

(No Model.)

2 Sheets—Sheet 1.

T. V. ALLIS.
WIRE ROLLING MILL.

No. 463,696.

Patented Nov. 24, 1891.

Fig. 1.

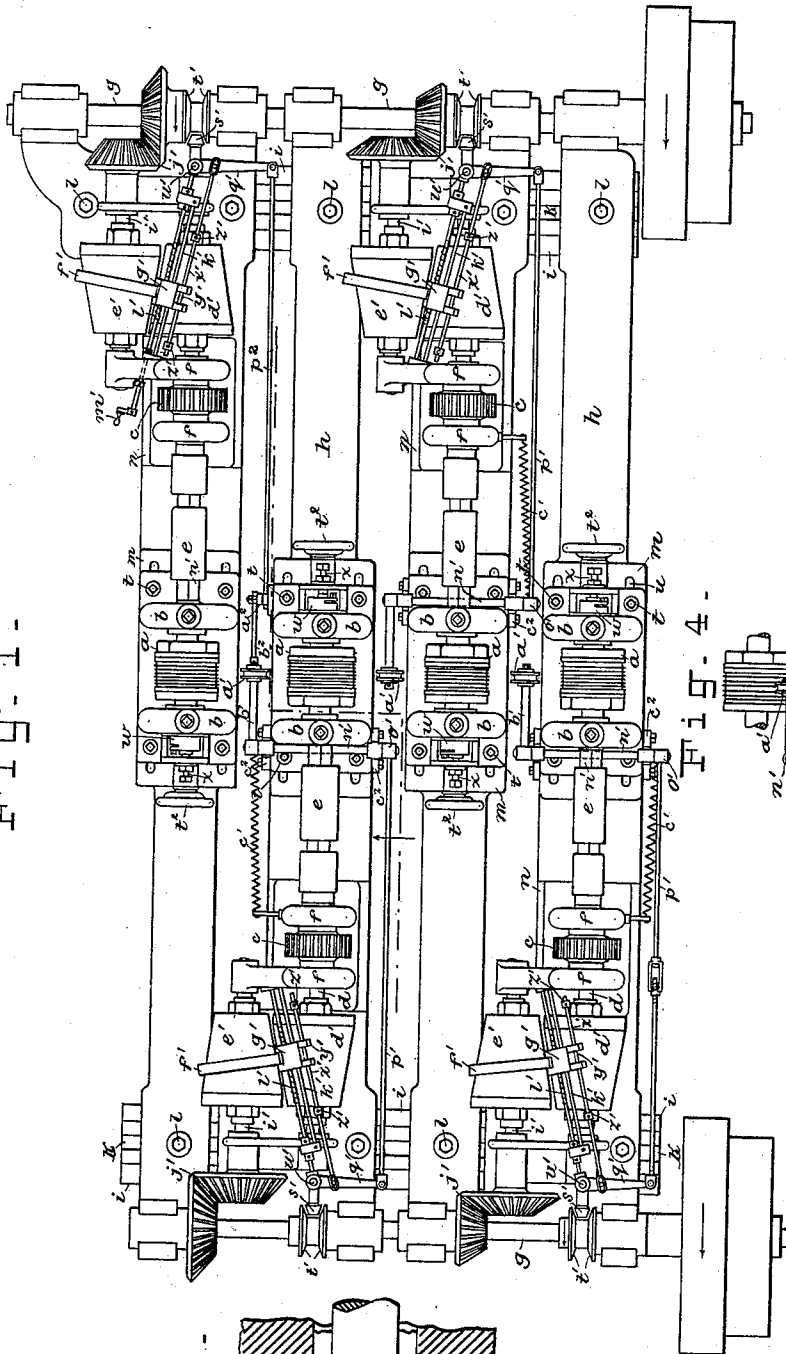


Fig. 4.

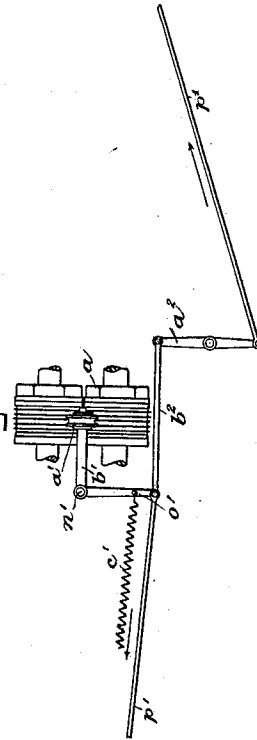
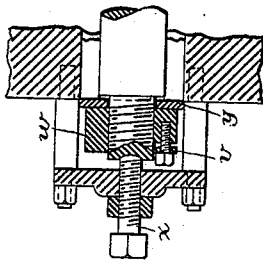


Fig. 5.



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(No Model.)

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Fig. 2.

Fig. 6.

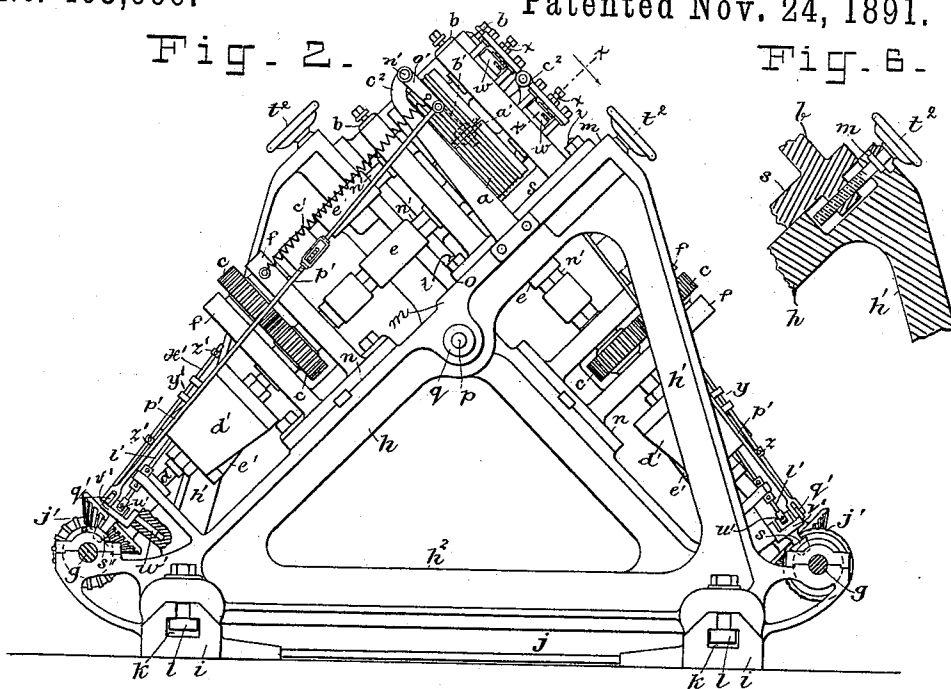
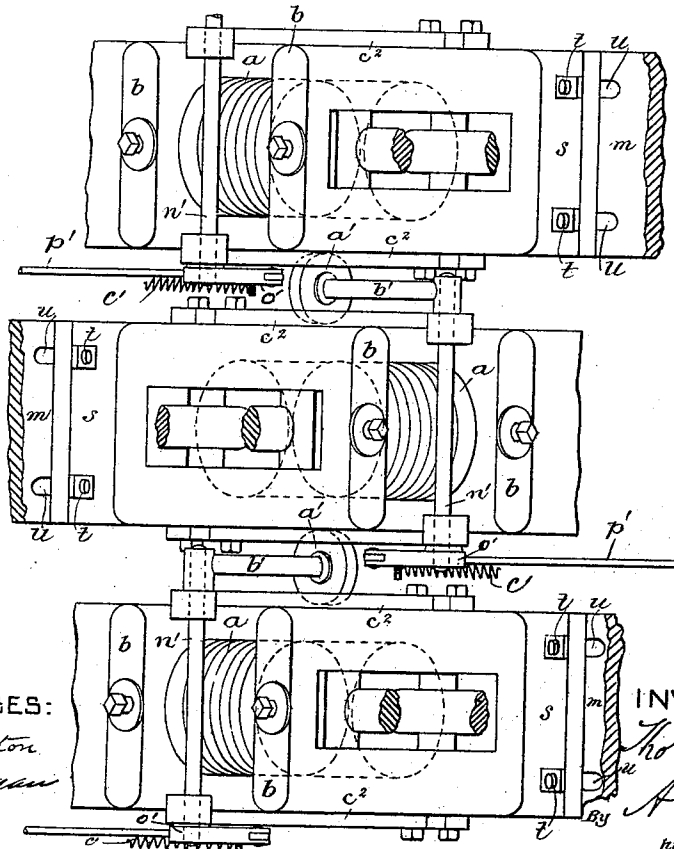


Fig. 3.



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UNITED STATES PATENT OFFICE.

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

WIRE-ROLLING MILL.

SPECIFICATION forming part of Letters Patent No. 463,696, dated November 24, 1891.

Application filed August 16, 1889. Serial No. 320,966. (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-Rolling Mills, of which the following is a specification.

My invention relates to continuous-train wire-rolling machinery; and its object is to obviate some of the difficulties now existing in the use of such machinery. When reducing wire to small sizes in mills as now in use, the rolls are successively placed in close proximity in the same line of feed, which is the most desirable arrangement for economy of space and for other reasons. The wire, passing directly from one pair to another in a straight line, is taken up as fast or a little faster by the succeeding rolls than it is delivered by the preceding rolls.

The essential features of my invention consist, first, of means for producing and maintaining a loop and automatically varying the same by a loop-guide between each pair of rolls by which the wire is given to each pair beyond the first uniformly, so that they will all act on the wire by compression only, and the stretching of the wire which occurs between some pairs of rolls as ordinarily constructed (because of the impossibility of uniform delivery to each pair in a straight line) is avoided; second, the employment of variable driving-gear to each pair of rolls for controlling the feed; and, third, an improved construction for the adjustment of the pairs of rolls relatively to each other for alignment of the passes, all as hereinafter fully described, reference being made to the accompanying drawings, in which—

Figure 1, is a plan view of a series of four pairs of rolls, illustrating the application of some of my improvements to a train in which all the rolls are arranged in a horizontal plane. Fig. 2 is an end elevation of a roll-train as I construct it, for the preferable arrangement of the rolls at right angles successively, and comprising all of my improvements. Fig. 3 is a plan view of some of the parts as arranged in Fig. 2, and on an enlarged scale for greater clearness. Fig. 4 is a detail of the automatic loop-guide as arranged in Fig. 1. Fig. 5 is a detail of a device for adjusting and

controlling the rolls individually in section on line *x x*, Fig. 2. Fig. 6 is a detail of the arrangement for shifting the roll-housings.

In practice there will be a much larger number of pairs of rolls *a* in the train than I have represented in the drawings, to avoid unnecessary repetition. They are mounted in housings *b*, one above another, and geared together at *c*, as usual, the lower one having a shaft *d*, extended beyond the gears connecting the rolls of each pair for the application of the driving power, and they have the usual wabblers-couplings *e* between the roll-housings *b* and the housings *f*, in which the gear-wheels *c* are mounted. I arrange the driving-shafts of the respective pairs of rolls to extend in opposite directions alternately, and provide two main driving-shafts *g* for enabling more space to be had in a given distance between the pairs of rolls placed in close proximity for the gearing by which the roll-shafts are connected with the main shafts, and I provide a bed plate or frame *h* for each pair of rolls and its adjuncts, extending the whole range of the shaft connections each way from the rolls to a sub-base sill *i* at each extremity, tied together by substantial cross-sills *j*, the roll-housings being mounted at the middle of these bed plates or frames. The sills *i* have a T-groove *k* extending the whole length in the upper side, and the bed plates or frames *h* are seated at their extremities on said sills at suitable intervals apart and secured by T-headed bolts *l*, inserted in said grooves from the ends. The sub-base may of course consist of a plate or be made in any other approved form. When the rolls are to be arranged in the horizontal plane, as in Fig. 1, these bed-supports *h* will consist of strong horizontal beams with suitable elevations at *m* and *n* for seats of the roll and gear housings, respectively; but for the preferred angular disposition of the successive pairs of rolls, as in Figs. 2 and 3, I have devised the triangular upright frames of three members, whereof the one *h*, corresponding to the roll and gearing supporting beam in Fig. 1, is inclined at an angle of forty-five degrees from one of the sills of the sub-base. The member *h'* is a brace inclined at an angle of about eighty degrees from the other beam of the sub-base and joining member *h* at the top, and the third

member h^2 is a base-tie connecting the front ends of the uprights, and the members h of the successive roll-frames are respectively placed on the opposite sides of the angular positions and extend the length of the roll-housing seats m beyond the point o , where the lines of the upper surfaces of the members h of the successive frames cross, as seen from the end view, and thereon they receive and hold the housing-frames of the successive pairs of rolls, which are thus arranged at right angles to each other. This arrangement is highly important, because then the slightly-finned sides of the wire produced in one pair run in the bottoms of the grooves in the next pair of rolls without the trouble of turning the same a quarter-turn between the rolls, which is done in some cases when producing oval and square shapes alternately, but is very difficult, if not impossible, when worked only in the round form. Where the members h of the bed-frames cross they are coupled through the whole series by a stay-rod p , with adjusting-nuts q to tighten it on each frame.

The roll-housings b are made integral with a base-plate s , and the whole is adjustable together on the seat m for alignment of the passes of the successive pairs of rolls, said bed-plates being held on said seats by the bolts t , adjustable in the slots u of the seat when the nuts are slackened off, and they are fitted with the well-known slide-adjusting screw device, as shown at t^2 , Fig. 6, for shifting them. The rolls of each pair are also adjustable lengthwise relatively to each other for adjusting the pass-grooves of each to the other by means of a collar w , screwed on one end and made fast by a spring binding-lip and screw device v , to prevent the collar from working slack and the adjusting set-screw x , bearing against said end of the roll, the collar being to prevent lengthwise shift of the roll in one direction by bearing against the journal-box with an intervening washer y , and the set-screw being to prevent similar movements of the roll in the other direction after being set for any given position of the roll, and both being adjustable for altering the position, as desired.

In continuous trains as now made with the successive pairs of rolls in close proximity, so as to pass the wire directly from one pair to another without loops, care is taken to adjust them to take up the wire a little faster than it is given out by the preceding rolls to avoid any chance of overfeed, the stretch of the wire between the rolls being relied on for the excess, this being necessary because it is impossible to gage the speeds of the different pairs of rolls exactly to the varying speed of the wire between the different pairs, due to the varying reduction of the different pairs of rolls and to the varying conditions of metal in the wire. It is desirable to avoid this stretching, which is injurious to the quality of the wire. It sometimes occurs that the wire is injuriously stretched when in the grip

of a number of pairs of rolls. Some drawing more than their proportion, the wire will be subject to far more tension than in the drawing process when the resistance of only one plate has to be overcome. For this reason it is highly important to provide for some amount of slack between the rolls, also means for regulating such slack, and it is equally necessary to avoid the great loops of the common Belgian or "open-face" mill, because of the great difficulty, if not impossibility, of controlling them between the closely-placed rolls of the train; also because it is a matter of great importance to have the wire run so quickly between the pairs of rolls that the heat of compression by the rolls will be kept up to a degree at which the requisite softness for continuous reduction to any required extent is preserved, instead of cooling between the pairs of rolls, which causes it to harden to the extent that its further reduction is greatly impeded and cannot be carried as far as when the heat is maintained. This I provide for by the employment of a loop-guide a' , located in the range of the wire between the pairs of rolls consecutively, so as to swing or otherwise play, as on the vibrating arm b' , to change according to the lengthening and shortening of the loop with a spring c' , or it may be a weight, or other means to keep the loop in tension; and with this device to control the slack in such short loops as only serve to avoid the stretching of the wire I provide independent variable driving-gear to each pair of rolls that may be shifted while the rolls are in motion to graduate the speed, so as neither to make the loops too long for the loop-guide to control properly nor to allow the rolls to run so slow as to retire the loops and thus stretch the wire. For so driving the rolls I employ the parallel reverse friction-cone $d' e'$ with the slack belt f' for contact between them and the belt-shifting slide g' , the cone d' being on the roll-shaft d and cone e' on the counter-shaft l' , geared to the driving-shaft g by the bevel-wheels j' . The belt-shifter g' slides forward and backward on the rod k' , and is shifted by the screw, which may have a crank m' , Fig. 1, by which the attendant may shift the belt from time to time, as he sees the loop lengthening or shortening too much, and thus the machine having the rolls placed in close proximity may be practically operated without subjecting the wire to any stretching whatever, and with such short loops as not to cool the wire and cause it to harden while passing from one pair of rolls to another. But beyond this I have devised a means to make the speed of the rolls automatically variable through the variable action of the loop-guide by the lengthening and shortening of the loops to avoid the care and attention of the operator, and so as to insure greater uniformity in the loops, as follows: I mount the arm b' , carrying the guide a' , on a rock-shaft n' , supported in standards c^2 , rising up from bed-frame h , said shaft having an arm o' , which I

connect by the rod p' with the lever q' , which reverses the motion of the belt-shifting-screw l' , geared by the friction-pinion s' , and the friction-drivers t' on the main shaft to turn
 5 said screw one way or the other, according as the pinion S' is in contact with one or the other of the wheels t' , said screw having a universal joint coupling it at u' with the vibrating shaft of friction-pinion s' , which is
 10 mounted in the support v' , pivoted at w' , (see Fig. 2,) and having said lever q' attached to it for causing the contact of said friction pinion and wheels above mentioned. The spring c' draws the loop-guide into the bight
 15 of the loop, and as the loop increases in length adjusts the belt-shifting and screw-driving pinion s' , in contact with that one of the friction-drivers t' that slows the motion of the rolls, giving the wire to the loop-guide, so that
 20 the loop shortens and shifts the loop-guide and pinion s' in the other direction, and when the loop shortens too much brings said pinion s' in contact with the other wheel t' , which causes a slight increase of the speed of the
 25 rolls and corresponding lengthening of the loop, thus effecting automatic regulation of the speed in a very efficient and satisfactory manner. When the shifting of the friction-belt is to be done by hand with the crank m' ,
 30 the shifting-pinion s' , wheels t , and the connecting devices for shifting the pinion by the loop-guide will be omitted, although herein shown together with the crank. The belt-shifting device has an automatic safety attachment to prevent the belt from being
 35 shifted either way beyond the allotted range, as, if the loop should get out of the groove of the loop-guide or should break, the spring would tend to keep pinion s' constantly
 40 against one of the drivers t' . The said safety device consists of the rod x' , connected to lever q' , extends through the arms y' of the shifter g' and has the stops z' , by which it is made to shift pinion s' out of gear with the
 45 wheels t' when said arms y' reach the stops z' , respectively. Said pinion will then remain in the middle space without effect on it by either friction-wheel t' . As there will be no loop for working the regulator of the last pair
 50 of rolls, the regulator of that pair may be connected to the loop-guide of the preceding pair, so that the speed of said last pair may be regulated all the same by a device such as is represented in Fig. 4, in which the rod
 55 p' is connected to the arm o' of the loop-guide rock-shaft so as to act thereon together with the rod p' of the preceding pair of rolls by the rock-lever a^2 and connecting-rod b^2 .

When the rolls are all arranged in one
 60 plane, as in a horizontal position, the loop-guide vibrates in the planes of the grooves of the rolls both in front and behind, the grooves of both being in the same plane; but when the rolls are in different angles successively
 65 and their grooves are in correspondingly different planes the loop-guide is made to vibrate

in the plane of the grooves of the pair of rolls to which the wire passes and enters from the loop-guide, so as to properly direct the wire thereto and transversely to the plane of the
 70 grooves from which the wire passes onto the loop-guide, as the wire will run from the rolls in any direction without detriment; but it must be guided in the plane of the passes into which it enters. For this purpose the
 75 loop-guide is mounted as in Figs. 2 and 3, so as to hang from its rock-shaft n' above the center of the rolls, from which the wire passes to the said guide, so as to swing in the plane of the grooves of the next pair, as is shown
 80 by the dotted outline of the guide-roller in Fig. 2 and by the full line in Fig. 3, the said rock-shaft n' , being mounted in the standards c^2 , rising up each side of the rolls from the part h of the supporting-frame, instead of the
 85 position represented in Fig. 1, for the rolls placed horizontally, the same being at the outside of the housings suitably arranged for the vertical play of the loop-guide, as it is required to work in that arrangement.
 90

To avoid the trouble of threading the rolls with each successive rod to be rolled it is proposed to weld on the other rods at the ends successively by the electric welding process, so that once the rolls are properly threaded
 95 for operation they continue in such condition, it being only necessary to stop them occasionally for welding on as the ends of the rods in process of reduction draw nigh to the rolls. The rods are furnished on reels in coils of
 100 such length that the stoppages will not be so frequent as to be objectionable.

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

1. The combination, in a continuous train
 105 of wire-reducing rolls, of a wire-loop guide located between two pairs of rolls placed in the same line of feed and having lateral play in the bight of the loop as the feed varies and in the plane of the roll-grooves to which the
 110 wire runs from said guide, substantially as described.

2. The combination, in a continuous train
 115 of wire-reducing rolls, of a wire-loop guide located between two pairs of rolls placed in the same line of feed and having lateral play in the bight of the loop as the feed varies, a spring pulling it into the loop and influenced reversely by the shortening of said loop, substantially as described.
 120

3. The combination, in a continuous train
 120 of wire-reducing rolls, of variable-speed driving-gears coupling the pairs of rolls severally with the main driving-shafts and being adjustable while in motion, substantially as described.
 125

4. The combination, in a continuous train
 130 of wire-reducing rolls, of a wire-loop guide located between two pairs of rolls placed in the same line of feed and having lateral play in the bight of the loop as the feed varies, and variable-speed driving-gears coupling

each pair of rolls respectively with the main driving-shaft and being adjustable while in motion; substantially as described.

5 The combination, in a continuous train of wire-reducing rolls, of a wire-loop guide located between two pairs of rolls placed in the same line of feed and having lateral play in the bight of the loop as the feed varies, variable-speed driving-gears coupling the
10 pairs of rolls severally with the main driving-shaft, and the speed-shifter of the roll-drivers coupled with and automatically variable by the loop-guide, substantially as described.

6. In a continuous train of rolls for reduc-
15 ing wire having the pairs of rolls geared severally with the driving-shaft by the reverse cones and friction-belt, with the automatic belt-shifting screw and reverse screw-driver, the vibrating loop-guide located between two
20 pairs of rolls placed in the same line of feed and coupled by the rock-shaft and connecting-rod with the shifting-lever of the belt-shifting screw, substantially as described.

7. The combination, in a continuous train
25 of rolls for reducing wire, of a series of pairs of horizontal rolls placed in the same line of feed successively, a supporting bed plate or frame to each pair of rolls, and having the roll-housings located thereon at the middle and paral-
30 lel therewith, a sub-frame supporting said bed

plates or frames at the ends, a main driving-shaft located at the ends of said bed plates or frames, and the pairs of rolls alternately geared with the said main driving-shafts, re-
spectively, substantially as described. 35

8. The combination, in a continuous roll-
train for reducing wire, of a series of pairs of rolls arranged in the same line of feed suc-
cessively and in independent housings sever-
ally adjustable laterally on the bed-plates 40
for alignment of the passes, and a variable loop-guide located between the pairs of rolls, substantially as described.

9. The combination, in a continuous train
of rolls for reducing wire, of a series of pairs 45
of rolls arranged in the same line of feed successively and in independent housings, and a variable loop-guide located between the pairs of rolls, said roll-housings being
severally adjustable laterally in relation to 50
each other and to the loop-guide, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name, in pres-
ence of two witnesses, this 15th day of August, 55
1889.

THOMAS V. ALLIS.

Witnesses:

W. J. MORGAN,
W. B. EARLL.