(No Model.)

3 Sheets—Sheet 1.

E. S. LENOX.

ART OF ROLLING WIRE RODS.

No. 361,591. Patented Apr. 19, 1887.

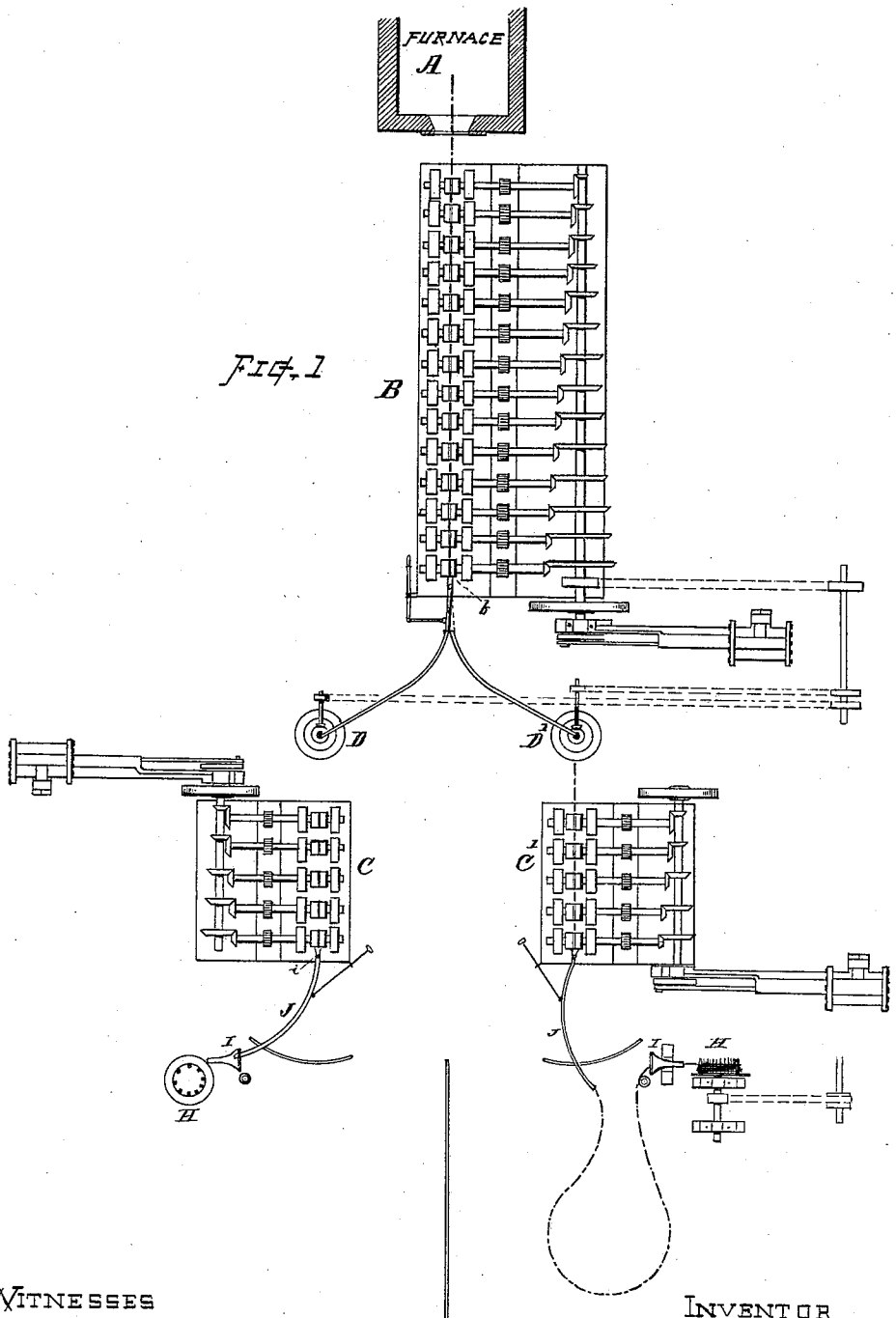


Fig. 1

WITNESSES

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(No Model.)

3 Sheets—Sheet 2.

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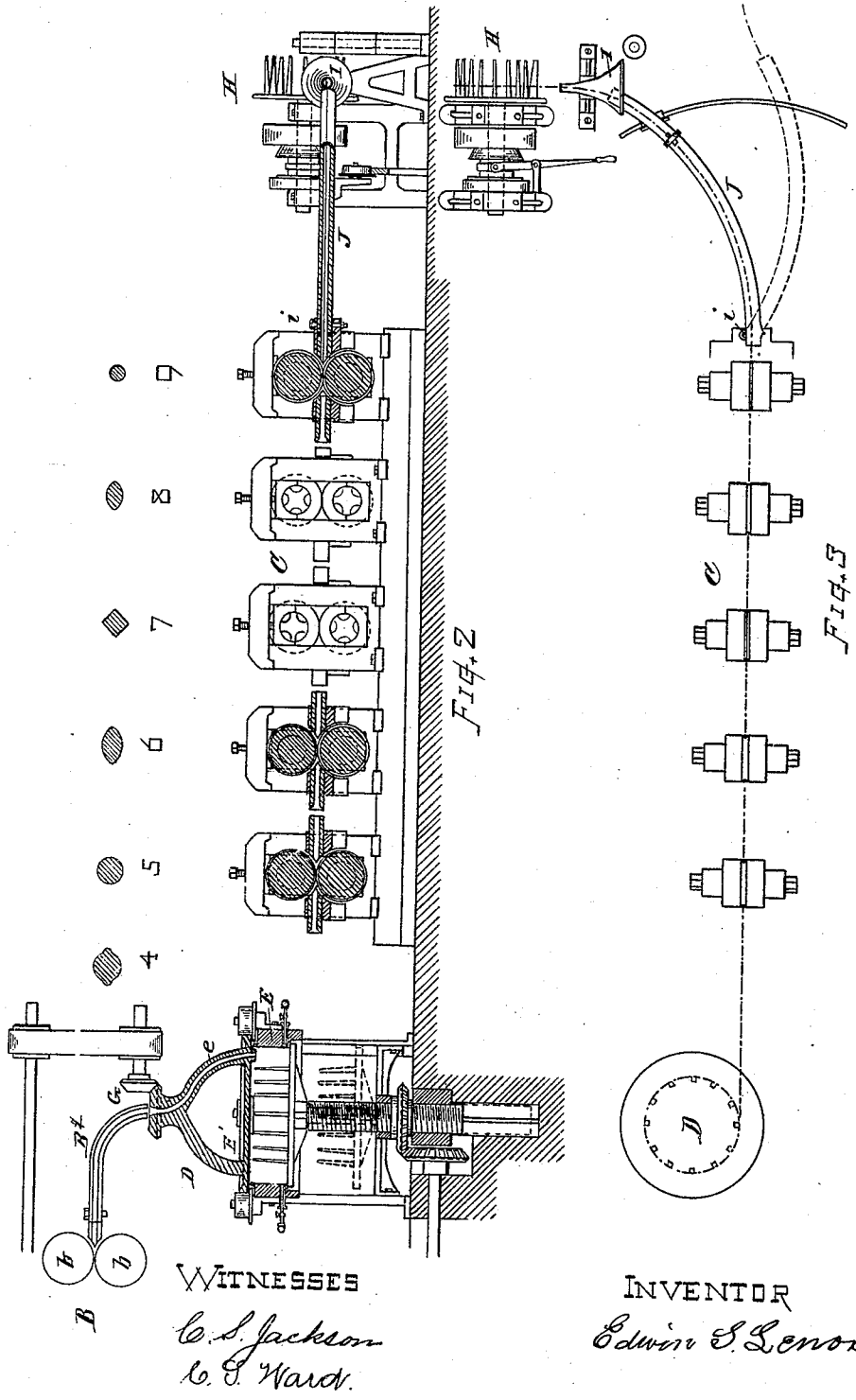


Fig. 2

Fig. 3

WITNESSES

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del.)

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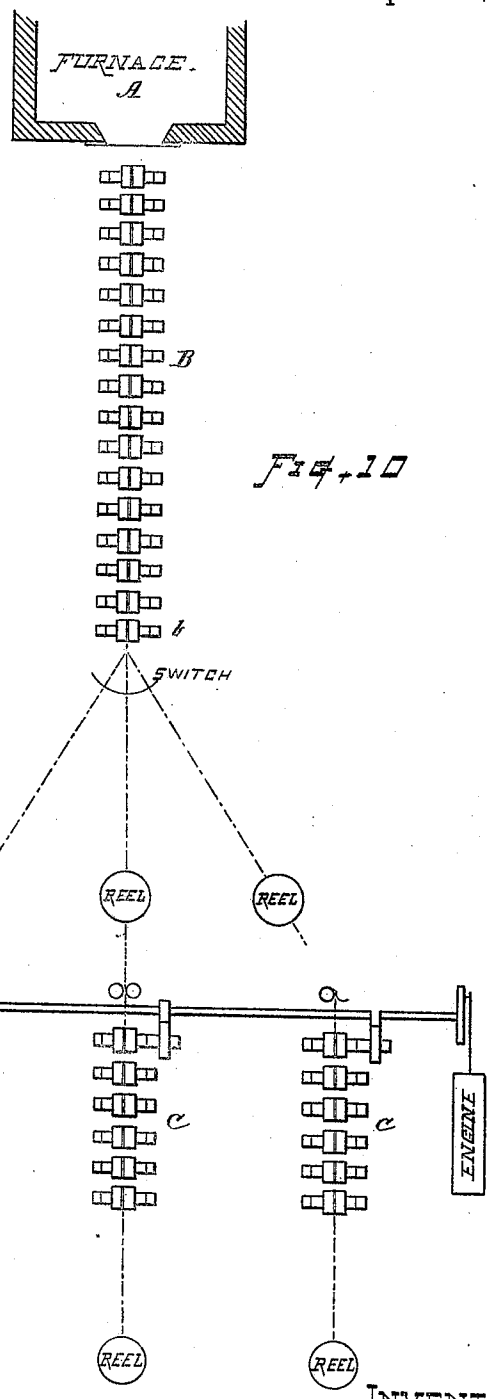


Fig. 10

WITNESSES
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UNITED STATES PATENT OFFICE.

EDWIN S. LENOX, OF WORCESTER, MASSACHUSETTS.

ART OF ROLLING WIRE RODS.

SPECIFICATION forming part of Letters Patent No. 361,591, dated April 19, 1887.

Application filed March 11, 1885. Serial No. 158,473. (No model.)

To all whom it may concern:

Be it known that I, EDWIN S. LENOX, of the city and county of Worcester, and State of Massachusetts, have invented a new and useful Improvement in Rolling Wire Rods, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

I am aware that in the manufacture of wire rods previous to my present invention some attempts have been made to retain the heat of the metal, with the view of extending the reduction of the rod, by reeling said rod at an intermediate stage of the rolling operation, and that mechanism has been described in English Patent No. 2,243 of 1870 which contemplates reeling or winding up of the rod at an intermediate stage of its reduction and the subsequent further reduction thereof before the rod is cooled. The invention referred to, however, is not available to effect complete and practical results, inasmuch as it does not afford means for taking and coiling the rod throughout its entire length at the same speed as and immediately it issues from the rolls of the primary train and provide facilities for the unwinding of the rod for delivery to the subsequent or secondary set of rolls.

The object of my present invention is to provide apparatus whereby wire rods can be practically rolled down to a small finished size, say about No. 11 wire-gage, in an expeditious and economic manner; also, to provide means for automatically winding up a partially-reduced rod at an intermediate stage in the rolling operation, directly as it issues from the rolls of the primary train and at a speed corresponding to that at which the rod issues therefrom, upon a reeling apparatus so constructed as to maintain or increase the heat of the rod in preparation for further reduction, and for facilitating the uncoiling and delivery of the rod through a supplemental train of rolls adjusted to give the required size and form; also, to afford means for reducing the enlarged finned or overstocked portions of the rod before its passage through the secondary or finishing train. These objects I attain by the method of operation and by an apparatus such as is herein described and illustrated, the particular subject-matter claimed being hereinafter definitely specified.

In the drawings, Figure 1 is a plan view of such portions of an apparatus for making wire rods as will illustrate the nature of my invention. Fig. 2 is a view, on a larger scale, part vertical section and part elevation, showing an automatic intermediate reel mechanism, the supplemental train of rolls, and reeling devices for winding up the finished rod. Fig. 3 is a diagram plan of the same. Figs. 4, 5, 6, 7, 8, and 9, respectively, show the forms of the rod at the several stages of its reduction as imparted by the last pair of rolls of the primary train and the rolls of the supplemental train at corresponding positions. Fig. 10 is a diagram plan showing three supplemental trains and reels.

Referring to the parts of the apparatus, A denotes the furnace for heating the billets or bars preliminary to rolling them down into wire rods. The furnace may be of ordinary or any suitable construction.

B denotes a primary train of fourteen (more or less) pairs of rolls arranged for operation in continuous order, and mounted, geared, and operated substantially as in the ordinary "continuous" rolling-mill.

C and C′ indicate supplemental train of rolls or sets of rolls for completing the reduction or imparting the finished form and size to the wire rods.

D D′ denotes reeling mechanism, located intermediately between the primary and supplemental trains, for receiving the rod directly after it issues from the last pair of rolls, *b b′*, of the primary train, and for automatically winding or coiling it, as fast as it comes from the rolls, into compact space, in suitable order for retaining or increasing the heat thereof, and without permitting the distribution of any portion of the rod upon the floor or platform, where its heat would be rapidly exhausted.

In the present instance the reel for winding the rod at intermediate stage between the rolling-trains is arranged in horizontal position at the top of a vertical spindle, which turns in an elevating-column, *d*, with which is combined mechanism for raising and lowering the reel, as indicated by dotted lines in Fig. 2.

The reel is surrounded when in elevated po-

sition by an annular casing, E, supported by a suitable frame or standard, and a revoluble cap or covering-plate, E′, is provided, which serves, in connection with the annular casing and reel-plate, to inclose the coil-receiving space to prevent the loss of heat from the rod. The rod is delivered into the interior of the case through the pipe *e* and tubular guide B′, which receives the rod directly from the rolls of the primary train and conducts it onto the reel, and by the revolution of the cap the rod is wound or coiled automatically as soon and as fast as it comes from the rolls *b b*, so that there will be no opportunity for the rod to loop out on the floor before it is coiled on the reel.

The portion of the guide or pipe by which the rod is delivered into the coil-receiving space is preferably formed with a backward spiral curve, so that the direction given to the rod as it comes out of the guide will approximately conform to the circle of revolution or to the curve in which the coils are intended to lie.

The term "automatic" or "automatically," as herein used, implies that the rod is reeled without handling, the rod as it issues from the primary rolls being by its own impulse delivered to the receiving-space, and the reeling apparatus being operated in unison with said rolls to immediately and in accord with the delivery effect the coiling action, so that the rolls *b b* will deliver and the reeling apparatus will coil the rod at substantially the same relative rates of speed at the commencement and throughout the entire length of the rod. To effect this in a practical manner the reel mechanism may be driven by the same motor, or by gearing from the roll-operating shaft, or by belts and pulleys arranged for driving the reel apparatus in connection with the primary train or at properly corresponding speed.

The reeling apparatus for automatically winding the rod direct from the primary train, in addition to its capacity for retaining the inherent heat of the rod, may be provided with facilities for augmenting or increasing the heat at this stage of the operation; but as this special construction of the reel forms the subject-matter for a separate application for Letters Patent it is not necessary to describe it more definitely herein.

The device for raising and lowering the reel, as herein shown, consists of a screw-thread formed on the elevating-column and a nut fitted thereon to be operated by a suitable gearing, as indicated in Fig. 2. I do not, however, confine my invention to this particular construction of lifting device.

In lieu of making the reel apparatus with a revoluble cap-plate for coiling the rod onto a stationary reel, the equivalent coiling action may be attained by making the reel revoluble and the cap-plate stationary, or revolving both the reel and cap, each at half-speed. The annular casing E may also, if desired, be made removable.

Any suitable stop or brake device may, if desired, be employed for holding the reel stationary or retarding its motion to a greater or less degree when coiling or uncoiling the rods. A single supplemental train can be used, or two or more supplemental trains may be employed, for extending the reduction, rounding up, and finishing the rods. Said supplemental trains may each be constructed and arranged as illustrated in Figs. 2 and 3, with grooves or passes in the several rolls for imparting to the rod the sectional forms respectively indicated in Figs. 5, 6, 7, 8, and 9, or such other forms as may be preferred.

Two or more reels may be employed, as required, for alternately receiving and automatically winding up the rods from the train B and to facilitate feeding them therefrom to the several supplemental trains. Said reels may be fixed or movable in position, as is most convenient for receiving and delivering the rod from and to the respective rolling mechanisms.

With two reels a double guide may be employed, with a switch for alternately directing the rods to the right or left reel, from one of which a rod can with facility be fed to the supplemental rolling-train C or C′ while a succeeding rod is being rolled in the primary train and automatically coiled on the other reel.

The leading pair of rolls in the supplementary train C C′ are adapted for rectifying the size and section of the rod, and are furnished with grooves that give a pass of substantially the same size and form as the pass of the last pair of rolls, *b b*, of the primary train B, so that said leading pair of rolls act on the finned or overstocked portions of the rod, (see section, Fig. 4,) to reduce it to normal size and unfinned condition (see sections, Fig. 5) before it passes onward to the subsequent reduction and finish in the latter rolls of the train.

In the construction of my supplemental trains I do not confine myself to the use of pairs of rolls; but sets of three or more rolls may be substituted for any of the pairs, as may be found desirable; nor do I confine myself to the use of what is called a "continuous" mill for a primary train. I have in a separate application for Letters Patent described a system of rolls in which sets of rolls having three or more rolls in a set are employed, which system might be applied for use in connection with the intermediate automatic reeling apparatus herein set forth.

For coiling the finished rods secondary reels H are provided. The winding part of said reels may be of any suitable form. In front of the reel is a bell-mouthed guiding-horn, I, stationary and supported, for directing the end of the rod to the winding-forks of the reel. A curved swinging guide, J, is pivoted to the mill-frame at *i* in proper position to receive the end of the rod as it leaves the rolls, while the rear end of said guide is adapted to traverse laterally to or from the mouth of the horn I,

as indicated, so that it can direct the rod into the horn and thence to the reel, or can direct it past the end of the horn onto the floor, for distributing the overfeed in loops. A suitable handle may be attached to the guide J, for enabling the operator to move it back and forth, as desired; or, if preferred, the guide may be connected to be moved by the driving-power. The end of guide J is placed at the mouth of the horn, in position, as shown in full lines, Figs. 3 and 4, to conduct the end of the rod to the reel H, and it is then moved away from the horn, (see dotted lines, Fig. 3,) to allow the overfeed to distribute itself in loops about the floor, as indicated in Fig. 1.

If preferred, an automatic reel may be substituted for the final reel H, for coiling the finished rods as they are delivered from the secondary train.

The method of operation of my improved apparatus is as follows: The bar or billet, having been heated in the furnace A, is passed through the rolls of the primary train B, and is by such rolls, in their respective order, reduced to a size of about No. 6 wire-gage (more or less) at the last pair of rolls, *b b*, from which rolls the rod passes direct and automatically, without any handling by an attendant, into the reeling apparatus D D', and is wound up without looping out or overfeed distributed between the rolls and the reel. The rod is inclosed and protected, so that its heat is maintained by the inclosing-casing; or the heat may be increased by the combustion of gas in contact with the casing or introduced through suitable gas-ports, as set forth in my separate application for patent above referred to, or in other suitable manner.

In my intermediate reel or coiling mechanism the rod is received and coiled at the same speed and as fast as it issues from the rolls of the primary train, the rod being deposited, laid, or coiled in its entire length outside the fingers, spokes, or drum of the reel; and it is not necessary to stop or retard the motion of the coiling mechanism in order to introduce the end of the rod within the spokes or drum or to form a short bend or bight at the leading end of the rod in order to secure it to the reel to insure its proper coiling; but the action being automatic, the coiling results without interruption or attention; hence a great saving of time, labor, and heat results from my improvements. When the rod is all coiled the reel may be lowered, as indicated in dotted lines, Fig. 2, to permit convenient access to the coil and facilitate the uncoiling thereof. The further reduction of the rod is effected by passing it through one of the supplemental trains, the end of the rod last wound onto the reel being introduced to the leading rolls of the train and the rod run through in reverse order from that in which it was run through the primary train.

In the supplemental train the end of the rod is entered between the rolls or pass-guides with the finned edges up and down, and the first rolls thereof rectify the overstocked section, Fig. 4, of the end to correspond with the proper section, Fig. 5, of the main part of the rod; and from these first rolls the rod proceeds in order through its further reduction and to its finished condition, and is then wound or coiled upon the final reel H.

I am aware that wire-rolling mills have been heretofore patented in which more than a single supplemental train was described; but such trains are without means for the automatic intermediate coiling of the rod to be fed to them from the reel or reels. I am also aware that means for reeling wire-rods at an intermediate stage of their reduction have heretofore been invented; but in none of such machines, so far as I have knowledge, does the apparatus provide for the automatic coiling and the delivery of the rod to a secondary rolling train.

It will be understood that I do not herein claim, broadly, the use of a supplemental train (one or more) with a primary train of rolls for making wire-rods; neither do I claim, broadly, the use of a reel at an intermediate stage of the process, except such reel apparatus provides for coiling or winding the rods automatically or at the same speed as they come from the rolling mechanism, and for uncoiling the rod to be fed to a secondary train.

What I claim as of my invention, and desire to secure by Letters Patent, is—

1. In combination, a primary train of reducing-rolls, a finishing or supplementary train of rolls, a coiling mechanism intermediate to said train of rolls, and mechanisms to deliver the rod to the coiling device and cause it to be coiled at the same speed while traveling as that at which it issues from the rolls.

2. In combination, a primary train of rod-reducing rolls, a secondary train or set of rolls, a coiling device intermediate to said trains and provided with mechanism to deliver the rod to said coiling device and cause it to be coiled while traveling at the same speed as that at which it issues from the rolls, and mechanism to facilitate unwinding the rod for feeding it to said secondary train, substantially as hereinbefore set forth.

3. In combination, a primary train of reducing-rolls, a finishing or supplementary train of rolls, an automatic reeling mechanism intermediate to said primary and supplemental rolling-trains, adapted for coiling the hot rod at a speed corresponding to that at which it is delivered, and a guide arranged for receiving the rod directly from the primary rolls, conducting it to and delivering it into the receiving-space of the reeling mechanism, substantially as hereinbefore set forth.

4. In combination, a primary train of reducing-rolls, a supplemental train of rolls, an intermediately-located rod-coiling mechanism, and a rod-conducting guide leading from the primary train to the receiving-space of the coiling mechanism, provided with a rotating end section for directing and depositing the hot rod automatically in coils therein, sub-

stantially as set forth, whereby the coiling is effected without the leading end of the rod being gripped or secured to the reel.

5. The combination, with the primary train of rolls and one or more supplementary series of rolls, of an intermediately-located automatic reel having a revoluble cap and guide for delivering the rod from the last pair of the primary train of rolls upon said reel, an inclosing-case for maintaining the heat of the rod, and apparatus for elevating said reel into said case for receiving said rod and lowering the reel to a convenient position for feeding the rod therefrom to the supplementary series of rolls, substantially as set forth.

6. The combination, substantially as described, of a primary train of reducing-rolls, a plurality of coiling mechanisms having inclosed space for receiving a hot rod as it comes from said rolls and for automatically coiling the same at a speed corresponding to that at which it issues from the primary rolls, a guide-switch and guides leading from said rolls to the respective receiving-spaces of said reeling mechanisms, a plurality of finishing or supplemental trains of rolls, as C C', secondary reels for automatically receiving and winding up the finished rods, and guides leading from the finishing-rolls to said final reels, as set forth.

7. In combination, substantially as decribed, a primary continuous train of reducing-rolls, an intermediate automatic reeling mechanism adapted for coiling the rod as fast as it issues from said primary train of rolls and for retaining the heat thereof, and a supplemental train of rolls, the leading-rolls in which are constructed for depressing fins or rectifying the size and section of the rod as it comes from the intermediate reeling mechanism and before its final reduction in said supplemental train, as set forth.

8. The combination of a primary set or train of rod-reducing rolls, an automatic rod-coiling mechanism, means for operating said coiling mechanism in connection with or by the same motor as said primary rolls for coiling the rod as fast as it issues therefrom, and a supplemental set or sets of reducing or finishing rolls, substantially as set forth.

9. In combination, a primary train of reducing-rolls, a plurality of supplemental sets or trains of rolls, intermediately-located automatic coiling mechanism operated in unison with or by the same motor as said primary train, for coiling the rods as they issue from the rolls of said primary train, and an inclosing-case for maintaining the heat of the rod, from which the reel can be removed preliminary to the delivery of the rod to the supplemental sets of rolls, substantially as set forth.

10. The combination, with the finishing-rolls in a wire-rod-rolling mill, of the laterally-curved traversing guide J, the directing-horn I, and the final reel H, substantially as and for the purpose set forth.

11. In combination, a primary train of reducing-rolls, an intermediate automatic reeling mechanism adapted for coiling the rods as they issue from said primary train, and a supplemental train composed of a pair (or pairs) of rolls combined with a set (or sets) of rolls having three or more rolls in a set.

EDWIN S. LENOX.

Witnesses:

H. BRONSON,

D. L. PRINCE.