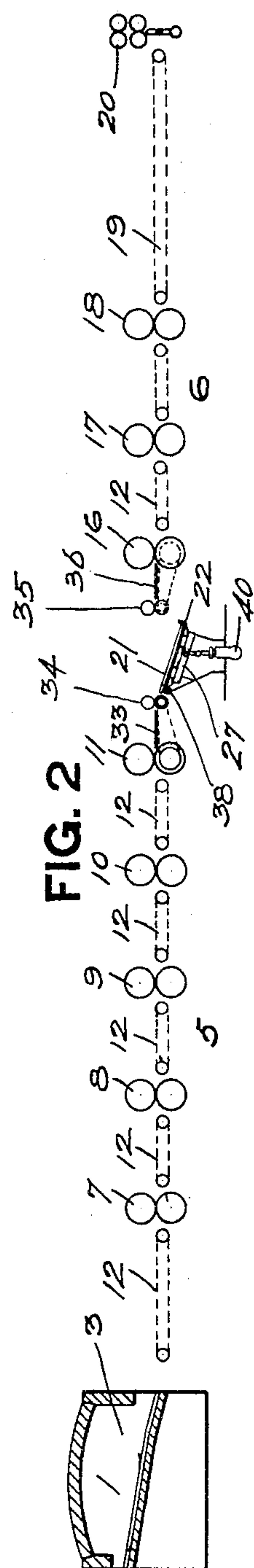
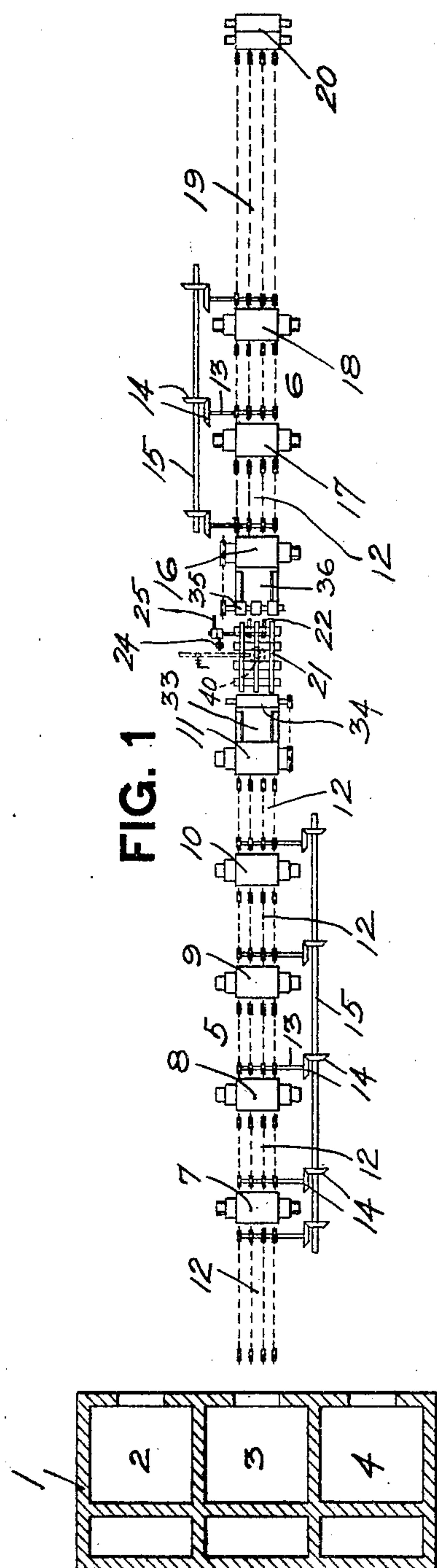


P. E. DONNER.

APPARATUS FOR ROLLING SHEET AND TIN PLATE.

APPLICATION FILED SEPT. 14, 1904.

2 SHEETS—SHEET 1.



WITNESSES.

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## APPARATUS FOR ROLLING SHEET AND TIN PLATE.

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2 SHEETS—SHEET 2.

FIG. 3

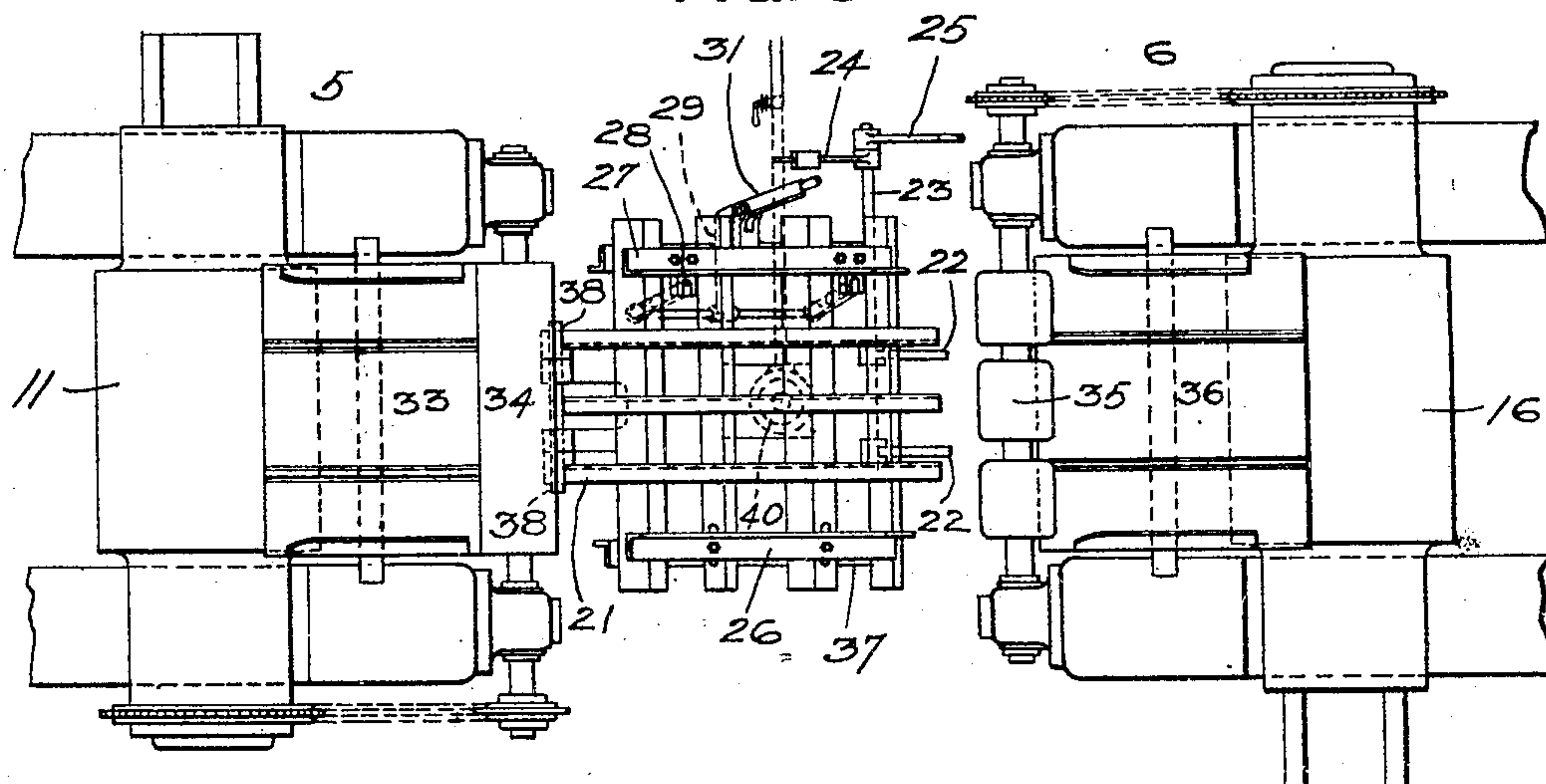


FIG. 4

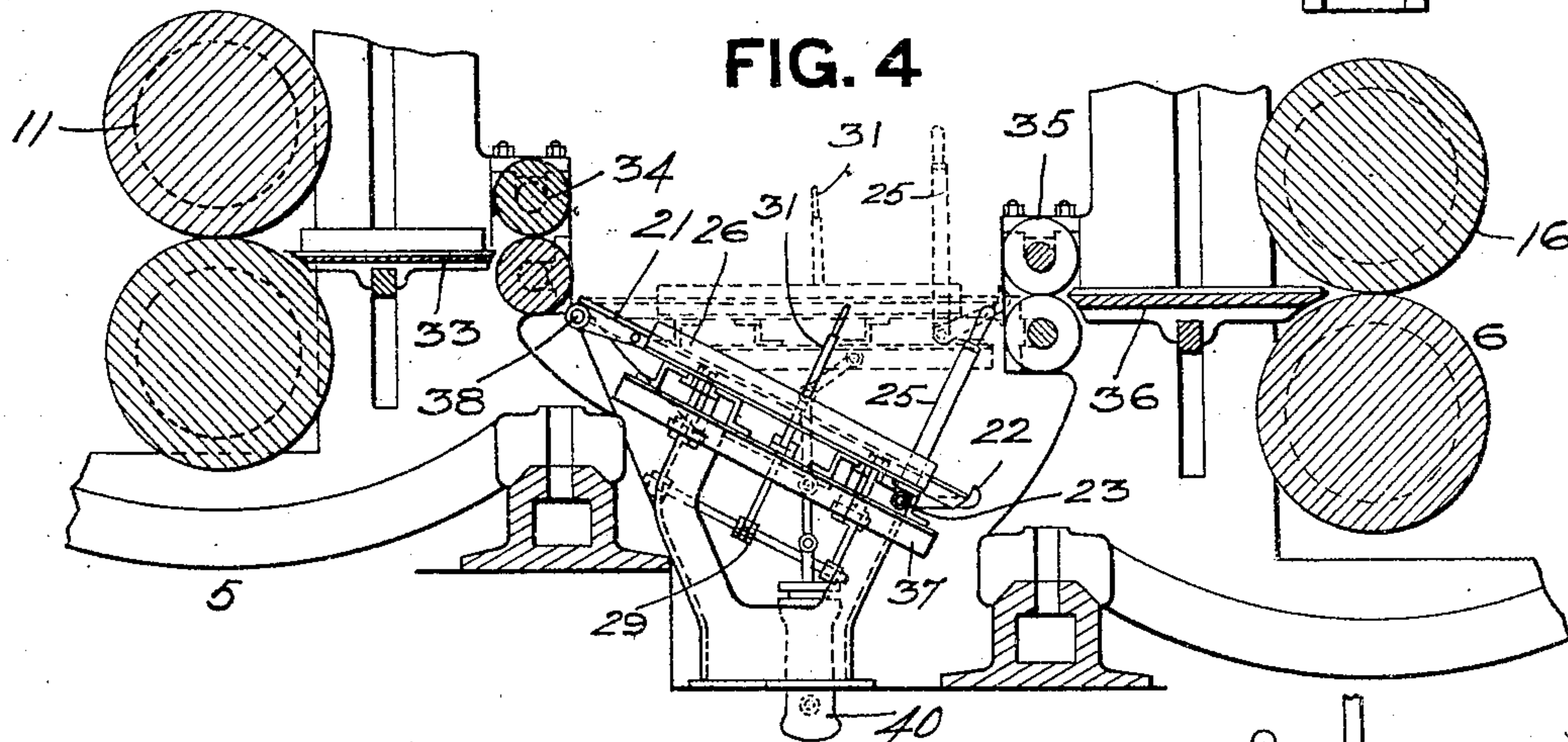
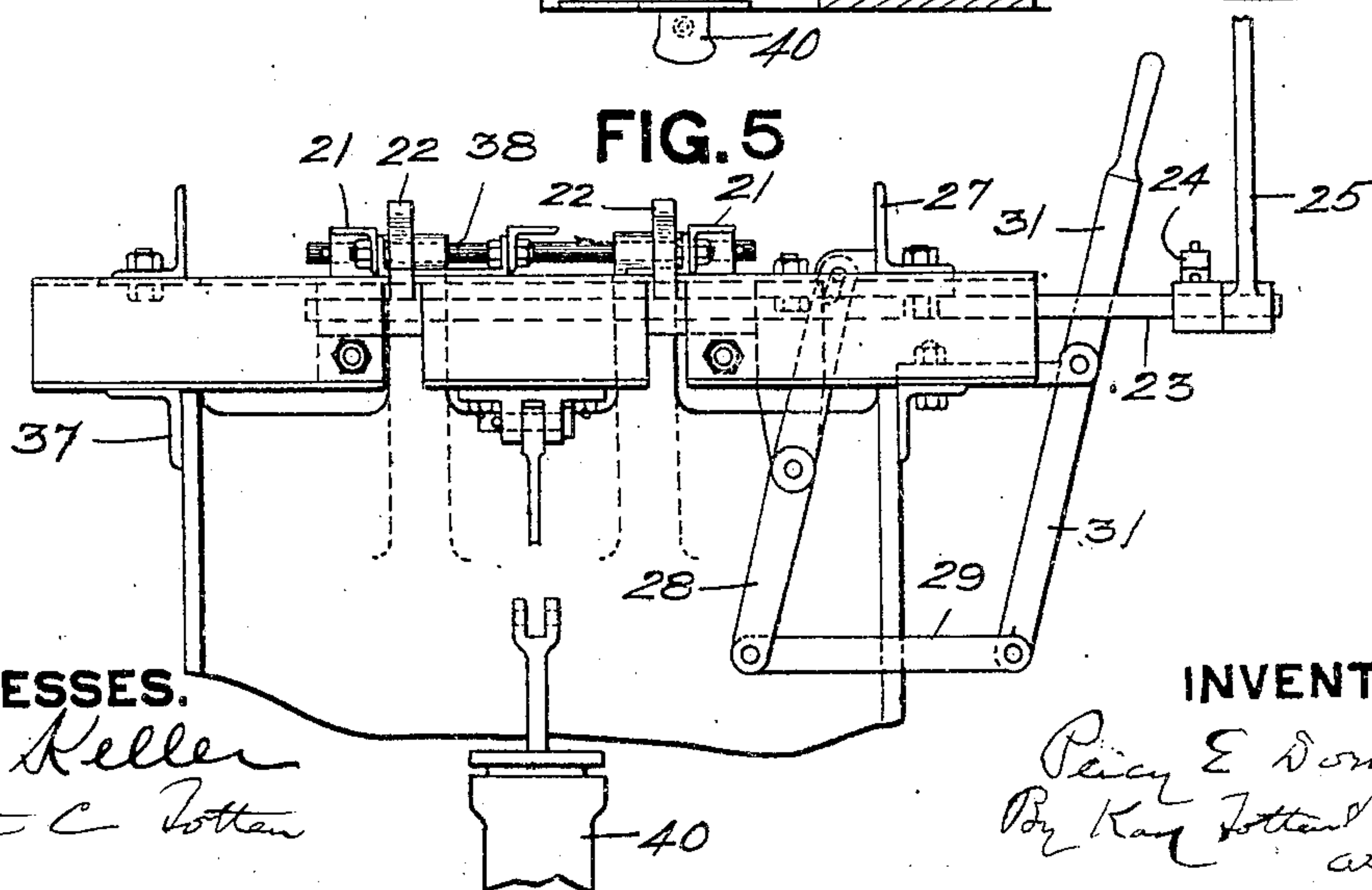


FIG. 5



WITNESSES.

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# UNITED STATES PATENT OFFICE.

PERCY E. DONNER, OF COLUMBUS, INDIANA.

## APPARATUS FOR ROLLING SHEET AND TIN PLATE.

No. 803,745.

Specification of Letters Patent.

Patented Nov. 7, 1905.

Application filed September 14, 1904. Serial No. 224,455.

*To all whom it may concern:*

Be it known that I, PERCY E. DONNER, a resident of Columbus, in the county of Bartholomew and State of Indiana, have invented a new and useful Improvement in Apparatus for Rolling Sheet and Tin Plate; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to apparatus for rolling sheet metal, and it is designed to provide improved apparatus whereby ordinary sheet-bars are reduced at a continuous operation to such a gage that they can afterward with one heating and at one operation be reduced to such lighter gages as are used for tin-plating and similar purposes.

In the rolling of sheet metal it has been proposed to use a continuous mill having a plurality of pairs of two-high rolls arranged in tandem through which the plate-bar passes in succession and is gradually and progressively reduced in thickness. Metal sheets, however, when run singly through rolls cannot be reduced beyond a certain gage and not sufficiently thin for commercial uses, this being due to the fact that after the plate has been reduced a certain amount sufficient pressure cannot be exerted by the ordinary adjusting mechanism of the rolls to further reduce the same. Consequently it has always been the custom to match up two or more partially-reduced plates—that is, place one upon the other—and then pass the pile through reducing-rolls. In this way the rolls develop sufficient pressure to further reduce the plates. This matching of the plates has also been proposed with reference to continuous reducing-mills, it being the custom to provide a gap or space between two contiguous pairs of rolls of the continuous mill, or, more strictly speaking, to have two continuous mills with a gap or space between the same, in which gap or space is placed mechanism provided with stops for matching up two or more plates. All apparatus of this kind heretofore proposed, whereby the plates fall onto the matcher by gravity, has necessitated the placing of the second reducing-train at a lower level than the first reducing-train. This arrangement is objectionable, as many mill-floors and ground sites are such that the second train cannot advantageously be placed at a lower level than the first reducing-train.

The object of my invention is to provide apparatus of the general character above de-

scribed and in which the objection named is avoided.

To this end the invention consists, generally stated, in placing the second reducing-train at the same or a higher level than the first reducing-train, thus adapting the double train to mill-floors or ground sites having obstructions in the way of placing the second train lower than the first train, and in providing a matching device between the two trains which is arranged so as to receive the plates from the first train on a downward angle and deliver the pack into the second train on a level with or higher than the rolls from which the plates were received by the matcher.

The invention also consists in details of construction and arrangement hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a diagrammatic plan view of a rolling-mill plant embodying my invention. Fig. 2 is a diagrammatic side elevation of the same. Fig. 3 is a plan view, on an enlarged scale, of the matcher. Fig. 4 is a side elevation of the same, and Fig. 5 is an end elevation of the same.

In the drawings, 1 represents a heating-furnace having chambers 2, 3, and 4, in which the plate-bars are heated. This furnace may be of any known type, heated in any suitable way, and having any desired arrangement for charging the plates into and drawing the plates out of the same. This furnace will be provided with as many chambers as are necessary, or, if preferred, a number of separate furnaces may be employed. In this furnace the plate-bars are brought to the proper rolling heat and are then reduced in the apparatus to be described.

My rolling-mill comprises two continuous tandem trains 5 and 6, each of which may be made up of as many pairs of two-high rolls as is necessary. I have shown the first train made up of five pairs of two-high rolls arranged in tandem and numbered 7, 8, 9, 10, and 11, respectively; but I may vary this number without departing from my invention. Placed in front of each pair is a feed-table or conveyer 12, which may be of any suitable type, those shown consisting of a series of sprocket-chains passing at their ends over sprocket-wheels. The sprocket-wheels at one end of the chains are mounted upon a shaft 13, driven by suitable beveled gears 14



from a counter-shaft 15, extending along the side of the train. In this manner the chains will be positively driven to feed the bar in succession through the several pairs of rolls.

5 The second train is shown as consisting of three sets of two-high rolls numbered 16, 17, and 18, respectively; but the number thereof may be varied as desired. Between these sets of rolls likewise are placed feed-tables

10 12 of the same character as just described in connection with the first train and driven in the same way. From the last set of rolls of the second train a conveyer 19 carries the sheets to a doubler 20, which may be of any

15 well-known form of apparatus for this purpose and by means of which the sheets are doubled. They are then conveyed to a reheating-furnace, wherein they are again raised to the desired temperature and then passed

20 through further reducing or finishing rolls. They will be doubled and reheated and re-rolled as many times as necessary to bring them to the desired gage. As the apparatus for performing the later steps of the operation is not new with me, it is neither shown

25 nor described.

In the drawings the tandem trains 5 and 6 are shown in line with each other and with the second train at the same elevation as the

30 first train and the matcher 21 located between said trains. This arrangement, however, is not absolutely essential, as the trains 5 and 6 may be placed parallel with each other, but out of line, and the matcher arranged not only to match up the plates, but

35 to move them sidewise into line with the second train, as shown and described in my companion application Serial No. 224,453, or the two trains 5 and 6 may be arranged at an

40 angle with reference to each other and the matcher mounted so as to have an oscillatory movement, as shown and described in my companion application Serial No. 224,454. In all arrangements, furthermore, the second

45 train may be either at the same level with the first train or at a higher level. With the latter arrangement it is necessary that the matcher have a slightly greater vertical movement than when the second train is arranged

50 on the same level with the first train; but in all other particulars the arrangement can be the same.

The matching device 21 may be of any suitable or desirable form, that shown in the

55 drawings comprising bars or plates sloping downwardly from the rolls 11, as shown in Fig. 4, in order that the plates emerging from the last set of rolls of the first reducing-train can slide down the matcher by gravity. At

60 the lower forward end of the matcher is a retractable stop or stops 22, which will arrest the forward travel of the plates, and thus permit the succeeding plates to fall down upon the same and have their forward ends matched.

65 The stops 22 are shown as fingers mounted on

a rock-shaft 23 and are normally held elevated or in the path of the plates by means of a counterweighted arm 24. The rock-shaft 23 may be actuated to depress the fingers 22 by any suitable means, such as the lever 25. 70

It is also desirable to have means for matching up the side edges of the plates. This also may be of various forms—such, for instance, as the means shown for this purpose in the patent to C. W. Bray, No. 718,974, 75 January 27, 1903. In the drawings this means is shown as a stop 26, mounted on one side of the matcher and, preferably, being adjustable, so that it may serve also as a guide or gage for directing the sheets into the second set of 80 reducing-rolls. In conjunction with this side stop suitable means will be provided for moving the plates sidewise into contact therewith, thereby matching up the side edges. This means is shown as a bar 27, connected to le- 85 vers 28, which are connected by a link 29 to an actuating-lever 31. A counterweight may be used for returning the bar 27 to its normal position. The stop-fingers 22 serve to match up the front end of the plates, while the bar 90 27 and side stop 26 serve to match up the side edges of the plates, and the stop 26 also serves as a guide or gage to position the sheets for entering the second set of reducing-rolls.

When the bars or plates emerge from the 95 last set of rolls 11 of the first reducing-train, they pass over a suitable stationary plate 33 into the bite of a pair of feed-rollers 34, which feed said plates into the matching device, the plates passing by gravity from said feed-roll- 100 ers down the matcher and against the retractable stops 22. At the entrance of the second train is placed another pair of feed-rollers 35, which will feed the piled plates into the second train over a suitable stationary plate or 105 table 36. Both sets of feed-rollers 34 and 35 will be positively driven by any suitable mechanism, such as by sprocket-chains from the contiguous roll-shafts.

In order to deliver the matched plates at the 110 same or a higher level than that in which they were received, it is necessary that the matcher have a vertical movement. This may be accomplished in many ways—such, for instance, as by moving the matcher bodily vertically, as 115 by mounting it on the upper end of the piston-rod of a suitable power-cylinder, whereby the matcher can be raised after receiving a pair of plates from the first reducing-rolls to such a height that the lower or delivery end of the 120 matcher will be on a level with the receiving-pass of the second reducing-train. Preferably, however, the matcher will be mounted so that its forward or delivery end alone will be vertically movable and is so shown in the draw- 125 ings. The matcher-frame 37 is mounted on horizontal pivots 38, located, preferably, near the receiving end of said matcher. The delivery end has connected thereto the piston-rod of a power-cylinder 40, arranged verti- 130



cally below the matcher and preferably pivoted so that it can swing and accommodate itself to the changing angle of the matcher. The stroke of this power-cylinder will be sufficient to elevate the delivery end of the matcher into position to deliver the sheets to the receiving-pass of the second reducing-train. If the second reducing-train is at a higher level than the first reducing-train, the power-cylinder will have to have somewhat a longer stroke than it will when said second train is arranged on the same level as the first train.

The operation of the apparatus is as follows: The plate-bars are raised in the furnace 1 to the desired temperature and are then fed to or placed upon the feed-table 12 in front of the first pair of rolls of the first reducing-train. They pass singly and in succession through the several sets of rolls of the first reducing-train, being carried from one set of rolls to the other by the feed-tables described. When the sheets emerge from the last set of rolls of the first train, they pass over the table 33 and through the feed-rollers 34, which feed the same forward onto the matcher. They slide down the matcher by gravity until their forward ends strike the stop-fingers 22 at the lower edge of the matcher. After one plate has come to rest in this position the next succeeding plate will slide down in the same manner and on top of the first plate, with its forward end also resting against the stop-fingers 22. In this position the two plates have their forward ends accurately matched. As soon as the desired number of plates have been thus matched the attendant will move the lever 31 and through the bar 27 push the sheets sideways on the matcher against the side stop 26, in this manner matching up the side edges thereof. He will then admit pressure to the power-cylinder 40, thus raising the delivery end of the matcher and bringing the same into position to deliver the plates to the entering-pass of the second set of reducing-rolls. He will then operate the lever 25 and depress the stop-fingers 22, and the matched plates will then be pushed into the bite of the feed-rollers 35, which will feed the same into the second reducing-train. The matcher will then be lowered to its original position to receive another pile of plates. The stop-fingers 22 will have been automatically returned to normal position by the counterweight 24, and the pushing-bar 27 likewise will have been returned to its normal position. In this position another pile of plates will be received in the matcher one upon the other and will have their forward ends and side edges matched up, and the matcher will then again be raised to deliver the same to the second set of reducing-rolls. The piled sheets will pass through the second reducing-train and will then be taken to the doubler 20, where they will be doubled and then manipulated in the manner which is the ordinary practice—that is, reheated, re-

rolled, and redoubled as often as is necessary to reduce the same to the desired gage.

When the sheets emerge from my mill, they will be about from sixteen to twenty-six gage, depending upon the thickness and character of sheet-bar used. In this condition they will be sufficiently thin for many commercial purposes, and therefore need not be doubled and reheated and rerolled. For tin-plate, however, and many other purposes the gage will often have to be further reduced, and consequently said sheets will be doubled, reheated, and rerolled.

My apparatus has the advantage of adapting a continuous automatic rolling process for sheet metal to mill-floors or sites in which the second continuous reducing-train must be placed at the same or a higher level than the first reducing-train.

What I claim is—

1. In apparatus for rolling sheet metal, the combination of two sets of rolls, a matching device located between said rolls and having a downward inclination, a stop at the lower end of said matcher, and means for elevating the delivery end of said matcher into position to deliver to the second set of rolls.

2. In apparatus for rolling sheet metal, the combination of two sets of reducing-rolls, a matching device located between said rolls and provided with suitable stop mechanism, and means for elevating the delivery end of said matcher into position to feed to the second set of reducing-rolls.

3. In apparatus for rolling sheet metal, the combination of two sets of reducing-rolls, a matching device located between said rolls and having a downward inclination from the horizontal and pivoted at its higher end, a stop at the lower end of said matcher, and power mechanism for raising the lower end of the matcher into position to deliver to the second set of reducing-rolls.

4. In apparatus for rolling sheet metal, the combination of two sets of reducing-rolls, a matcher located between said rolls and provided with suitable stop mechanism, said matcher being pivoted at one end, and means for elevating the opposite end of said matcher to bring the delivery end thereof into position to feed to the second set of reducing-rolls.

5. In apparatus for rolling sheet metal, the combination of two sets of reducing-rolls, a matcher located between said rolls, stop mechanism for limiting the forward movement of the plates in said matcher, and mechanism for elevating the forward end of the matcher to the level of the second set of reducing-rolls.

In testimony whereof I, the said PERCY E. DONNER, have hereunto set my hand.

PERCY E. DONNER.

Witnesses:

ROBERT C. TOTTEN,  
G. C. RAYMOND.