F. H. DANIELS.

ROLLING MILL.

APPLICATION FILED JUNE 8, 1909.

956,301. **Patented Apr. 26, 1910.**

2 SHEETS—SHEET 1.

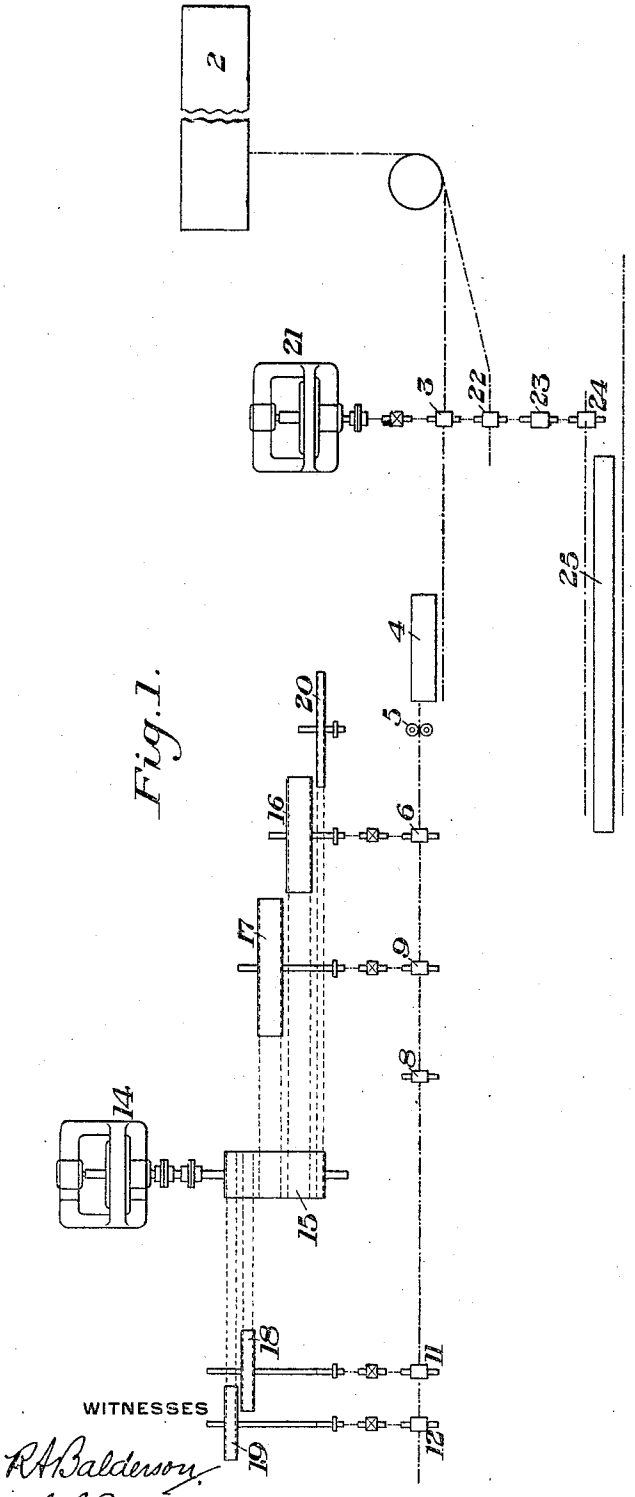

Fig. 1.

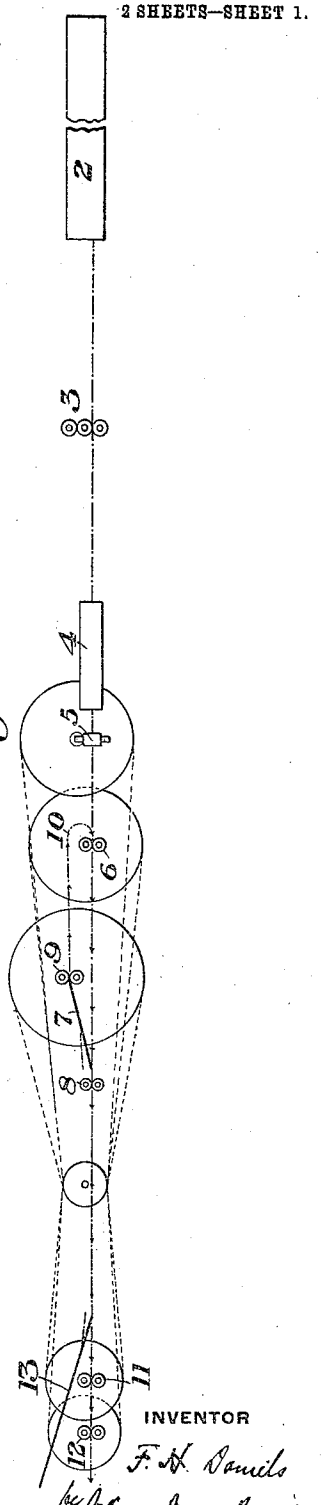

Fig. 2.

WITNESSES

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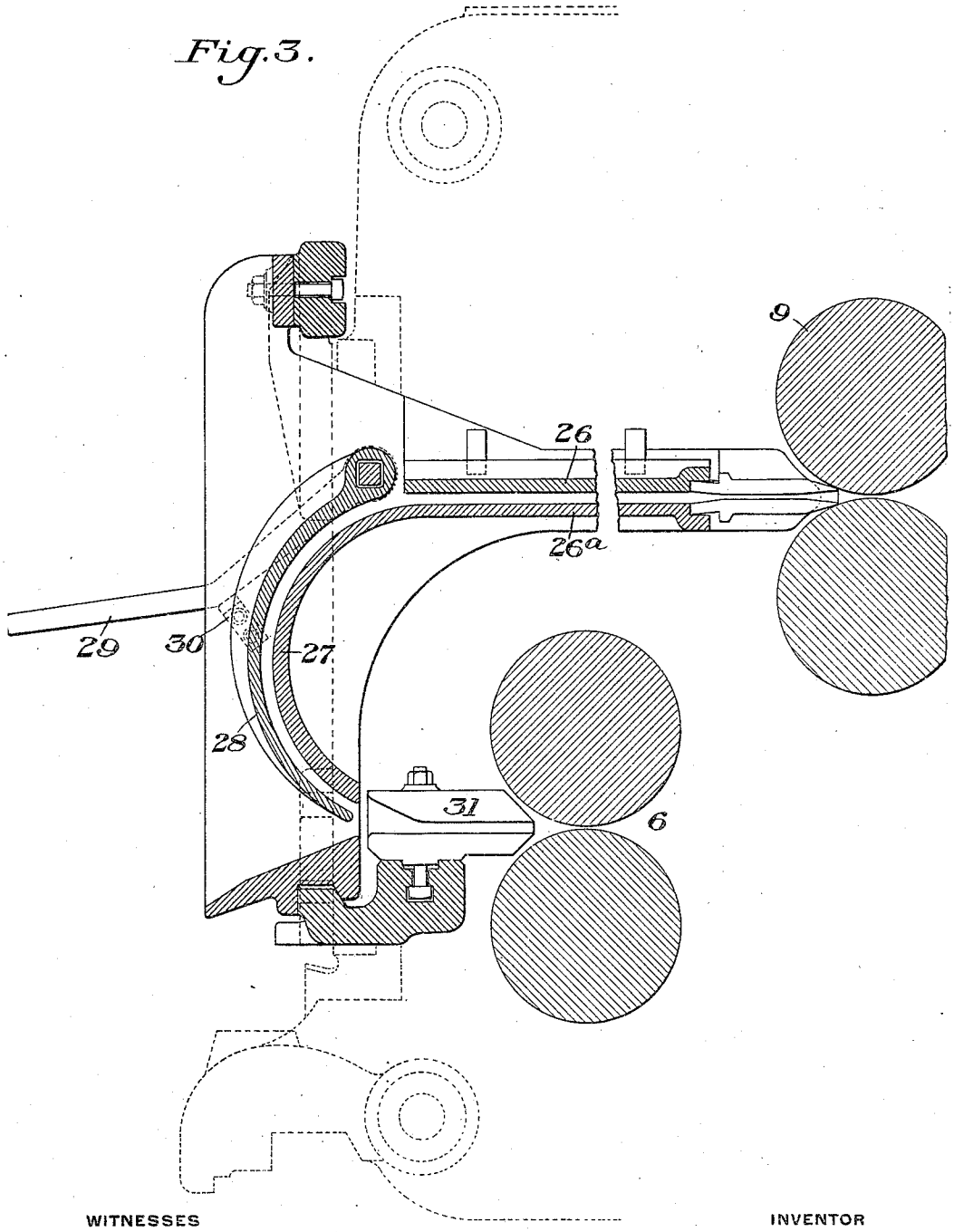
2 SHEETS—SHEET 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

FRED H. DANIELS, OF WORCESTER, MASSACHUSETTS.

ROLLING-MILL.

956,301. Specification of Letters Patent. Patented Apr. 26, 1910.

Application filed June 8, 1909. Serial No. 500,893.

To all whom it may concern:

Be it known that I, FRED H. DANIELS, of Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Improvement in Rolling-Mills, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a diagrammatic top plan view showing one form of mill constructed in accordance with my invention; Fig. 2 is a diagrammatic side elevation of the same; and Fig. 3 is a sectional side elevation of a repeater which I employ.

My invention relates to mills for rolling flexible material, such as flats of greatest width, and is designed to avoid sidewise movement of the piece during the rolling operation. It is also designed to avoid manual labor in handling the piece and to carry the piece along in the same vertical plane during its rolling after roughing.

In the drawings, 2 represents a heating furnace in which the billet or slabs are heated, these being preferably about four inches thick in the forming of wide flats. From this furnace the metal is taken to a three-high roughing mill 3, which is preferably of the type where the position of the middle roll is fixed and the upper and lower rolls are adjusted up and down by suitable screw-downs, preferably electrically operated. These rolls are preferably plain-faced without grooves, the bar passing repeatedly through them in the same vertical plane without sidewise shifting and is preferably reduced to about one inch thickness in five passes. A suitable manipulator may be used for transferring the bar from the upper to the lower pass, and vice versa. From the roughing mill, the bars pass to the furnace or heat retainer 4, where they are reheated or stored. They are then fed out of this furnace, and pass forward through edging rolls 5, which I have shown as vertically arranged, thence through a two-high mill 6, and thence forward, preferably over a roller table by which they are carried bodily forward until the rear end of the piece has passed beneath a swinging guide 7. During this passage the metal feeds through pinch rolls 8, which revolve idly during this period. As soon as the last end of the piece has passed the loosely swinging guide 7, this guide drops down; the pinch rolls 8 are actuated to feed the bar rearwardly, and up through a two-high mill 9, which is at a higher level. On passing through this mill 9, the metal feeds backwardly over a suitable support or feed mechanism, to a repeater, indicated at 10, which returns it downwardly and forwardly into the rolls 6. This operation on the mills 6 and 9 is preferably repeated—say three times—after which the bar is allowed to pass forwardly along a support or feed mechanism to the sets of rolls 11 and 12 in the same line of feed. Above these rolls is an inclined guide 13 with a swinging part similar to guide 7 which is dropped down while the piece is being rolled in mills 6 and 9 so as to guide the first end up over the two high mills 11 and 12, and is lifted up when the piece finally is to be rolled in these mills, which further reduce it. The finished thickness is preferably one-sixteenth of an inch or less, the width depending on the original width of the bar selected. The sets of rolls 6 and 9 are preferably plain-faced without grooves, and are provided with screw-downs, the bar thus moving in the same vertical plane without sidewise shifting and passing repeatedly through the same sets of rolls at the same point in the rolls. For wide flats this is of great importance, as otherwise it is almost impossible to roll straight pieces, the operation at the same time requiring great watchfulness, and taken as a whole is very unsatisfactory. The reductions are obtained by adjusting the rolls through the screw-downs between the passes.

I have shown the finishing mill succeeding the furnace 4 as driven by a suitable electric motor, indicated at 14, actuating a long pulley 15 having rope drives connecting to pulleys 16, 17, 18, 19 and 20 on the shafts of the several mills. I have shown the roughing mill as driven by a motor 21, so constructed as to give a fly wheel effect. The feed rolls and roller tables are also preferably electrically driven, and all motors may be controlled from a single pulpit. The guides, repeaters, etc., are automatic in their action.

In connection with the roughing mill, I have shown other sets of rolls 22, 23 and 24, which are preferably two-high roll pairs, which may be used for rolling shafting or special shapes, 25 being the cooling bed therefor. These rolls may be driven from the same motor 21.

In Fig. 3 I show in detail the form of repeater which I preferably employ. The metal leaving the rolls 9 passes through an inclosed guide 26, the lower portion 26ª of which is provided with a reversely curved downward extension 27. Surrounding this groove is the swinging guide 28, having on its shaft a handle 29, which normally rests against the stop 30. When the metal passes through the rolls 9 the operator presses down on the handle 29, or the guide 28 may be heavy enough to stay down until the front end of the piece is caught in the rolls 6, being directed thereto by guide 31. The pressure is then removed or the operator lifts up the swing guide which allows the metal to loop out as the speed of rolls 6 should be somewhat less than continuous in relation to rolls 9.

The advantages of my invention result from the continuous feeding of the piece in a single vertical plane in the mill; also from the automatic return of the piece to the higher set of rolls, and thence to the lower set of rolls, thus doing away with manual labor, and giving a large number of passes without increased labor cost. The construction of the flat mill is simple; so is the operation of the same. It is flexible,—that is, allowing for a wide range of reductions in length, and by simply adding the rolls 22, 23 and 24, provides for rolling a great variety of shapes.

Variations may be made in the form and arrangement of the mills, the drive, the feeding means, &c., without departing from my invention.

I claim:—

1. A finishing mill having a set of rolls, a succeeding set of rolls at a higher level, a guide leading backwardly to the upper set, means in coöperative relationship with the lower set of rolls for feeding the metal backwardly on said guide to said upper set after it has passed through the lower set, and a repeater leading from the upper set to the lower set; substantially as described.

2. In mills for rolling flexible material, a set of two-high rolls, a feed device following the same and having an upwardly inclined return guide, an upper set of rolls to which the said guide feeds, and a repeater between the upper and lower sets, arranged to give a backward pass to the metal after it has been fed through the upper set; substantially as described.

3. A finishing mill for flexible material, having a series of sets of rolls arranged in line, another set of rolls arranged at a higher level and between two of the lower sets, an upwardly inclined feed device in front of the upper set of rolls to carry the metal upwardly and backwardly thereto after it has passed through one of the lower sets, and a repeater in the rear of said upper set of rolls for carrying the material therefrom to one of the lower sets of rolls; substantially as described.

4. A finishing mill for flexible material, having a series of sets of rolls arranged in line, another set of rolls arranged at a higher level and between two of the lower sets, an upwardly inclined guide device in front of the upper set of rolls to carry the metal upwardly and backwardly thereto after it has passed through one of the lower sets, and a repeater in the rear of said upper set of rolls for carrying the material therefrom to one of the lower sets of rolls, together with positive means for feeding the metal backwardly through the upper set of rolls.

5. A finishing mill for flexible material, having a set of rolls, another set of rolls at a higher level and in advance of the lower set, an upwardly inclined feed device in front of the upper set to carry the metal upwardly thereto after it has passed through the lower set, and a repeater for carrying the metal from the upper set back to the lower set; substantially as described.

6. In a device for reducing material which is flexible when heated, the combination of a mill having a plurality of passes arranged at different elevations, the rolls being so driven that the metal going through two of the passes will be fed in opposite directions, guiding devices extending between the two said passes, feeding means in coöperative relation with the guiding device and adapted to feed the work piece so that the end of the work piece which is the last to leave one of the passes is the first to enter the second of said passes, and a repeater extending from the second pass and arranged to deliver the work piece to a lower roll pass; substantially as described.

In testimony whereof, I have hereunto set my hand.

FRED H. DANIELS.

Witnesses:
A. F. Backlin,
Geo. Sieurin.