(No Model.)

3 Sheets—Sheet 1.

C. H. MORGAN & V. E. EDWARDS.

ROLLING MILL PLANT.

No. 600,335. Patented Mar. 8, 1898.

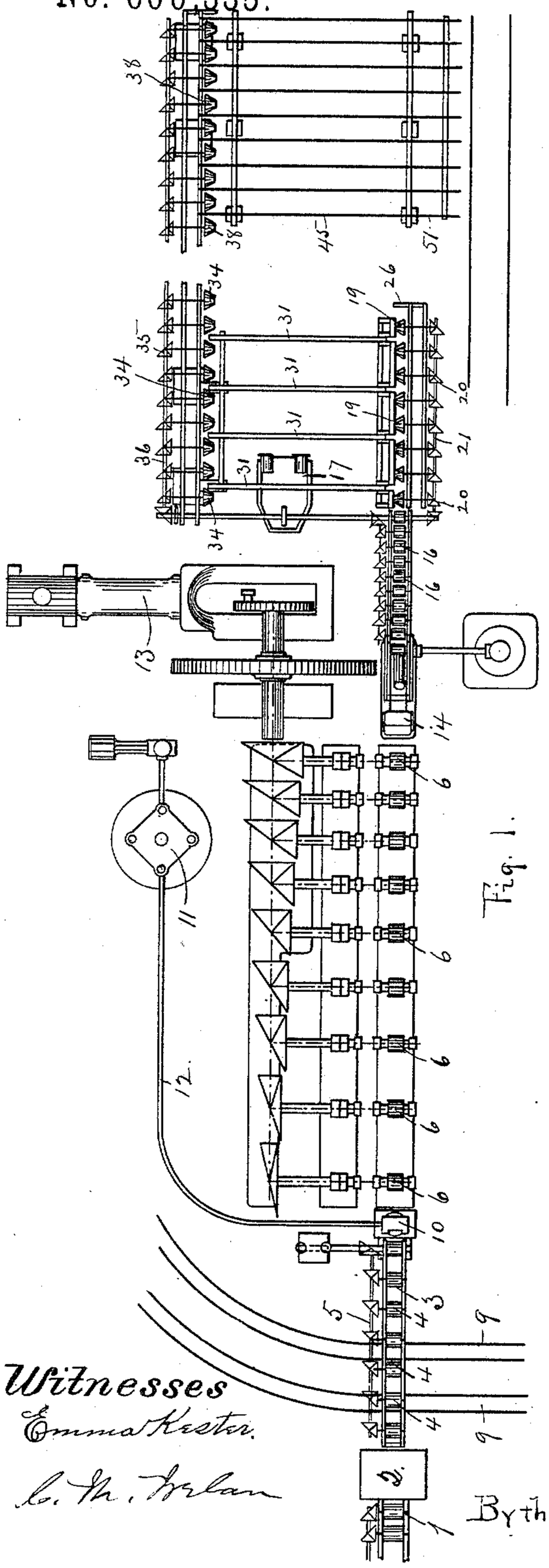

Fig. 1.

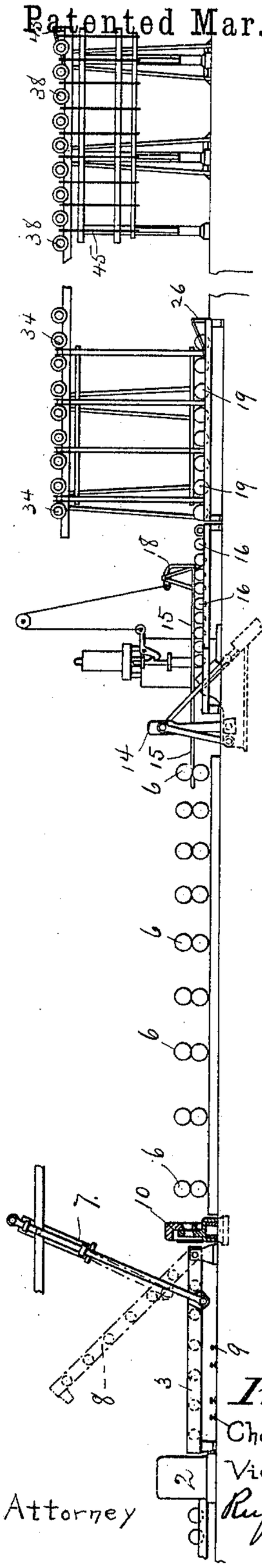

Fig. 2.

Witnesses

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(No Model.)

3 Sheets—Sheet 2.

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Fig. 5.

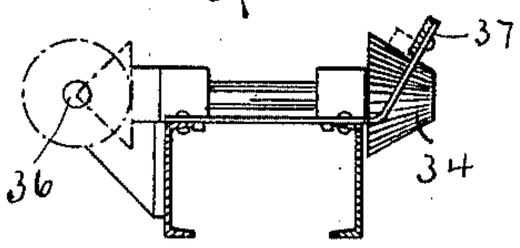
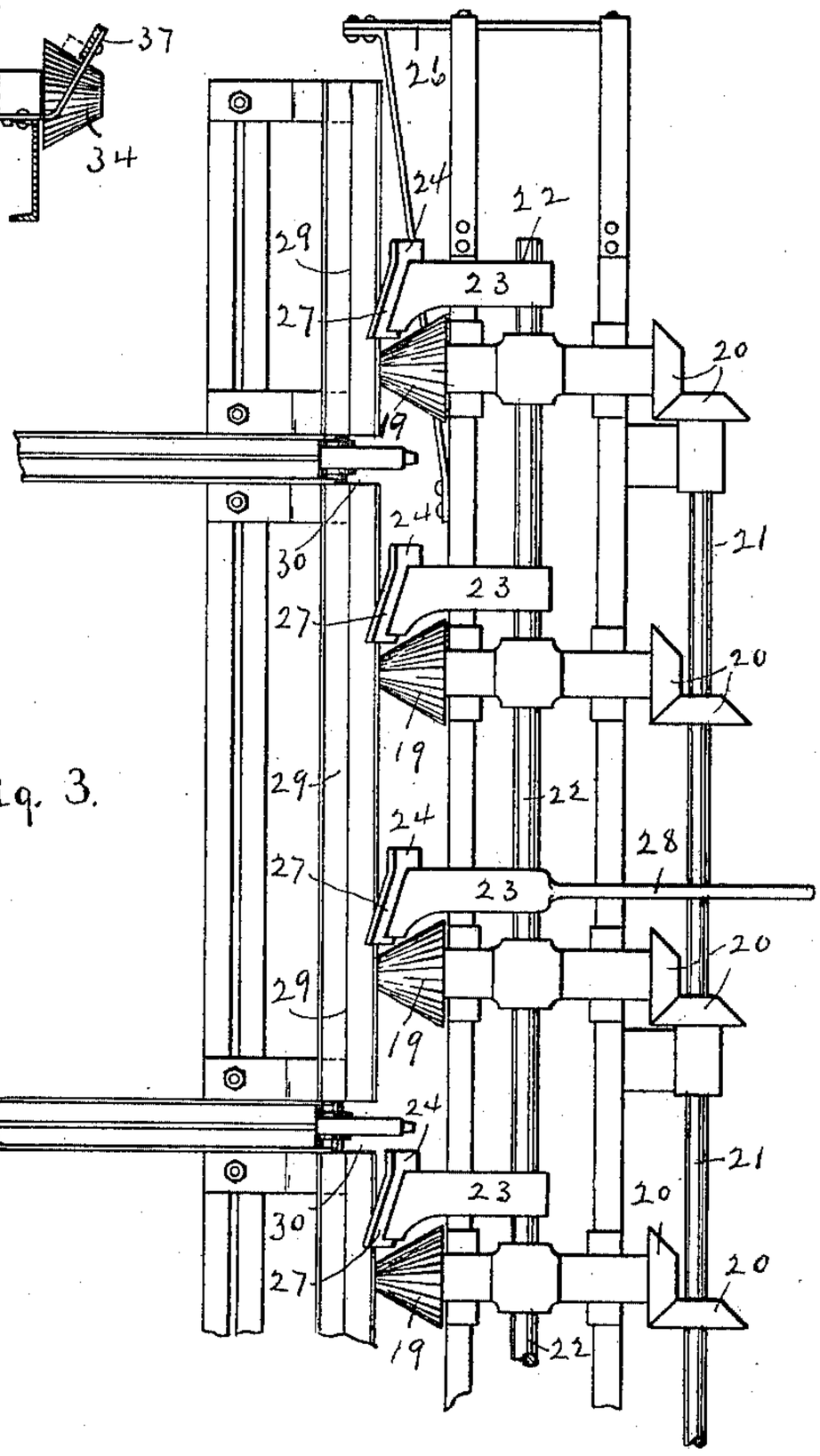


Fig. 3.



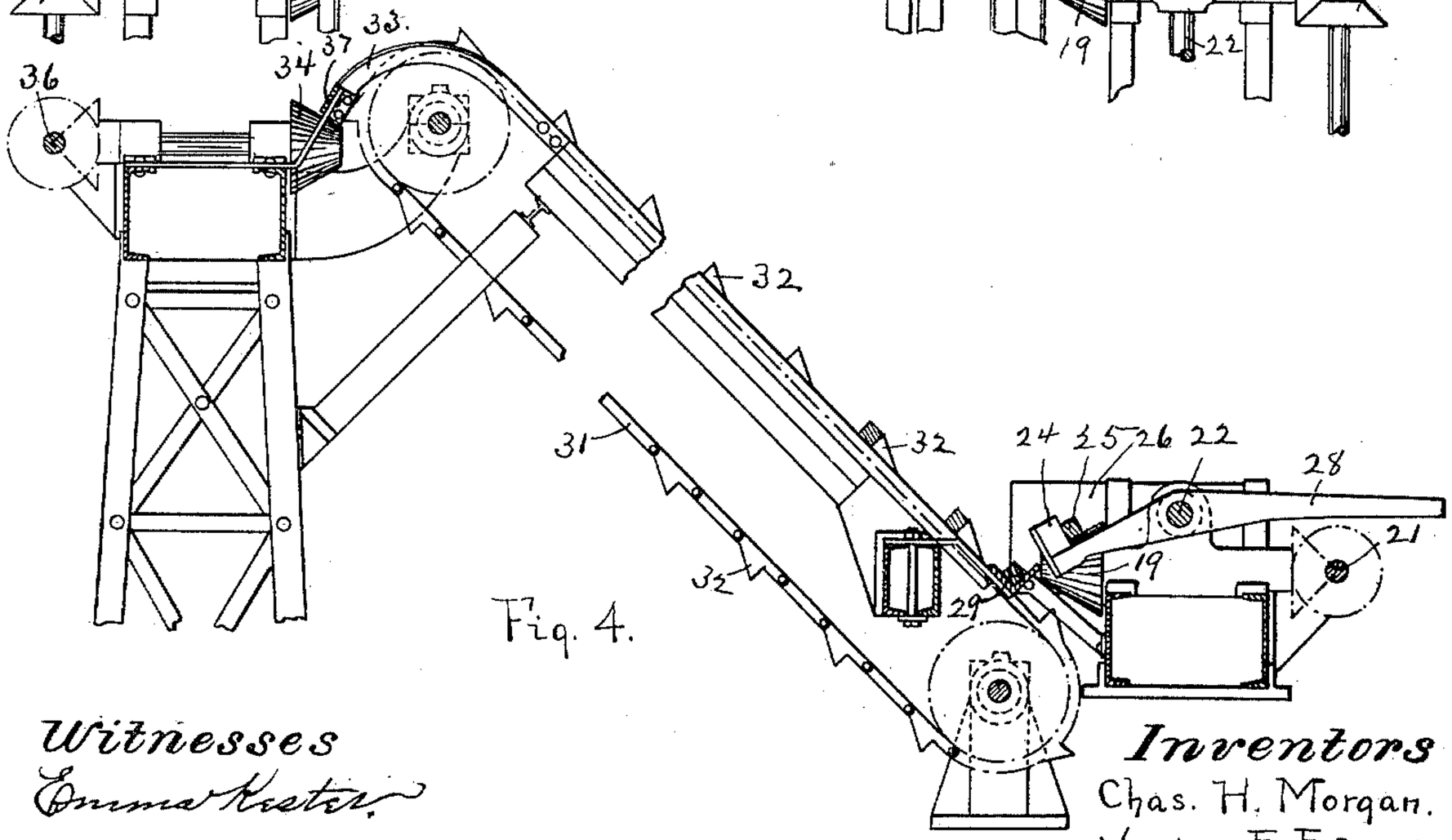


Fig. 4.

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3 Sheets—Sheet 3.

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ROLLING MILL PLANT.

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Fig. 6.

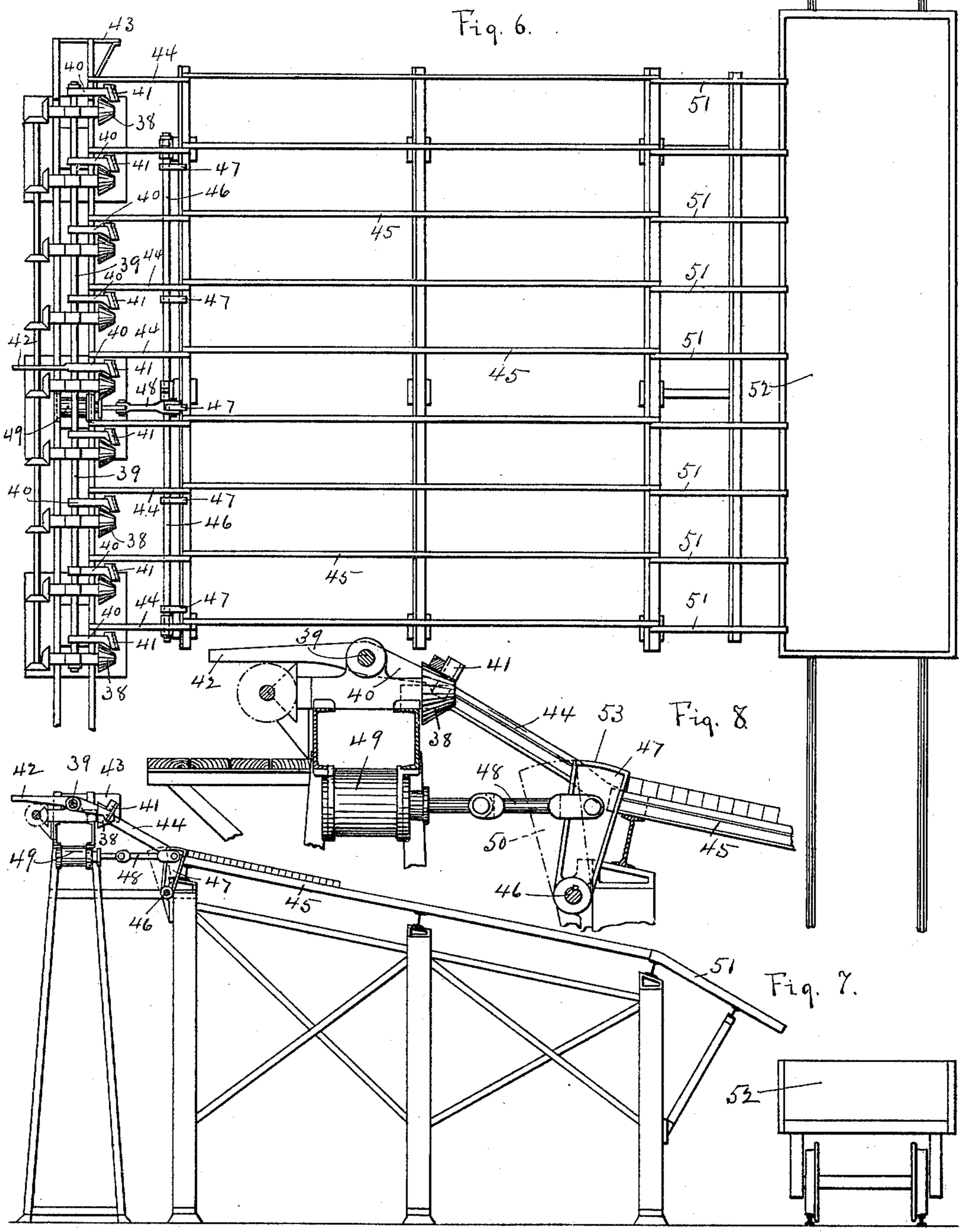

Fig. 8

Fig. 7.

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UNITED STATES PATENT OFFICE.

CHARLES H. MORGAN AND VICTOR E. EDWARDS, OF WORCESTER, MASSACHUSETTS, ASSIGNORS TO THE MORGAN CONSTRUCTION COMPANY, OF SAME PLACE.

ROLLING-MILL PLANT.

SPECIFICATION forming part of Letters Patent No. 600,335, dated March 8, 1898.

Application filed July 23, 1895. Serial No. 556,933. (No model.)

To all whom it may concern:

Be it known that we, CHARLES H. MORGAN and VICTOR E. EDWARDS, citizens of the United States, and residents of Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Improvement in Rolling-Mill Plants, of which the following is a specification, accompanied by drawings forming a part of the same, in which—

Figure 1 represents a plan view of a rolling-mill plant embodying our invention. Fig. 2 is a side elevation of the same. Fig. 3 is a plan view representing portions of the conveyer by which the product of the mill, after having been cut into suitable lengths, is conveyed away from the reducing-rolls, the portions being represented upon a larger scale than shown in Fig. 1. Fig. 4 represents an end view of the lower series of conical rolls upon which the rails or bars are delivered from the reducing-mill, the elevator-chain by which they are raised, and the upper series of conical rolls upon which they are delivered by the elevator-chain. Fig. 5 represents one of the upper series of conical rolls and the stationary guide-rail shown in transverse sectional view, representing one of the rails or bars in broken lines resting upon the roll. Fig. 6 is a plan view of the cooling-bed and conical conveyer-rolls from which the rails are delivered to the cooling-bed. Fig. 7 is an end view of the same; and Fig. 8 represents one of the conveyer-rolls shown in Figs. 6 and 7 with the pushing mechanism by which the rails are pushed along upon the cooling-bed, the parts being shown in Fig. 8 upon a larger scale than in Figs. 6 and 7.

Similar numerals refer to similar parts in the different figures.

The object of our invention is to provide a rolling-mill plant capable of rolling a large ingot or bloom into a finished product of comparatively small area in its cross-section—such, for example, as rails, bars, &c.—without requiring a subdivision of the ingot or bloom until its reduction is completed.

It is the present practice, so far as we know, to reduce the large ingot by means of a roughing-mill, cut off the first end, subdivide the balance into shorter lengths, and then reroll the several pieces, which are again subdivided into the desired lengths of the finished product. Each rolling renders the ends of the rolled piece imperfect, and these imperfect ends, known as "crop ends," have to be removed before the piece is again rolled. The subdivision of the piece into definite lengths usually leaves a remainder, known as a "short," and it is the purpose of our present invention to avoid the loss occasioned by the cutting off of crop ends and the formation of shorts due to the subdivision of the ingot or bloom before it enters the finishing-mill, and for the accomplishment of this purpose our invention consists in the combination, with a roughing-mill by which the first reduction of the ingot is effected and a fixed shear, of a reducing or finishing mill having a flying shear at its entrance end capable of cutting the last crop end from the piece while in motion and a flying shear at the delivery end of the finishing-mill capable of subdividing the product of the finishing-mill into predetermined lengths, together with actuating mechanism by which the shear is set in motion at stated periods during the passage of the bar or rail, so as to cut the same into definite and uniform lengths; and our invention further consists in providing a conveying-mechanism by which the severed lengths are removed from the finishing-mill, said conveyer being hereinafter fully described, and the features embodying our invention specifically pointed out in the annexed claims.

Referring to the accompanying drawings, Figs. 1 and 2 represent a rolling-mill plant in plan and side elevation, respectively, embodying our present invention, in which 1 denotes a portion of the roughing-mill of the usual and well-known construction.

2 denotes a fixed shear such as is now used in roughing-mills for subdividing the bloom into several pieces.

3 denotes a feed-table consisting of a framework containing a series of rolls 4, all operatively connected with a rotating driving-shaft 5, by which the rolls are positively rotated, causing the severed pieces to be conveyed from the shear 2 to a finishing-mill, consisting of a series of reducing-rolls 6. The framework of the feed-table 3 is preferably

pivoted at one end and operatively connected in the usual manner with a hydraulic lifting apparatus 7, Fig. 2, by which it can be raised from a horizontal into an elevated position, as indicated by the broken lines 8, in order to allow the pieces to be delivered from the shear directly upon a car standing upon a railway-track 9.

The roughing-mill 1, fixed shear 2, and feed-table 3, with its hydraulic lift 7, are now in use, and therefore we have not deemed it necessary to give a detailed description, as their construction will be known and understood by those conversant with the construction of rolling-mill plants.

Between the feed-table 3 and the rolls 6 of the finishing-mill we place a flying shear 10, or shear capable of cutting a bar or rail while in motion. Said shear 10, as represented in plan view in Fig. 1 and in central sectional view in Fig. 2, is constructed like the shear forming the subject of the application of said Victor E. Edwards, Serial No. 555,899; but in place of the shear therein described any known shearing mechanism suitable for the purpose can be employed. The shear 10 (represented in Figs. 1 and 2) is driven by a water-pressure derived from an accumulator 11 through a pipe 12. The rolls 6, constituting the finishing-mill by which the bloom is reduced into the form of the finished product, are driven by suitable connecting mechanism by an engine 13. At the delivery end of the finishing-mill we place a second flying shear 14, or shear capable of cutting the rail or bar while in motion, said shear 14 being of the same construction as that described in the Letters Patent of the United States No. 505,512, granted to Victor E. Edwards September 26, 1893; but any form of flying shear suitable for the purpose can be used. The end of the rail 15 as it leaves the finishing-mill is projected upon the feed-table, consisting of a series of rolls 16, rotated through connected mechanism by an engine 17. Interposed in the path of the advancing rail 16 is a pivoted finger 18, so connected with the actuating mechanism of the flying shear 14 that the contact of the end of the rail with the pivoted finger will serve to set the shear 14 in motion, as fully shown and described in the application of said Edwards, Serial No. 556,093, by which the continuous rail as it is delivered from the finishing-mill is cut into predetermined lengths and delivered to the conveying mechanism hereinafter described.

The operation of so much of the rolling-mill as we have described above is as follows: The ingot is reduced in the usual manner by the roughing-mill 1 and its first crop end cut off by the fixed shear 2. The bloom in its full length is then conveyed across the feed-table 3 to the rolls of the finishing-mill, presenting a solid end to the first pair of the series of rolls 6. The ingot is reduced to the desired area in its cross-section by finishing-rolls, being delivered in one continuous length by the last pair of rolls in the finishing-mill, and as the last end of the piece is entering the finishing-mill the flying shear 10 is set in operation by the attendant to cut off the last crop end of the piece to prevent it from going through the finishing-mill. The continuous rail or bar as delivered from the finishing-mill has its first crop end cut off by the second flying shear 14, which is set in motion for the purpose by an attendant, and as the rail passes over the feed-table its advancing end comes in contact with the pivoted finger 18, by which the flying shear 14 is again set in motion, cutting the rail into a definite and predetermined length, the operation of the shear 14 being repeated at each contact of the advancing end of the rail with the pivoted finger 18.

By the above operation the bloom as it is delivered from the rolling-mill is reduced to the desired area without any previous subdivision, thereby avoiding the consequent loss in crop ends and shorts and also avoiding the increased cost in the reduction of the ingot due to the cooling of the metal during the subdivision of the ingot. The plant is also rendered extremely compact for the reason that the length of the table upon which the rail is delivered from the finishing-mill requires to be no longer than the desired length of the finished product.

The construction and arrangement of the flying shear 14, pivoted finger 18, and the operative connection of said finger with the actuating mechanism of the shear are fully shown and described in the application of said Edwards, Serial No. 556,093.

It is obvious that the severed pieces of rail can be delivered from the rolls 16 upon a car, if desired; but our invention further contemplates the removal of the severed pieces by means of a conveyer. (Represented upon a larger scale in Figs. 3 to 8.) Referring to Fig. 3, 19 denotes a series of conical or tapered rolls carried upon the ends of shafts which are driven by the bevel-gears 20 from a driving-shaft 21, said rolls 19 being placed in alinement with the rolls 16 of the feed-table, so that the severed rail as delivered by the rolls 16 will be moved over the tapering surface of the conical rolls 19. Journaled above the shafts of the conical rolls 19 is a rocking shaft 22, to which are attached a series of arms 23, carrying upon their free ends guide-plates 24, which project above the plane of the tapered surface of the rolls 19, so as to form a support for the rail as it rests upon the rolls 19 and hold it from sliding down the tapered surface of the rolls. In Fig. 4 a rail is represented in sectional view at 25 as it lies in position upon the tapered surface of the rolls 19 and is held by the guide-plates 24. At the end of the series of rolls 19 is a plate 26, which is held by the fixed framework of the machine and serves as a stop-plate to limit the movement of the rail as it is carried upon the rotating rolls 19. A portion 27 of the guide-plates 24 are inclined to the line of movement

of the rail, so that in case the advancing end of the rail should move down the tapered surface of the rolls it will strike the inclined section 27 and be moved back into its proper position. When the end of the rail strikes against the stop-plate 26, the shaft 22 is rocked by means of the lever-handle 28, thereby depressing the arms 23 and guide-plates 24, allowing the rail which rests upon the surface of the rolls 19 to slide off and be caught in the angular trough 29. The trough 29 is divided at intervals, as at 30, Fig. 3, to allow the passage of an endless chain 31, provided with lugs 32, which lift the rails from the angular trough 29 and carry them over upon the curved track 33, from which they fall upon the tapered surface of a series of conical rolls 34, supported upon a suitable framework in an elevated position and driven by the bevel-gears 35 from a driving-shaft 36. The upper series of rolls 34 is provided with a fixed guide-plate 37, by which the rail is held from sliding off the rolls while it is being carried by the rotation of the rolls forward upon a second series of elevated rolls 38. The second series of elevated rolls 38, like the first series 19, is provided with a rocking shaft 39, carrying arms 40 and guide-plates 41, said shaft having a lever-handle 42, by which the rail is released and allowed to slide off the tapered surface of the conical rolls 38. A stop-plate 43 is provided at the end of the series of rolls 38 to limit the forward movement of the rail and hold it at rest while the shaft is rocked, allowing the rail to be delivered from the rolls 38 upon the inclined skids 44, from which the rail slides by its own weight upon a cooling-table 45, consisting of an open framework preferably having a slight inclination. Journaled in suitable bearings beneath the inclined skids is a rocking shaft 46, carrying the arms 47, connected by a link 48 with a motor 49, by which a rocking motion is imparted to the shaft 46, whereby an oscillating movement is given to the arms 47, carrying them from the position shown by solid lines in Fig. 8 to that indicated by broken lines 50 in said figure. The rails as they are delivered from the conical rolls 38 slide by their own weight down the inclined skids 44 and come to rest upon the inclined cooling-table 45, and the oscillating arms 47 serve to push the rails forward upon the cooling-table at each forward movement of the arms, the rearward movement of the arms carrying them below the surface of the skids 44, as represented by the broken lines 50, Fig. 8. As the series of rails are pushed along upon the cooling-bed 45 they are delivered over the inclined skids 51 upon a car-body 52 or other receptacle. The pushing-arms 47 have their upper or free ends curved in the arc of a circle, as at 53, concentric with the rocking shaft 46, so that as the rails are delivered upon the inclined skids 44 they will not prevent the rearward oscillating movement of the arms 47, as the curved end 53 will pass under the rail into the position indicated by the broken lines 50.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The combination of a pair of cutting mechanisms each capable of moving with the metal during the operation of cutting, a series of reducing-rolls forming a continuous mill interposed between said cutting mechanisms by which the metal is withdrawn from the first of said cutting mechanisms and is fed to the second of said cutting mechanisms and means for automatically actuating said second cutting mechanism at stated periods relatively to the speed of said reducing-rolls, whereby an ingot is reduced to rods or rails of a predetermined length without reheating, handling, or intermediate subdivision, substantially as described.

2. In rolling-mill apparatus the combination of a series of rolls arranged to act consecutively upon a rail or rod, cutting mechanisms capable of moving with the rail or rod arranged at opposite ends of said series of rolls and in alinement therewith, said rolls serving as a feeding mechanism for both of said cutting mechanisms, substantially as described.

3. In rolling-mill apparatus the combination of a cutting mechanism capable of moving with the metal during the operation of cutting, a series of reducing-rolls arranged to act consecutively upon the metal and forming a continuous mill with the first pair of rolls in said series arranged to receive the metal directly from the cutting mechanism, of a second cutting mechanism capable of moving with the metal during the operation of cutting and arranged to receive the metal directly from the last pair of rolls in the series of rolls, said rolls and said cutting mechanisms being capable of simultaneous action upon a continuously-moving rod or rail, substantially as described.

4. In rolling-mill apparatus the combination of a cutting mechanism capable of moving with the metal during the operation of cutting, means for automatically actuating said cutting mechanism at stated periods, and a series of reducing-rolls forming a continuous mill arranged to act upon the metal simultaneously with said cutting mechanism, whereby the metal is fed to the cutting mechanisms by said reducing-rolls and cut into predetermined lengths by a continuous operation, substantially as described.

5. In a rolling-mill plant, a rail or bar conveyer, consisting of a series of rolls, upon which the roll or bar is delivered, and having their upper surfaces inclined to allow gravity to slide the rail or bar off the ends of said rolls, and a removable guide-plate bearing against the rail or bar, arranged to hold the same against gravity, substantially as described.

6. In a rail or bar conveying apparatus, the

combination of a series of rolls upon which the rail or bar is delivered from the rolling-mill having their upper surfaces inclined to allow gravity to slide the rail or bar off the ends of said rolls, a movable guide arranged to support a rail against gravity on said rolls and means for moving said guide in order to release the rail or bar, substantially as described.

7. In a rail, or bar, conveyer, the combination of a series of rolls having their upper surfaces inclined, a rocking shaft, a series of arms carried by said rocking shaft, guide-plates carried by said arms and arranged to form with said rolls a support for a rail, or bar, and a lever-handle by which said shaft is rocked and said guide-plates moved to allow said rail, or bar, to slide off said rolls, substantially as described.

8. In a rail, or bar, conveyer, the combination of a series of rolls having their upper surfaces inclined, a movable guide-bar arranged to form with said rolls a support for a rail, or bar, a pocket in which a rail or bar is delivered by the removal of said guide-bar, and an elevator-chain by which said rail, or bar, is raised into an elevated position, substantially as described.

9. In a rail or bar conveyer, the combination of a series of rolls having their upper surfaces inclined, movable guide-plates arranged to hold a rail or bar from sliding off said rolls, a pocket to receive the rail or bar, as it is delivered from said rolls, means for elevating the rail, or bar, means for moving the rail or bar endwise, a series of rolls having their upper surfaces inclined, and movable guides arranged to hold the rail or bar from sliding off said rolls, and a cooling-table upon which the rail, or bar, is delivered, substantially as described.

10. In a rolling-mill plant, the combination with an inclined cooling-table and inclined skids, of a pushing mechanism by which the rails or bars are successively pushed along said cooling-table, consisting of oscillating arms moving in the arc of a circle, whereby the rearward motion of said arms will carry them below the surface of said skids, substantially as described.

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HENRY W. FOWLER.
Witnesses to V. E. E.:
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ANNETTA C. WEBB.