(No Model.) 6 Sheets—Sheet 1.

J. MORGAN, Jr.

FEEDING APPLIANCE FOR ROLLING MILLS.

No. 383,000. Patented May 15, 1888.

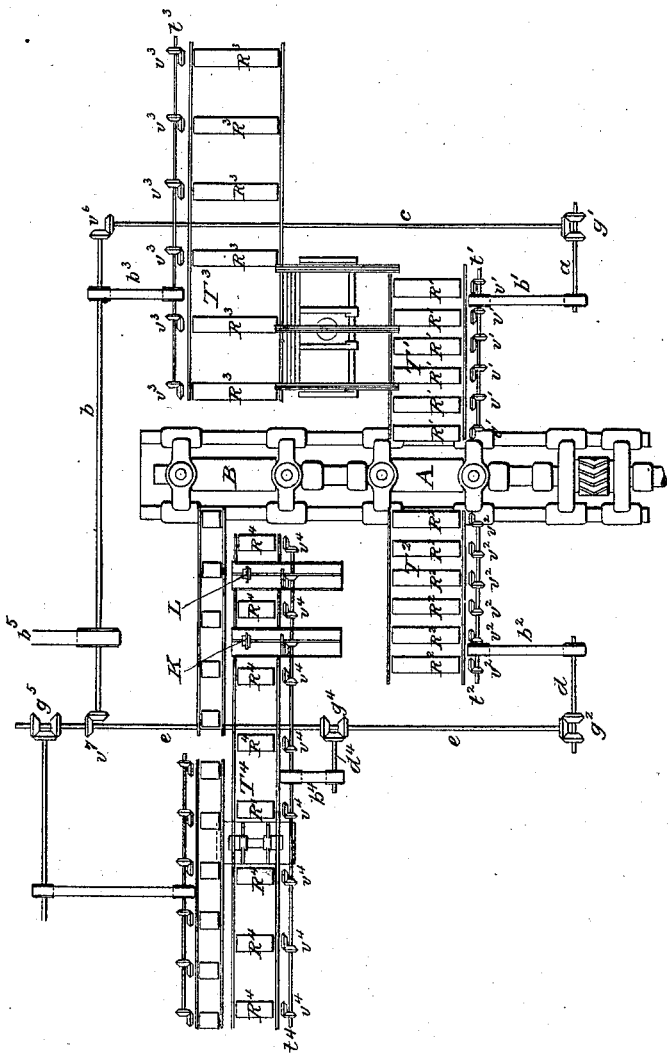

Fig. 1.

WITNESSES.

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FEEDING APPLIANCE FOR ROLLING MILLS.

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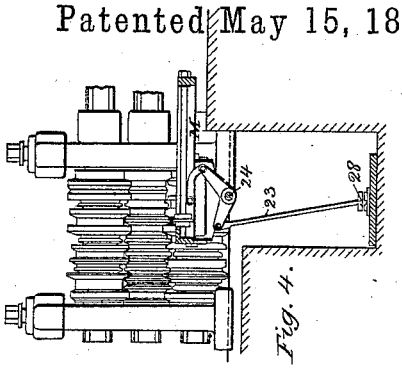

Fig. 4.

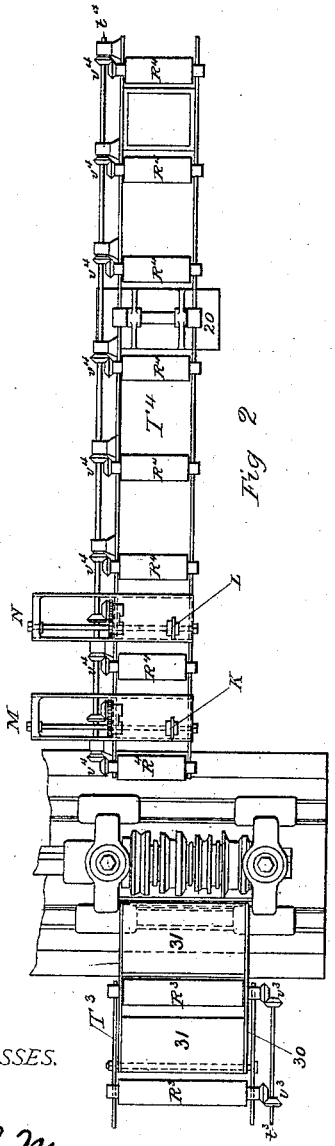

Fig 2

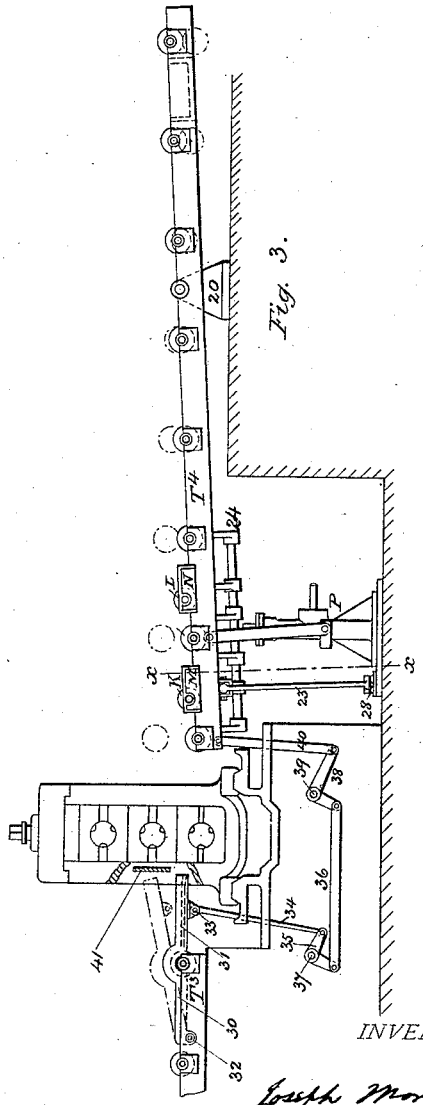

Fig. 3.

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(No Model.) 6 Sheets—Sheet 3.

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FEEDING APPLIANCE FOR ROLLING MILLS.

No. 383,000. Patented May 15, 1888.

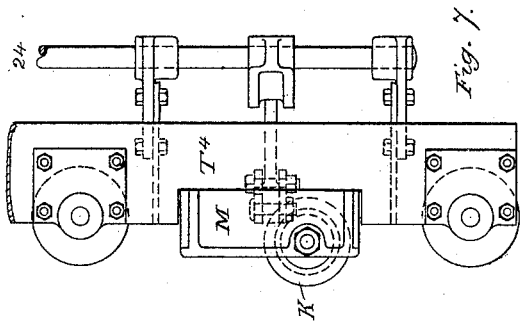

Fig. 7.

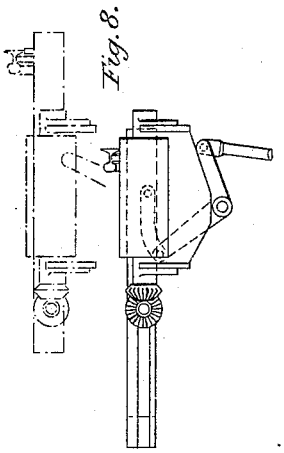

Fig. 8.

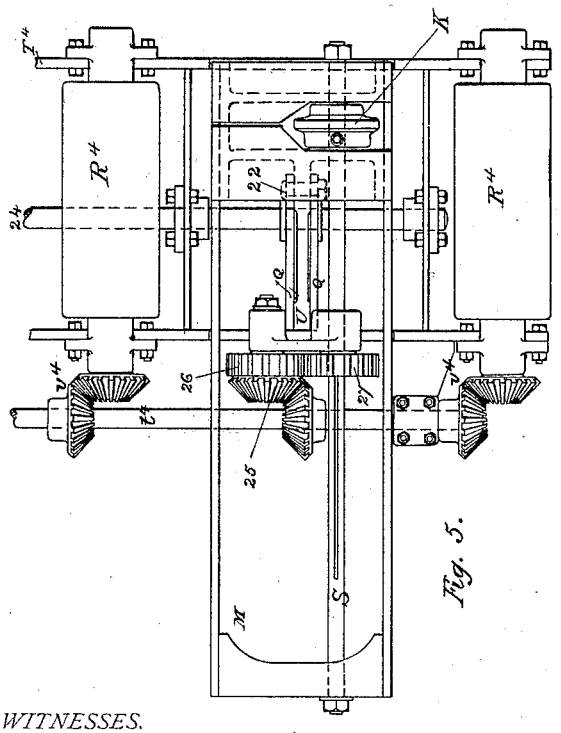

Fig. 5.

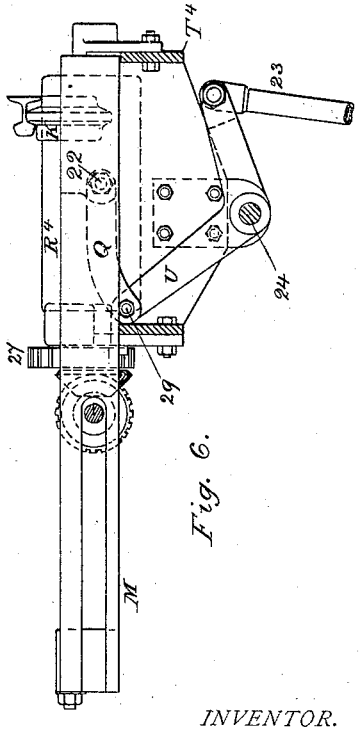

Fig. 6.

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(No Model.) 6 Sheets—Sheet 4.

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FEEDING APPLIANCE FOR ROLLING MILLS.

No. 383,000. Patented May 15, 1888.

Fig. 9.

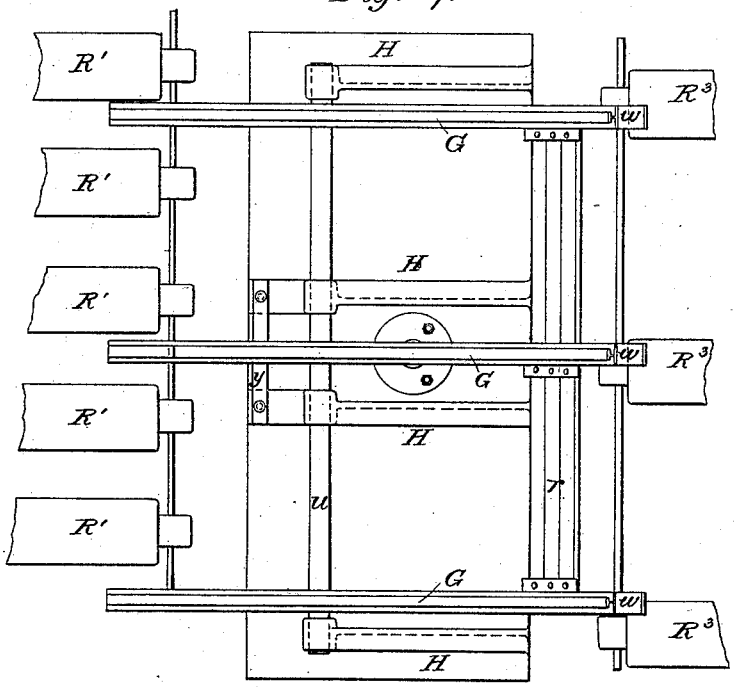
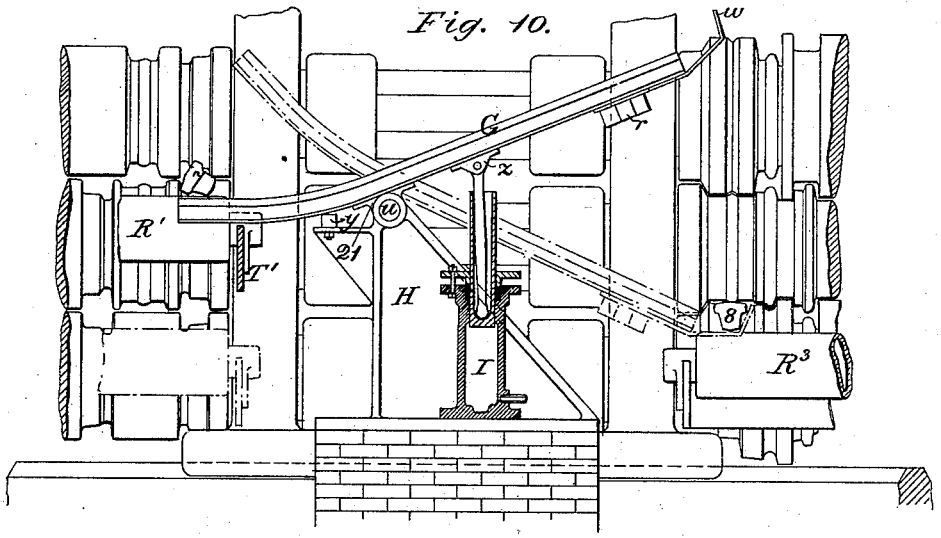


Fig. 10.



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FEEDING APPLIANCE FOR ROLLING MILLS.

No. 383,000. Patented May 15, 1888.

Fig. 15.

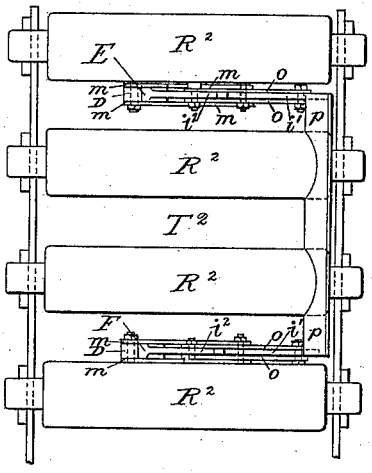
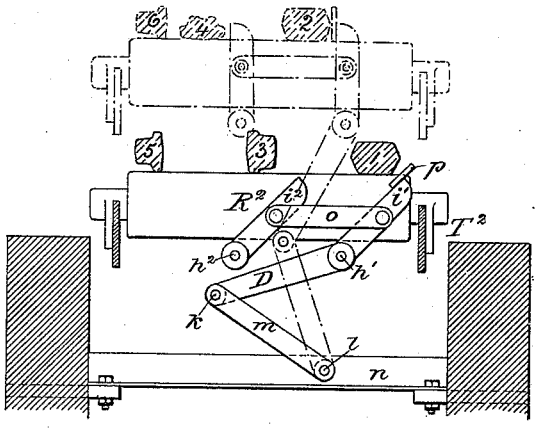


Fig. 11.



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(No Model.) 6 Sheets—Sheet 6.

J. MORGAN, Jr.

FEEDING APPLIANCE FOR ROLLING MILLS.

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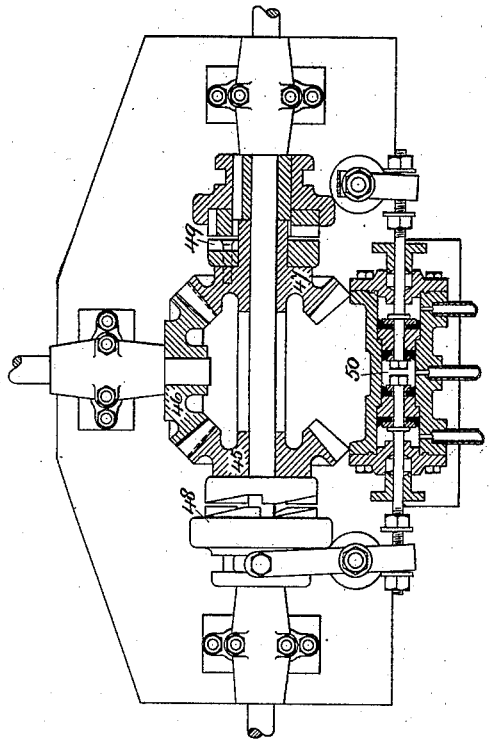

Fig. 12.

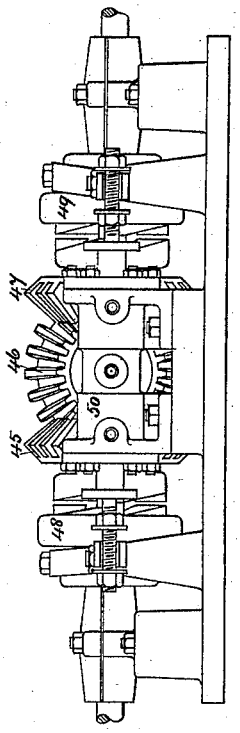

Fig. 13.

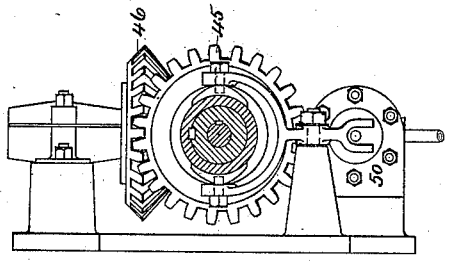

Fig. 14.

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UNITED STATES PATENT OFFICE.

JOSEPH MORGAN, JR., OF JOHNSTOWN, PENNSYLVANIA.

FEEDING APPLIANCE FOR ROLLING-MILLS.

SPECIFICATION forming part of Letters Patent No. 383,000, dated May 15, 1888.

Application filed October 3, 1887. Serial No. 251,354. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH MORGAN, Jr., of Johnstown, in the county of Cambria and State of Pennsylvania, have invented a new and useful Improvement in Feeding Appliances for Rolling-Mills; and I do hereby declare the following to be a full, clear, and exact description thereof.

My improvement is particularly adapted to rolling-mills of the usual three-high type on which railroad-rails and other long bars are rolled.

My improvement relates to such appliances, and its object is to facilitate the operation of rolling and to overcome the manifest objections to the so-called "automatic" mills heretofore in use.

To enable others skilled in the art to make and use my invention, I will now describe it by reference to the accompanying six sheets of drawings, in which—

Figure 1 is a plan view of a three-high train of rolls provided with my improvements, which consist of four tables and their attachments. Fig. 2 is a plan, on an enlarged scale, of the tables marked T^3 and T^4 on Fig. 1. Fig. 3 is a side elevation of the same. Fig. 4 is a section on line $x\,x$ of Fig. 3, looking toward the rolls. Fig. 5 is a detail of table T^4 in plan. Fig. 6 is an end elevation, and Fig. 7 a side elevation, of the same. Fig. 8 is a figure descriptive of the working of table T^4, showing relative positions. Fig. 9 is a plan of the "slide-over" from table T′ to table T^3. Fig. 10 is an elevation of the same. Fig. 11 is an elevation of table T^2, showing details of the "push-over" and "tilt" mechanism. Fig. 15 is a plan of the same. Figs. 12, 13, and 14 are respectively a plan, side elevation, and end elevation of the clutch I use to transmit motion to the feeding-rolls.

Like letters and figures of reference indicate like parts in these several figures.

As clearly shown in the drawings, the train consists of two berths of three-high rolls, (indicated by A and B.) As the construction of such a train is well known, the drawings are deemed to convey a sufficiently accurate description thereof.

T′ and T^2 are the tables used to feed the blooms and partly-rolled rails to the roughing-rolls A. They are fitted with driven and reversible feed-rollers, and are so connected together that they rise and lower in unison.

I will now describe the several parts and workings of tables T′ and T^2. (Fig. 1 is the most convenient figure for reference.)

R′ R′ R′ R′ R′ R′ are the feed-rollers of table T′.

$v'\,v'\,v'\,v'\,v'\,v'$ are pairs of bevel-wheels which drive aforesaid rollers, one wheel of each pair being attached to shaft t', which has its bearings attached to table T′ and rises and lowers with it.

a is a shaft free to revolve in fixed bearings.

b' is a belt transmitting motion from shaft a to shaft t'. As referred to horizontal levels, the shaft a is midway between the upper and lower position of shaft t', so that the belt is uniformly tight in both positions. This is not more fully illustrated, as it forms no part of my invention.

c is a shaft constantly driven in one direction. Motion is transmitted from shaft c to shaft a through the set of three bevel-wheels, g', which three bevel-gears form part of a reversing-clutch, which I will hereinafter describe.

b is a constantly-driven shaft, motion being transmitted from shaft b to shaft c by means of bevel-wheels v^6.

b^5 is the main belt, through which motion is transmitted to shaft b from some outward source.

$R^2\,R^2\,R^2\,R^2\,R^2\,R^2$ are the feed rollers of table T^2. They are driven in a similar manner to the rolls of table T′, and as follows: through bevel-wheels $v^2\,v^2\,v^2\,v^2\,v^2\,v^2$, shaft t^2, belt b^2, shaft d, bevel-wheels and clutch g^2, shaft e, wheels v^7, and shaft b.

Tables T′ and T^2 are raised and lowered simultaneously by means of the usual bell-cranks, links, and hydraulic pistons, the construction of which is so well known to mechanics that it is not deemed necessary to illustrate. As there is neither any novelty in the push-over or tilting mechanism I use on table T′, I have not shown such in the drawings; but the push-over and tilt mechanism which I use on table T^2 being novel and forming part of my invention I will now describe.

Referring to Figs. 11 and 15, it will be seen that there are two tilt and push-over mechanisms shown at E and F, Fig. 15—one for each

end of the bloom or partly-rolled rail. As these are alike in all their parts, a description of one of them will suffice for both.

D is a bent lever pivoted near its center at h' to the lifting-table T^2. One arm of this lever is connected by means of pivot k, link m, and pivot l to the stationary beam n. The other arm of the bent lever D is indicated by i' and forms the tilt and push-over proper.

R^2 is one of the rolls of table T^2.

It will be seen from Fig. 11 that the end of the arm i' of lever D is at the extreme end of the rolls when the table is in the lower position shown.

i^2 is an arm pivoted to the table at h^2, and connected to the arm i' of the lever D through the parallel bar o and suitable pivots, so that the arm i^2 is always maintained parallel to the arm i'. The functions of arms i' and i^2 are nearly the same; but they serve different passes of the rolls. The dotted lines show the uppermost position of the table with the corresponding position of the tilt and push-over levers. It will be readily understood how through the described connection they come to occupy this position. Though the two tilt and push-overs E and F, Fig. 15, are each complete in themselves, the arms i' of each are connected by a plate, p, the office of this plate being to not too much restrict the endwise position of the bloom while it is being tilted and pushed over.

1, 2, 3, 4, 5, and 6 are successive positions of the rolled piece while it is being acted on by the rolls of the mill.

Having described the several parts of the feeding-tables T' and T^2, I will now describe the successive operations of the same. It will be understood in this description that the feed-rollers R' R' R' R' R' R' and R^2 R^2 R^2 R^2 R^2 R^2 are operated to receive from and reversed to feed to the rolls by means of clutches g' and g^2, which I will hereinafter describe. The tables T' T^2 being in their lower position, the bloom is deposited on table T', and passed through the rolls and received on table T^2 in the position indicated by 1, Fig. 11. The tables are then raised. At the same time the arms, acting through the mechanism described, move to the dotted position shown, thus pushing the bloom over to position 2. It is then passed through the rolls and received on table T'. The tables are then lowered and the bloom is pushed over and tilted by some well-known device and returned to table T^2 in position 3. The tables are then raised and at the same time arms i^2 tilt the bloom and push it to position 4. It is then passed to table T'. The tables are again lowered and the bloom received on table T^2 in position 5. The tables are then raised and, there being no push-over on this pass, the bloom passes through the rolls in position 6, and is delivered on the extreme edge of table T', and is ready to be received by my novel slide-over, which I will now describe.

Fig. 9 shows plan, and Fig. 10 elevation, of the slide-over, which consists in the main of a tilting platform and mechanism for tilting the same independent from any motion of the tables.

G G G indicate a series of slightly-bent rails.

r is a beam rigidly connected to said rails. A bracket is riveted to each of these rails near their center, (shown at 21, Fig. 10,) each of these brackets being rigidly keyed to the shaft u.

w w w are hooks formed of bent flats riveted to the ends of the rails G G G. The rails G G G, brackets 21, shaft u, hooks w w w, and beam r, all rigidly fastened together, form the tilting platform or slide-over proper.

H H H H are fixed standards, forming the bearings for the shaft u, the same being free to oscillate therein.

y is a bar supported on brackets integral with the two central standards and forming a stop to limit the motion of the tilting table in one direction.

z is a bracket attached to the central rail of the tilting table, to which the hydraulic motor I (shown in section) is attached by means of connections, so evident from the drawings as to need no description. The motor I acting only in one direction, the beam r is made heavy enough to act as a counter-weight.

The dotted lines show the second position of the tilting platform. Its action is as follows: (As the piece being rolled has now assumed somewhat the form of a rail, I will hereinafter designate it as such.) 7 indicates the position of the rail as it is received by the slide-over. The slide-over may now be left in this position, supporting the rail upon it at 7, while tables T' T^2 are lowered and raised to commence the operation of rolling the succeeding bloom. When the preceding rail has passed from the finishing-rolls B, the slide-over is tilted by means of the hydraulic motor, so that it occupies the dotted position. At the same time the rail gradually slides down the incline thus formed, arriving at position 8. The advantage of having the rails G G G slightly bent in a vertical plane with the concave side of such bend upward is that I thus have a slide-over of varying inclination, the first part being steep enough to start the rail in its downward slide and the second part not so steep as to cause a too-rapid movement therein. Should the rail reach the end of its slide before the slide-over comes to its dotted position, it is received by the hooks w w w and gently lowered to position 8 on table T^3, and is ready to pass through the finishing-rolls. I will now describe the mechanism used to feed the rail to these finishing-rolls. Table T^3 is stationary and has its rollers constantly driven toward the train. Table T^4 has a tilting motion and has its rollers reversible. The shaft t^4 has its bearings in brackets which are attached to the table T^4, and is free to revolve therein. Motion is communicated to the shaft t^4 through belt b^4, shaft d^4, reversing-clutch g^4, shaft e, bevels v^7, and shaft b. The shaft t^4 in turn gives motion to the feed-rollers R^4 R^4 R^4 R^4 R^4

R^4 R^4 R^4 through the bevel-wheels v^4 v^4 v^4 v^4 v^4 v^4 v^4 v^4, and also to rollers K and L in a manner I will describe.

M and N, Fig. 2, are two frames arranged to slide across table T^4. I will now describe one of these frames, referring to Figs. 5, 6, and 7.

24 is a rock-shaft extending for a short distance under table T^4, and having its bearings attached to said table.

U is a bell-crank lever attached at its central part to this shaft.

23 is a link one end of which is pivoted by ball and socket to the outer end of one arm of lever U. The other end is similarly pivoted to a fixed point, 28, Fig. 3. The other arm of the lever U is pivoted at 29 to one end of the link Q, the other end of this link being pivoted to the sliding frame M at 22. It will be seen that if table T^4 be raised the link 23, bell-crank U, rock-shaft 24, and link Q, with their pivots, will act together to push the sliding frame M across the table T^4. The bevel-wheels 25 communicate motion to the spur-gear 27.

S is a shaft having its bearings near its ends in the sliding frame M. Shaft S is connected to gear 27 by means of a feather, so that it is free to slide through said gear and must turn with it at all times.

K is a roller of shape to fit the rail being operated upon, and is attached firmly to the shaft S.

By the foregoing description it will be seen that the roller K turns with the shaft t^4 and traverses table T^4 with frame M. The frame N is like frame M, with the omission of link 23 and one arm of bell-crank lever U, the link 23 serving both N and M through the rock-shaft 24.

P is a hydraulic motor to operate table T^4.

In speaking of table T^4 as rising, I refer to the end nearest the roll, as it will be seen the other end has a motion in the reverse direction.

Referring to Fig. 3, 30 is one of the side plates of an apron, 31, pivoted to the side plate of table T^3. The other end of this side plate is pivoted at 33 to link 34. Link 34 is pivoted to one arm of bell-crank 35. Bell-crank 35 pivots on fixed pivot 37. The other arm of bell-crank 35 pivots to link 36, which in turn pivots to one arm of bell-crank 38. Bell-crank 38 pivots on fixed pivot 39. The other arm of bell-crank 38 pivots on one end of link 40. The other end of link 40 pivots on table T^4. The other side plate of the apron 31 is connected in a similar manner.

31 is the apron proper, and consists of a plate or plates fastened between the side pieces described. It will be seen that the apron 31, by the described connection, rises and lowers simultaneously with table T^4.

41 is a stop-plate opposite the middle roll of the train, which may extend across from housing to housing. The office of this apron and plate is to lower the rail gradually to the feeding position and to prevent its being too soon fed forward. Table T^3 has its rollers R^3 R^3 R^3 R^3 R^3 R^3 driven through bevel-wheels v^3 v^3 v^3 v^3 v^3 v^3, shaft t^3, belt b^3, and shaft b.

The manner of operation of tables T^3 and T^4 is as follows: The rail being delivered by the slide-over onto table T^3, and the table T^4 and apron 31 being in their lower position, the rail is passed through the rolls and is delivered onto table T^4, which is then raised to its upper position. Its feed-rollers now being in the dotted position, Fig. 3, by the act of raising table T^4, the apron 31 is raised to its upper and dotted position. At the same time the sliding frame M is pushed over to its dotted position. (See Fig. 8.) This motion carries over and at the same time tilts the rail by mechanism attached to the sliding frame, which I have not shown or described, as I wish to embody it in a future patent. It is then passed through the first upper pass of the finishing-rolls and the end drops a short distance on the apron 31. The tendency of the feed-rollers of table T^3 is now to return the rail. It cannot do this, as it comes in contact with the stop 41. Table T^4, with apron 31, is now lowered to its lower position, while some well-known push-over device is moving the rail to the next pass. The rail is now free to pass under the stop 41 and through the rolls, and is received on rollers L and K. The system is then raised, and the rail is at the same time pushed over by means of the traversing rollers K and L, and is passed through the last upper pass, when it is received on the apron 31, as before, lowered to position, and allowed to pass through the final finishing pass, after which it is received on the delivery-rollers. (Shown in Fig. 1, but not described.)

Figs. 12, 13, and 14 are complete drawings of the reversing-clutch I use, and are in the main an old and well-known device to mechanics, and consists of three bevel-gears, 45, 46, and 47, two crabs, 48 and 49, and of a hydraulic motor, 50, for operating the same.

I am aware that arms caused to move by the act of raising the table of a rolling-mill have been used to tilt blooms in connection with other arms used to push them over; but heretofore when such double sets of arms have been used to perform in turn their separate functions it has been necessary to have the motion of each variable and peculiar, and this motion has only been attained by means of a cam action on peculiarly-shaped upright standards, whereas the motion I attain is smooth and regular, the same set of arms tilting and pushing over at the same time.

I am also aware that radially-moving arms have been used to tilt and push over; but as these arms have been constructed they have not been applicable to a rising table, besides they have not been automatic in their action, but require two separate and independently-working hydraulic motors to operate them.

I am aware that slide-overs of various types have been used to convey the rail from

one set of rolls to the next; but such slide-overs have been either stationary with too little incline or pivoted at one end and tilted by the action of the table, which is objectionable, as it delays the work on the first set of rolls until the second set is ready to receive the rail.

I am aware that a movable and automatic gate has been used to prevent a rail from entering the rolls until the receiving-table is in the proper position. This is after the rail has been violently dropped on the feeding-rolls and is in lateral and vertical position to pass through the same, whereas my invention lowers the rail more gradually into the feeding position, thus preventing deformation of its lower flange, and finally reaches the feeding position only when the receiving-table is ready to receive it, and is prevented by a fixed stop from passing into the rolls before the correct feeding position is reached.

Having now fully described my invention and the means for operating the same, what I claim as my invention, and desire to secure by Letters Patent, is—

1. In a feeding appliance for rolling-mills, the combination of a rising and falling table and an arm pivoted thereto, the outer end of this arm being connected by a link to a fixed pivot, a continuation of this arm extending upward for the purpose of pushing over the piece being rolled when the table rises and by the act thereof, substantially as set forth.

2. In a feeding appliance for a rolling-mill, the combination of a rising and falling table, an arm pivoted thereto, and a link connecting the said arm with a second similar pivotally-swinging arm, the said second swinging arm being connected by a pivoted link with a stationary point, the whole acting together to cause the first-mentioned swinging arm to push over and tilt the pieces being rolled as the table rises and by the act thereof, substantially as set forth.

3. In a feeding appliance for rolling-mills, the combination of a rising and falling table, and pivotally-swinging arms thereon, the axes of said pivots being coincident, the outer end of said arms being connected by a flat strip or bar, the whole being adapted to swing by the act of the rising or lowering of the table for the purpose of pushing over the piece being rolled, and for extending longitudinally the range of the position of said piece while it is being acted upon, substantially as and for the purpose set forth

4. In a feeding appliance for a rolling mill, the combination of a rising and falling table, and pivotally-swinging arms thereon, the axes of the pivots being coincident, the outer end of said arms being connected by a flat strip or bar, the whole adapted to swing by the act of raising or lowering the table through the means of pivoted links, one end of each of said links being pivotally attached to each one of said arms, and the other end of each of said links being pivotally attached to a fixed point, substantially as set forth.

5. In a feeding appliance for a rolling-mill, the combination of a rising and falling feed-table connected with one berth of rolls, a stationary feed-table connected with a second berth of rolls, a tilting slide-over located between aforesaid tables, a single-acting hydraulic motor adapted to tilt the slide-over in one direction, and a counter-weight adapted to tilt the slide over in the opposite direction, substantially as set forth.

6. In an appliance for feeding rolling-mills, the combination of a rising and falling table connected with one berth of rolls, a stationary table connected with a second berth of rolls, and a tilting slide over pivoted near its center and actuated by means of an independent motor, substantially as and for the purpose set forth.

7. As a device for transferring partly-rolled rails from one berth of rolls to another, a tilting slide-over pivotally supported at some point near its center, and having its portion between the pivoted point and the receiving edge concavely curved on its upper side for the purpose of gradually and surely starting the partly-rolled rail on its downward slide, substantially as set forth.

8. As a device for transferring partly-rolled rails laterally from one berth of rolls to another, a tilting slide over pivoted near its center, and provided with hooks on its delivering edge to retain the piece being operated upon, so that it may be gently lowered in place, substantially as and for the purpose set forth.

9. In a feeding appliance for rolling-mills, the combination of a pivoted and tilting feed-table provided with driven and reversible rollers, a frame carrying a roller arranged to slide transversely on said table, and automatic mechanism to slide this frame simultaneously with the movement of the tilting table, substantially as and for the purpose set forth.

10. In a tilting feed-table for a rolling-mill, the combination, with the frame thereof, of a transversely-sliding frame carrying a driven and reversible roller across said tilting table, substantially as and for the purpose set forth.

11. In a tilting feed-table for a rolling-mill, the combination of a shaft extending lengthwise of said table in bearings affixed thereto, driven through some suitable connection from some outward source of power, a series of bevel-wheels on this shaft engaging with similar bevel-wheels attached to feed-rollers which have their bearings in said tilting table, two bevel-wheels attached to this shaft engaging with two other bevel-wheels, each of which is attached to one of two spur-gears, each of said spur-gears engaging with one of two other spur-gears, a feathered shaft sliding through each of the latter spur-gears, the bearing of each of these shafts being attached to one of two transversely-sliding frames, two shaped rollers respectively attached to said last-mentioned shafts, a rock-shaft extending longitudi-

nally under the tilting table with its bearings affixed thereto, arms attached to this rock-shaft, links pivotally connecting ends of said arms to the before-mentioned transversely-sliding frames, an arm affixed to said rock-shaft, a link pivotally connecting this arm with a fixed point below the table, and a hydraulic motor for operating the table, substantially as and for the purpose set forth.

12. In a feeding appliance for rolling-mills, the combination of a rising and falling feed-table on one side of the rolls, a stationary feed-table on the other side of the rolls, a pivoted and tilting apron located over the stationary table to receive the end of the partly-rolled rail and lower it gently to its feeding position, and mechanism connecting this rising and falling apron with the rising and falling feed-table, so that the act of lowering the rising and falling feed-table lowers the rising and falling apron, substantially as and for the purpose set forth.

13. In a feeding appliance for a rolling-mill, the combination of a tilting feed-table on one side of the rolls, a stationary feed-table on the other side of the rolls, a pivoted tilting apron located over the stationary feed-table, a stationary stop arranged in front of the central roll and over the stationary table entirely above the lower pass of the rolls, and mechanism connecting the tilting apron with the tilting table on the other side of the rolls, so that they may both be operated together by means of the same motor, substantially as and for the purpose set forth.

14. In mechanism to prevent a piece from entering the rolls of a rolling-mill until the receiving-table is in proper position to receive it, the combination of a fixed stop located opposite the middle roll of the mill, a rising and falling apron located so that its upper position is lower than the top of the stop, so that when the rolled piece is expelled by the action of the rolls it may fall a measurable distance upon the apron, and mechanism to connect this tilting apron with the receiving table, so that the rolled piece is only at a position to pass through the rolls when the receiving-table is ready to receive it, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand this 4th day of August, 1887.

JOSEPH MORGAN, JR.

Witnesses:

CYRUS ELDER,

SIDNEY POSTLETHWAITE.