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PATENTED NOV. 7, 1905.

P. E. DONNER.

APPARATUS FOR ROLLING SHEET AND TIN PLATE.

APPLICATION FILED SEPT. 14, 1904.

3 SHEETS—SHEET 1.

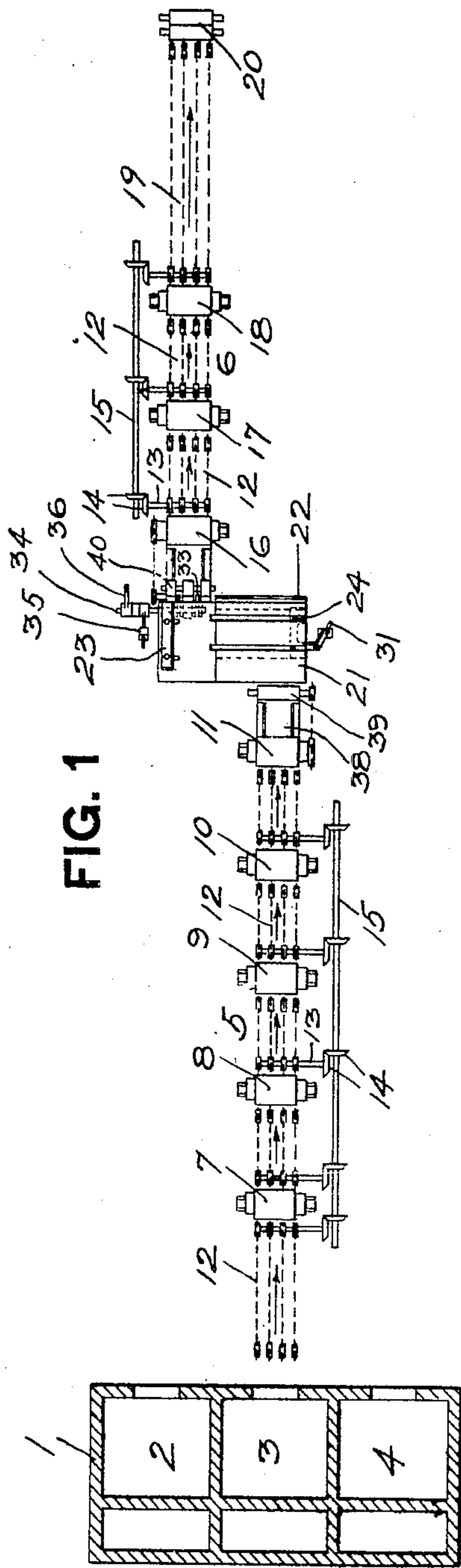


FIG. 1

WITNESSES.

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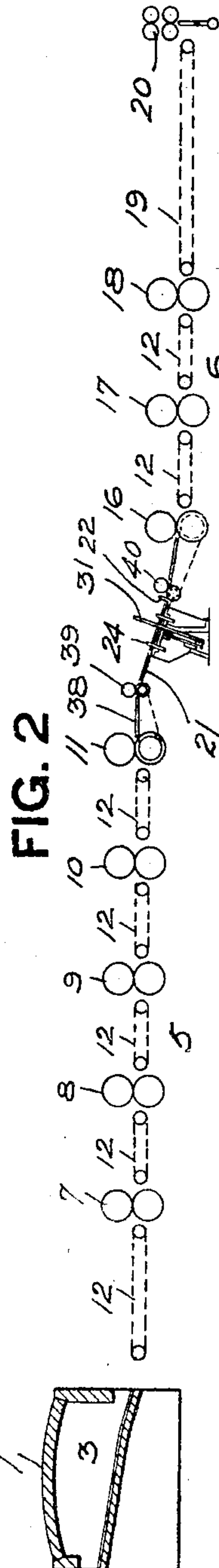


FIG. 2

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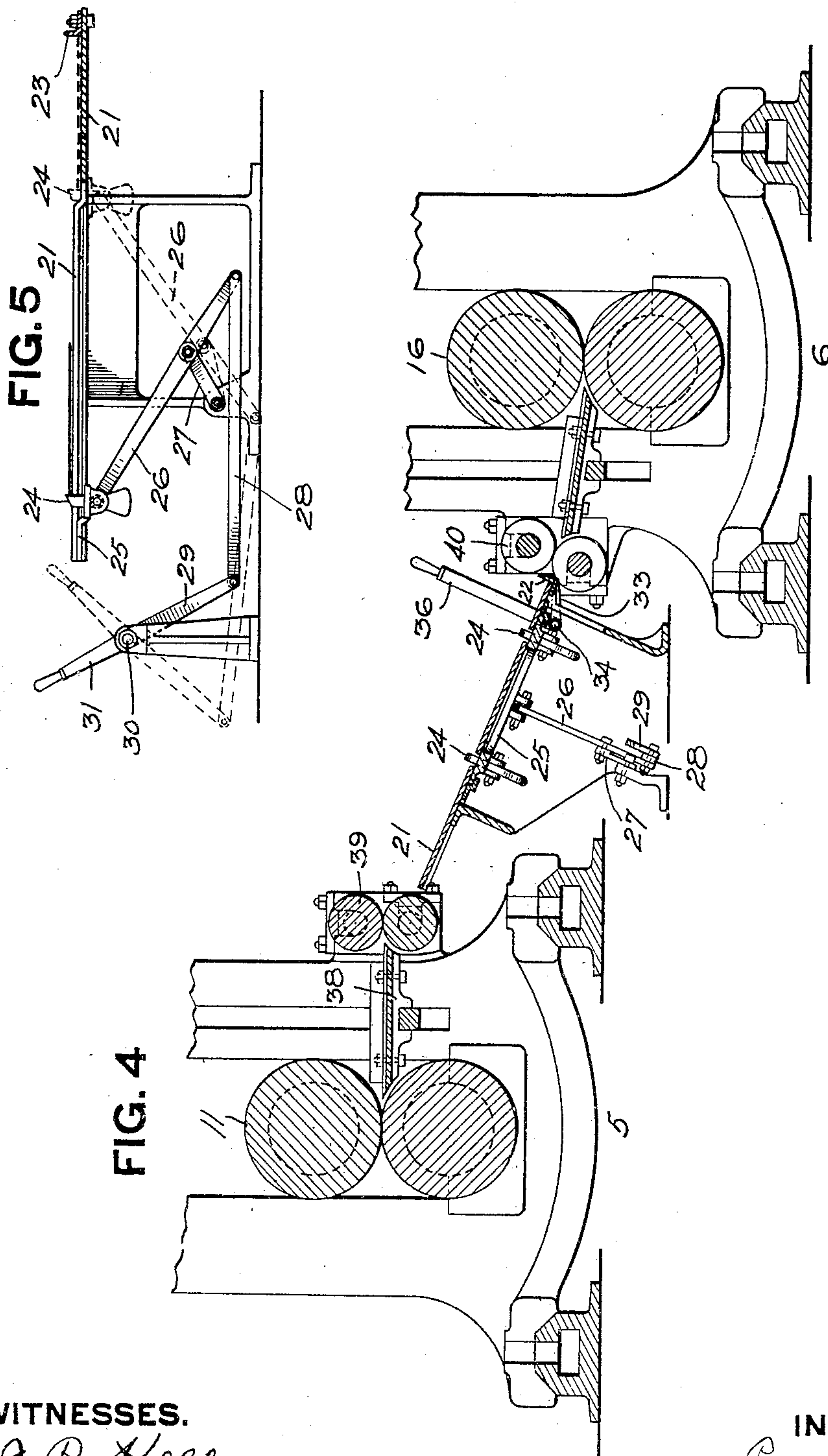
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3 SHEETS—SHEET 3.



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APPARATUS FOR ROLLING SHEET AND TIN PLATE.

No. 803,674.

Specification of Letters Patent.

Patented Nov. 7, 1905.

Application filed September 14, 1904. Serial No. 224,453

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 most 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 has necessitated the placing of the second continuous train in the same line with the first train and has also matched up the edges of the plates by means of manual-operated mechanism which made it necessary to bring a movable stop into contact with both sides of the superimposed plates. There are numerous objections to this old arrangement, one being the complexity of the mechanism for matching up the edges of the plates, another being that the matcher is so hedged in

as to be difficult of access in case of repairs, and still another being that not all mill-floors or ground sites are such that the second reducing-train can advantageously be placed in line with the first reducing-train.

The object of my invention is to provide apparatus of the general character above described and in which the objections above noted are avoided.

To this end the invention consists, generally stated, in the combination of the two continuous reducing-trains, each consisting of two or more pairs of rolls arranged in tandem, said trains being parallel but out of line with each other, and a matching device located at the exit end of the first train and entrance end of the second train, arranged to receive the plates from the first train and deliver the same to the second train, said matching device being provided with suitable end-stop mechanism and with a pusher having an extended engagement with the sides of the plates for moving the plates sidewise into line with the second reducing-train.

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 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 section thereof on the line 4 4, Fig. 3, and Fig. 5 is a section on the line 5 5, Fig. 3.

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.

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 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 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 through further reducing or finishing rolls. They will be doubled and reheated and rerolled 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 nor described.

The two tandem trains 5 and 6 are parallel to each other; but they are not in line, but are preferably arranged as shown in Fig. 1, this arrangement having been chosen partly for the reason that on many mill-floors there are obstructions to the placing of the second train in line with the first train and partly for the reason that the matcher can be more easily gotten at for repairs or alteration. At the exit end of the first train and entrance end of the second train is placed the matching device for matching up two or more sheets, so that they can be piled and passed in double or treble thickness through the second reducing-train. This matching device may be of any suitable or desirable form. It is shown as comprising suitably-supported plates or bars 21, sloping downwardly from the rolls 11 in the direction of the travel of the plates, as shown in Fig. 4. At the lower edge of this matcher is a stop 22, formed as an upwardly-projecting bar or plate and which arrests the travel of the plates, and thus permits the plates to fall down upon the preceding plate and have their ends matched. At the side edge of the matcher there is also provided a suitable stop or stops 23, which is placed in such position that it acts as a gage for directing the piled plates into the first set of rolls 16 of the second reducing-train. For this purpose said stop is made adjustable by any suitable means, such as the bolts and slots shown.

A suitable pushing device is used for push-

ing the piled plates sidewise against this stop 23, thus placing the plates not only in position for entering the second rolls, but at the same time matching up their side edges. This pusher may be of various forms and is shown as a pair of pivoted counterweighted dogs 24, mounted on a slide 25, which is pivotally connected to the end of a lever 26. The latter is pivoted on a swinging link 27 and is connected by a link 28 to an arm 29 on a rock-shaft 30, which is adapted to be rocked by a lever 31. A counterweight may be used to return the pushing-dogs to their original positions, so that the workman need give attention only to the pushing of the plates over against the side stop 23.

That portion of the stop 22 which is in front of the rolls 16 of the second reducing-train is made retractable or movable, so that it can be moved out of the way in order to permit the matched-up sheets to enter the second reducing-train. Accordingly that portion of the stop is formed as a pair of fingers 33, connected to a rock-shaft 34 and normally held in elevated position by a counterweight 35. The rock-shaft 34 may be operated by any suitable means, such as the lever 36, in order to depress the stop-fingers 33 and permit the plates to pass into the second train.

As the bars or plates emerge from the last set of rolls 11 of the first train they pass over a supporting-plate 38 into the bite of a pair of feed-rollers 39, which act to feed them into the matching device, the plates passing by gravity from said feed-rollers down the matcher and against the stop 22. At the entrance of the second train is placed another pair of feed-rollers 40, which feed the plates over a suitable stationary table or plate and into said second train. Both pair of feed-rollers 39 and 40 are positively driven by any suitable mechanism, such as by sprocket-chains, from the contiguous roll-shafts.

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 said train, being carried from one set of rolls to the other by the feed-tables described. The plates as they emerge from the last set of rolls of the first train pass over the table 38 and through the feed-rollers 39, which feed the same forward into the matcher. They slide by gravity down the matcher until their ends strike the stationary stop 22 at the lower edge of said matcher. After one plate has come to rest in this position the next succeeding plate will slide down in the same manner on top of the first plate with its end also bearing against the stop 22. In this position the two plates are matched up at their ends. As soon as the desired number of plates are thus piled the

operator will manipulate the lever 31, thus moving the dogs 24 transversely of the matcher and sliding the matched-up sheets sidewise and into contact with the side stop 23, by which
 5 act the side edges of the sheets will also become matched up. The side stop 23 is so placed that it serves as a guide for directing the matched-up plates to the second train of reducing-rolls. The operator will then ma-
 10 nipulate the lever 36 to depress the stop-fingers 33, and as the piled sheets in this position are inclined they will slide into the bite of the feed-rollers 40, by which they are fed into the second reducing-train. To facilitate this
 15 movement, the feed-rollers 40 are grooved, as shown in Fig. 3, and the ends of the stop-fingers 33 lie in these grooves, so that the ends of the plates while held by these fingers are almost in touch with the faces of the rollers.
 20 As a consequence when the fingers are depressed the plates need slide but slightly in order to come within the bite of the rollers. The counterweight 35 will at once return the stop-fingers 33 to their elevated position, so
 25 as to hold in place the next succeeding plates until such time as they are to be admitted to the second reducing-train. The piled plates will pass through the second reducing-train continuously and will then be fed to the dou-
 30 bler 20, where they will be doubled and then manipulated in the manner which has heretofore been the practice—that is, reheated, re-rolled, and redoubled as often as is necessary to reduce the same to the desired gage. The
 35 sheets as they emerge from my mill will be about sixteen to twenty-six gage, depending upon the thickness and character of sheet-bar used. In this condition they will be suitable for many commercial purposes and therefore
 40 need not be doubled and reheated and rerolled. For tin-plate, however, and many other purposes the gage will in many cases have to be still further reduced, and consequently said sheets will be doubled, rerolled, and reheated.
 45 The advantages of my rolling apparatus result from the simple arrangement thereof. The only necessary manual operations from the time the bars enter the first set of reduc-
 50 ing-rolls until they leave the last set are the ones whereby the stop-fingers 33 are depressed and the piled sheets moved sidewise against the side stop 23. This last operation, how-
 55 ever, serves two functions, not only matching up the sheets at the side edges, but also placing them in proper position for at once enter-
 60 ing the second reducing-train. In this way the delay during matching is very largely reduced, so that the sheets lose very little heat during this operation. The reducing-trains
 65 not being in line makes the matcher easy of access and adapts the arrangement to various mill-floors and ground sites, it being evident that the amount of sidewise movement given to the piled sheets can be varied within wide
 limits. A movement of a few inches sidewise

would suffice to match up the edges of the sheets, and the second reducing-train there-
 fore need be placed only to this extent out of line with the first reducing-train. At the
 70 same time if the mill-floor or ground site re-quires it the second train can be replaced a
 considerable distance out of line with the first train, and in that case the sidewise movement
 75 necessary to bring the plate edges into match would be increased in extent to also bring the
 plates into line with the second reducing-train.

In the drawings the two reducing-trains are shown in exact parallelism, and in the claims they are described as being "parallel." I
 80 wish it understood that by this term I do not exclude an arrangement in which the two trains are at a slight angle to each other, but not so great but that a pusher can push the plates
 85 sidewise and swing them sufficiently to bring them into line with the second train.

What I claim is—

1. In apparatus for rolling sheet metal, the combination of two continuous reducing-
 90 trains each consisting of two or more pairs of rolls arranged in tandem, said trains being parallel but out of line with each other, and a matching device located at the exit end of the first train and entrance end of the second train
 95 and arranged to receive the plates from one train and deliver the same to the other train, said matcher being provided with suitable end-stop mechanism, and with a pusher having an extended engagement with the sides of the
 100 plates for moving the plates sidewise into line with the second reducing-train.

2. In apparatus for rolling sheet metal, the combination of two continuous reducing-trains
 105 each consisting of two or more pairs of rolls arranged in tandem, said rolls being parallel but out of line with each other, and a match-
 110 ing device located at the exit end of the first train and entrance end of the second train and arranged to receive the plates from one train and deliver the same to the other train, said
 115 matcher being provided with suitable end-stop mechanism and suitable side-stop mechanism in line with the second train, and with a pusher having an extended engagement with the sides of the plates for moving the plates
 sidewise into line with the second reducing-train.

3. In apparatus for rolling sheet metal, the combination of two sets of reducing-rolls ar-
 120 ranged parallel but out of line with each other, and a matching device located at the exit end of the first train and entrance end of the second train, said matching device being pro-
 125 vided with a stop to limit the endwise movement of the plates and match up their ends, a stop at the side of the matching mechanism and in position to act as a guide or gage for the second set of reducing-rolls, and a pusher having an extended engagement with the sides
 130 of the plates for moving the plates sidewise

against said side stop, thereby to match up their side edges.

4. In apparatus for rolling sheet metal, the combination of two sets of reducing-rolls arranged parallel but out of line with each other and located at different levels, and a matching device located at the exit end of the first train and the entrance end of the second train and having a downward inclination from the horizontal, a stop located at the end of said matcher and a pusher having an extended engagement with the sides of the plates for moving the plates sidewise into line with the second set of rolls.

5. In apparatus for rolling sheet metal, the combination of two sets of reducing-rolls arranged parallel but out of line with each other and located at different levels, and a matching device located at the exit end of the first train and entrance end of the second train and having a downward inclination from the horizontal, a stop at the lower end of said matcher, a stop at the side of the matcher and in position to act as a guide or gage for the second

set of reducing-rolls, and a pusher having an extended engagement with the sides of the plates for moving them sidewise against said side stop.

6. In apparatus for rolling sheet metal, the combination of two sets of reducing-rolls arranged parallel but out of line with each other and located at different levels, a matching device located at the exit end of the first train and entrance end of the second train and having an inclination downwardly from the horizontal, a stop at the lower forward end of said matcher, that portion of said stop in front of the second set of reducing-rolls being retractable and the remaining portion thereof being stationary, and means for moving the plates sidewise into line with the second set of 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.