is intended more particularly for use with rolls for reducing wires in round form by cold-rolling, in which only short loops form between the rolls.

The guide of the present invention is intended more especially for use in hot-rolling wire rods and strips which have to run in loops of greater length between the pairs of rolls, but is also applicable for cold-rolling. The rolls *a* are placed successively in the same line of feed at short distances apart and alternately in opposite inclinations of about forty-five degrees to the level plane with the rolls proper at the lower sides and the driving-shafts *b'* at the upper sides of the inclines. Each pair of rolls is geared to its driving-shaft *b* by the bevel-wheels *c*, cone-pulleys *d*, and shifting friction-belt *e*, with a belt-shifter *g* for a simple and ready means of varying the speed of the rolls and with the multiplying spur-wheels *f* between the cone-pulleys and the rolls, the object of which is to enable the bevel-wheels, and especially the friction-cones, to run slower for the required speed of the rolls than if the transmitting-cone were coupled directly to one of the rolls. This saves wear and friction in obtaining the required high speed of the rolls, because the spur-gears are less affected in these respects than are the bevel-wheels and the cone-friction device, especially the friction-belt and the belt-shifter, on which the wear and friction are greatly increased at high speed.

In the use of the vibrating guide of the above-referred-to pending application it is contemplated that after first "threading" the rolls with the wire rods to be reduced they will remain threaded by stopping the rolls and welding on other lengths before running the previous lengths out, which cannot well be done in rolling the larger hot rods or strips for which the apparatus of this invention is more particularly intended, whereas it is an especial feature of the guide in this case that

it shall be such as will conduct the ends of new pieces directly from one pair of rolls to another before loops are formed and afterward take care of the loops as they are produced. Another feature of the said guide is that it provides for the bending of the loops in the flatwise direction of the rods to which they naturally tend, and therefore work better than in the other direction, said rods being thus flattened by rolling in shallow pass-grooves, which they are caused to enter edgewise, so that being flattened that way in said shallow grooves a greater reduction takes place and fins are avoided. They are caused to thus enter the pass-grooves by the arrangement of the successive pairs of rolls at right angles to each other. In trains of rolls all arranged in the same plane a twist-guide is employed for this purpose. It will be seen that the loops thus turning in the flatwise direction of the rods form in the planes of the pass-grooves of the rolls from which the rods issue instead of in the planes of the pass-grooves to which the rods run from the guides, as in the arrangement of the said pending application, which demands a special condition of the guide for directing the rod into the pass-grooves not required in that case.

Referring now to Figs. 2 and 4, there is seen a fixed guideway g' of the size and form of the rod, into which the rod enters directly as it issues from the pass-grooves of the rolls at the right hand, and at h is a similar fixed guideway leading into the pass-grooves of the next pair of rolls at the left hand, and between these two fixed guideways, which extend only part of the distance between the two pairs of the rolls, is another guideway i, which at times forms a direct continuation between the said two fixed guides and at other times shifts away therefrom laterally as the loop forms to control it; but it is to be understood that the movable guide will operate successfully in this arrangement of the same to work in the plane of the pass-grooves from which the rod enters the guide without the fixed guide g', and I am not limited to its use, though I prefer it as giving better results; but the chief purpose of said fixed guide is to provide for the use of the relief apparatus, that will be described further on. In such case the movable guide will be longer or will be otherwise so arranged that its receiving end will be close to the rolls from which it receives the rod. These fixed and movable guides are beveled at the ends j to gage them in alignment when the movable guide returns to that position. The stationary parts g' and h each have a guide-roller k at the end connecting with the movable guide, and said movable guide has the rollers l for anti-friction carriers to run the loop over, and the ends of the guides are slightly bell-mouthed to facilitate the running of the rods or strips. The movable guide is attached to the carriage m, which runs on the rails n, parallel with the plane of the pass-grooves of the rolls from which the rods enter the guide, said rails being in the inclined arrangement of rolls herein represented inclined correspondingly with them, so that said guide gravitates into the bight of the loop to keep it taut; but if used with rolls placed on a level base said guide may have a cord and weight working over a pulley or any other approved means of keeping the loop taut. A spring-buffer 39 is arranged at the lower end of the railway to break the shock when the carriage happens to run down without restraint, as when the rod runs out or happens to break in the loop. The carriage is connected by a belt o with a pulley p, mounted loosely on shaft b' or any approved shaft at a suitable distance above the upper end of the carriage-way and provided with a friction-clutch r to engage the friction-driver with said pulley to set the pulley in motion at any time when the carriage is to be run up the railway for returning the movable guide to alignment with the stationary guides, as when a rod has run out and another is to enter the rolls. A friction device is preferred for thus connecting the pulley p, because it allows the pulley to stop without much shock when the carriage comes to and is arrested in its position. Any approved form of friction device may be employed. When the carriage is thus returned to the said position, the retaining catch-hook t automatically engages the wrist-pin u in the forked head of the rod v, projecting from the upper end of the carriage, and holds it in that position until the new rod enters, when the retaining-hook is automatically detached and the loop-guide released to run with and control the loop.

For automatically detaching the retaining-hook a small disk or wheel w, mounted on the free end of an arm x, pivoted to the carriage at y, is arranged to rest in the slot z in the side of the movable guide, so that the periphery of said wheel projects into the guideway for the rod far enough to be forced out, and thus raise the arm a little by the entering end of the rod. A lever-latch, as 40, Fig. 7, may be substituted for the roller, if preferred, said lever being arranged to project into the guideway the same as the roller does to be raised by the entering rod. The arm x carries the fork 1, which engages the end of the short arm of the bell-crank 2, the long arm of which bears against the end of the push-rod 3, which may be made to set in motion various arrangements of devices for tripping said retaining-hook.

In Figs. 1, 2, and 3 I represent an electric device for the purpose, which consists of said hook arranged as the armature of the electro-magnet 4, with a circuit-closing lever 5, having one of the circuit-wires 6 connected to it and made to have contact with the binding-post 7, having the other wire 8 of the circuit, by the thrust of the push-rod 3 against the end of another push-rod 9, coupled with said lever and arranged in a slideway 10, so that

it bears against the end of push-rod 3 at 11 to receive the thrust of it, and thereby actuate the circuit-closing lever. The magnet then attracts the armature and releases the retaining-hook. The push-rod 9 is connected to the lever 5 in the socket 12, that contains a coiled spring 13, through which the thrust is transmitted for the relief of the parts from the hard shocks that would result if positively connected, and also from injury by too long a throw should wheel *w* be raised too high. The rod is secured in said socket by a pin 14, working in a slot of the socket to allow of the play of the rod relatively to the socket. The coiled spring 15 separates the circuit-closing lever 5 from the binding-post 7 when the carriage shifts away after being released, and then the attraction of the magnet ceases and the retaining-hook drops back to its position ready for again engaging the carriage on its return. The loop begins to form immediately on the end of the rod entering the rolls at the left hand, which makes it necessary that the carriage should be more quickly started on its way than it would be by its gravitating action alone, for which I provide the starter, consisting of the plunger 16 and the spring 17, which on the return of the carriage to the upper position are forced back and the spring is compressed ready for giving a starting thrust when retaining-hook *t* is disengaged.

To provide for the escape of a rod issuing from one pair of rolls when stalled in advance of the next pair and to avoid the jamming of a mass of metal, which quickly accumulates in such case with very damaging results, I provide an automatic relief device in the guide *g'* to allow the rod to escape through the side. This device consists of the said guide provided with the lateral enlargement 18, containing a movable side 19, and having the escape-passage 20 at the outer edge of one of the permanent sides of said enlargement. The movable side 19 is connected by the links 21 with the arms of a rock-shaft $21^{\times}$, pivoted in supporting-standards 23, said shaft having a balanced arm 24. In the normal condition of the device the movable side 19 stands in the position to limit the guideway to the dimensions of the rod, and it is secured in that position by the latch-bolt 25 at the extremity of the arm 24, engaged with the weighted keeper 26, fitted to slide in the stationary guideways 27, the power of which is sufficient to hold the lever and retain the rod when running properly, but is such that whenever the rod happens to get stalled any where along the guide, and is thereby forced to crowd laterally, the keeper will rise and allow the movable side 19 to move outward and open the passage 20, and thus permit the rod to escape that way until the mill can be stopped to remedy the matter. The stationary guideways 27, in which the latch-keeper moves, are so inclined that the keeper escapes from the latch-bolt when the movable side 19 has opened the escape-passage 20 to then relieve the escaping rod from all pressure, as it is desirable that after having entered the escape-passage the rod may run as free as possible. A buffer-spring 28 and the yielding seat $28^{\times}$ are arranged under the keeper to break the shock of its fall when the latch escapes. The latch-bolt 25 has a shoulder 29, which locks it securely against escaping from the keeper while in the normal position, as it might by the jarring and shaking of the mill, and the slideway for the bolt is sufficiently larger than the bolt, as indicated by the dotted lines 30, to allow the bolt to rise when striking the keeper, so as to release the shoulder 29 from the end of the slideway and allow the bolt to be forced back for engaging the keeper.

Another means of detaching the retaining-hook *t* automatically to permit the loop-guide to act may consist of the elbow-lever 31, mounted loosely on the stationary axis 32 of a continuously-rotating ratchet-disk 33, with one arm bearing against the tail-arm of the hook, and having the pawl 34 on the other arm, against which the rod 9 acts when receiving the thrust of rod 3, so as to engage the pawl with the ratchet-disk and cause lever 31 to be turned so as to actuate the hook. A stationary cam 35 detaches the pawl 34 from the disk 33 immediately after the hook is detached, and the pawl-lever 31 falls back to its original position, and a light spring 36 holds the pawl out of contact with the ratchet-disk. The spring 15 shifts rod 9 so far away from pawl 34 that it allows said pawl while held out of contact with the ratchet-disk to return to the normal position without hinderance by said rod. The movement of the pawl away from the ratchet by the spring 36 is limited by the stops 38. The ratchet-disk 33 may have a pulley 37 to be driven by a belt from any suitable driver to actuate it. This hook-detaching apparatus is susceptible of various modifications, and I do not limit myself to the particular arrangement of it above described.

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

1. The combination, in a train of rolls for rolling wire rods or strips, of a loop-guide reciprocating laterally in the plane of the pass-grooves from which the rods or strips run and enter the guide, substantially as described.

2. The combination, in a train of rolls for rolling wire rods or strips, of a laterally-reciprocating loop-guide, a carrier therefor, and ways for the carrier located between two pairs of rolls, substantially as described.

3. The combination, in a train of rolls for rolling wire rods or strips, of a laterally-gravitating reciprocating loop-guide, a carrier therefor, and ways for the carrier located between two pairs of rolls, substantially as described.

4. The combination, in a train of rolls for rolling wire rods or strips, of a laterally-gravitating reciprocating loop-guide, a carrier therefor, and ways for the carrier located be-

tween two pairs of rolls, and also a power device to raise the carriage and return the loop-guide to the direct line of feed, substantially as described.

5. The combination, in a train of rolls for rolling wire rods or strips, of a laterally-reciprocating loop-guide, and a fixed guide between the loop-guide and the rolls to which the rod runs from the guide, located between two pairs of rolls, substantially as described.

6. The combination, in a train of rolls for rolling wire rods or strips, of a laterally-reciprocating loop-guide, a fixed guide between the loop-guide and the rolls to which the rod runs from the guide, and also a fixed guide between the loop-guide and the pairs of rolls from which the rod runs to the guide, all located between two pairs of rolls, substantially as described.

7. The combination, in a train of rolls for rolling wire rods or strips, of a loop-guide normally in the direct line of feed to receive the entering rod and automatically movable laterally thereto with and controlling the loop, substantially as described.

8. The combination, in a train of rolls for rolling wire rods or strips, of a loop-guide normally in the direct line of feed to receive the rod and automatically movable laterally to control the loop, a hook to retain the guide in said line to receive the rod, and the roller in the carrier subject to the entering rod for tripping the hook, substantially as described.

9. The combination, in a train of rolls for rolling wire rods or strips, of a loop-guide normally in the direct line of feed to receive the rod and automatically movable laterally to control the loop, a hook to retain the guide in said line to receive the rod, the roller in the carrier subject to the entering rod, and the elbow-lever and thrust-rod actuated by said roller for tripping the hook, substantially as described.

10. The combination, in a train of rolls for rolling wire rods or strips, of a loop-guide normally within the direct line of feed to receive the rod and automatically movable laterally to control the loop, a hook to retain the guide in said line to receive the rod and being an armature-lever of an electro-magnet, the roller in the carrier subject to the entering rod, the elbow-lever, thrust-rod, and the circuit-closer of the electro-magnet actuated by said roller to detach the retaining-hook, substantially as described.

11. The combination, in a train of rolls for rolling wire rods or strips, of a rod-guide between two pairs of rolls having the movable side sliding between the two opposite sides and subject to the lateral thrust of a stalled rod, and an escape-passage which the said movable side opens along the edge of one of said opposite sides for the escape of the rod, substantially as described.

12. The combination, in a train of rolls for rolling wire rods or strips, of a rod-guide between two pairs of rolls and having the movable side subject to the lateral thrust of the stalled rod, and the escape-passage for the rod, subject to the control of said movable side and the weighted retaining-lever to said movable side, substantially as described.

13. The combination, in a train of rolls for rolling wire rods or strips, of a rod-guide between two pairs of rolls, having the movable side subject to the lateral thrust of the stalled rod and the escape-passage subject to the control of said movable side, the weighted retaining-lever to said side, and the automatic weight-releasing catch, substantially as described.

14. The combination of the rolls, the adjustable friction-cones and belt-drivers, and the spur-gears intermediate to said friction-drivers and 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 30th day of November, 1889.

THOMAS V. ALLIS.

Witnesses:
W. J. MORGAN,
A. P. THAYER.