No. 803,567. PATENTED NOV. 7, 1905.

P. E. DONNER.

# APPARATUS FOR ROLLING SHEET AND TIN PLATE.

APPLICATION FILED SEPT. 14, 1904.

2 SHEETS—SHEET 1.

FIG. 1

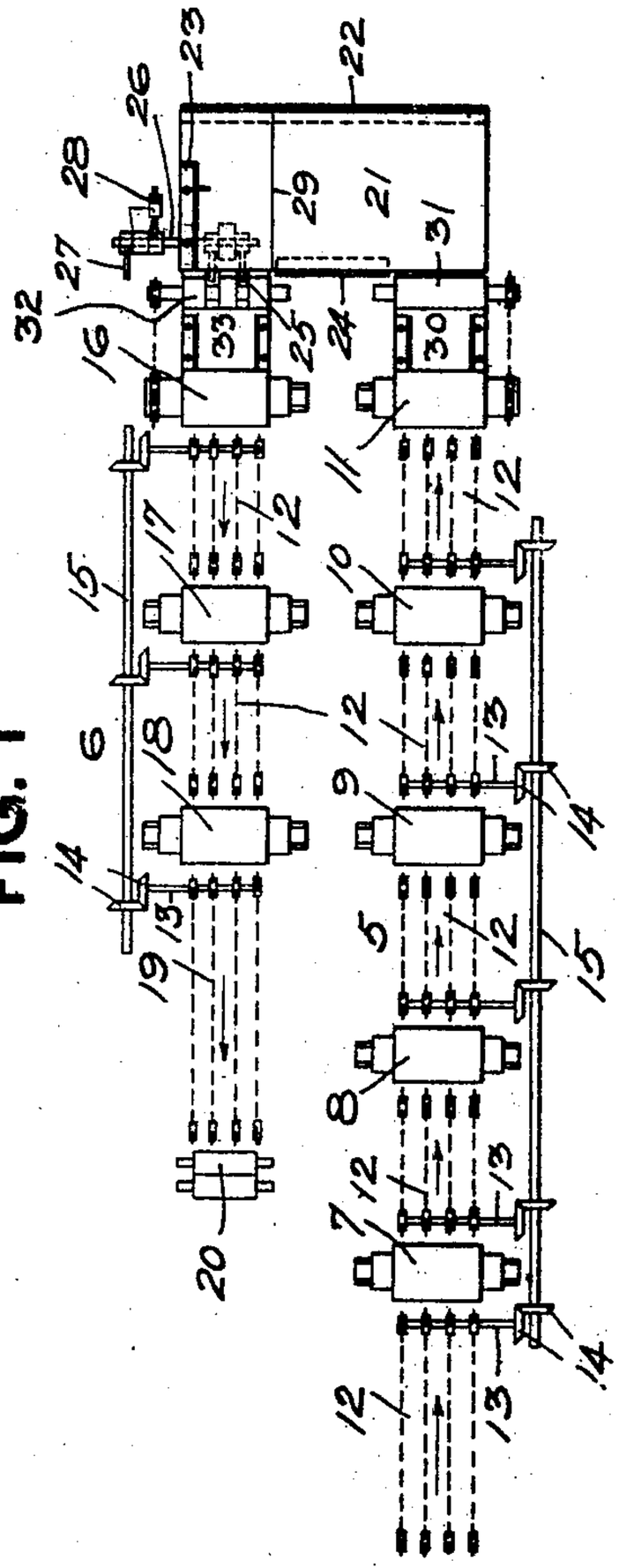
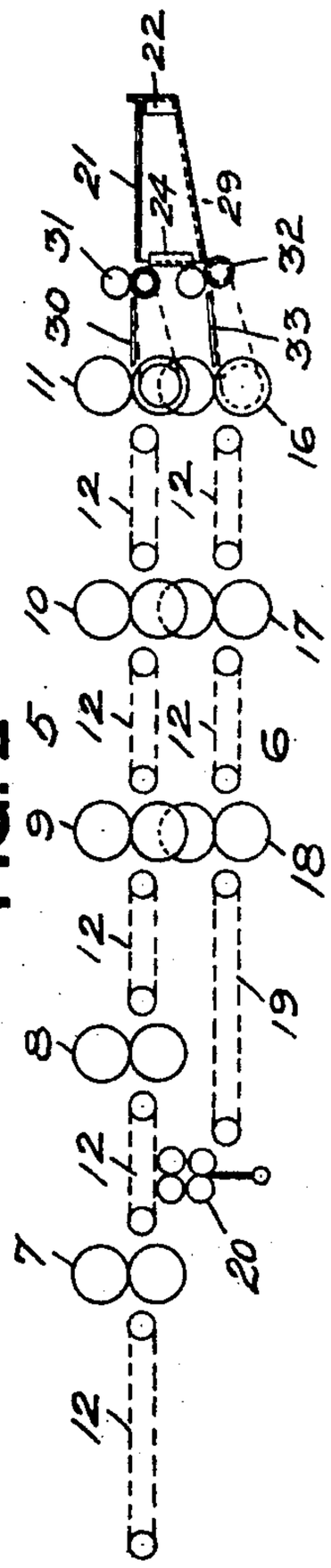
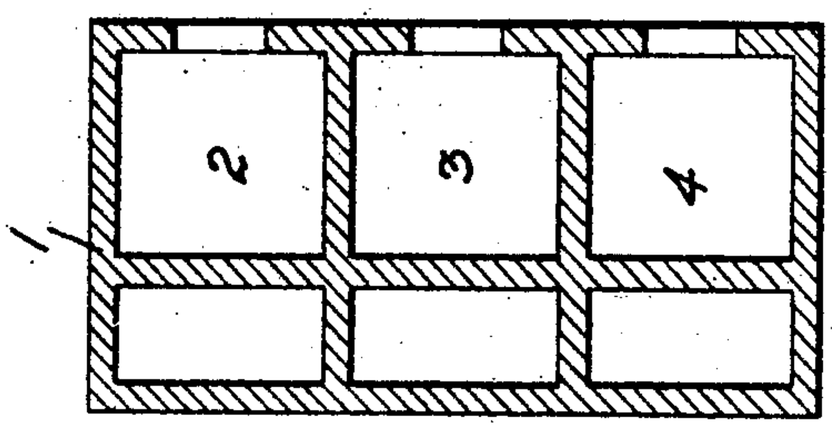
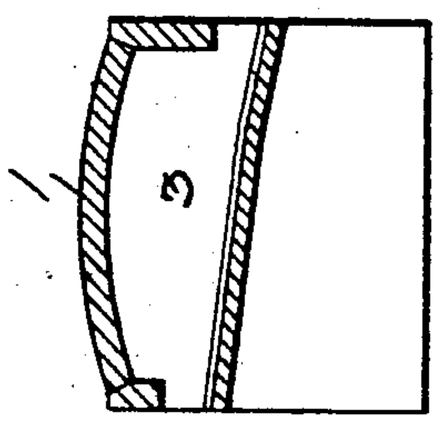



FIG. 2




WITNESSES.

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# APPARATUS FOR ROLLING SHEET AND TIN PLATE.

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2 SHEETS—SHEET 2.

FIG. 4

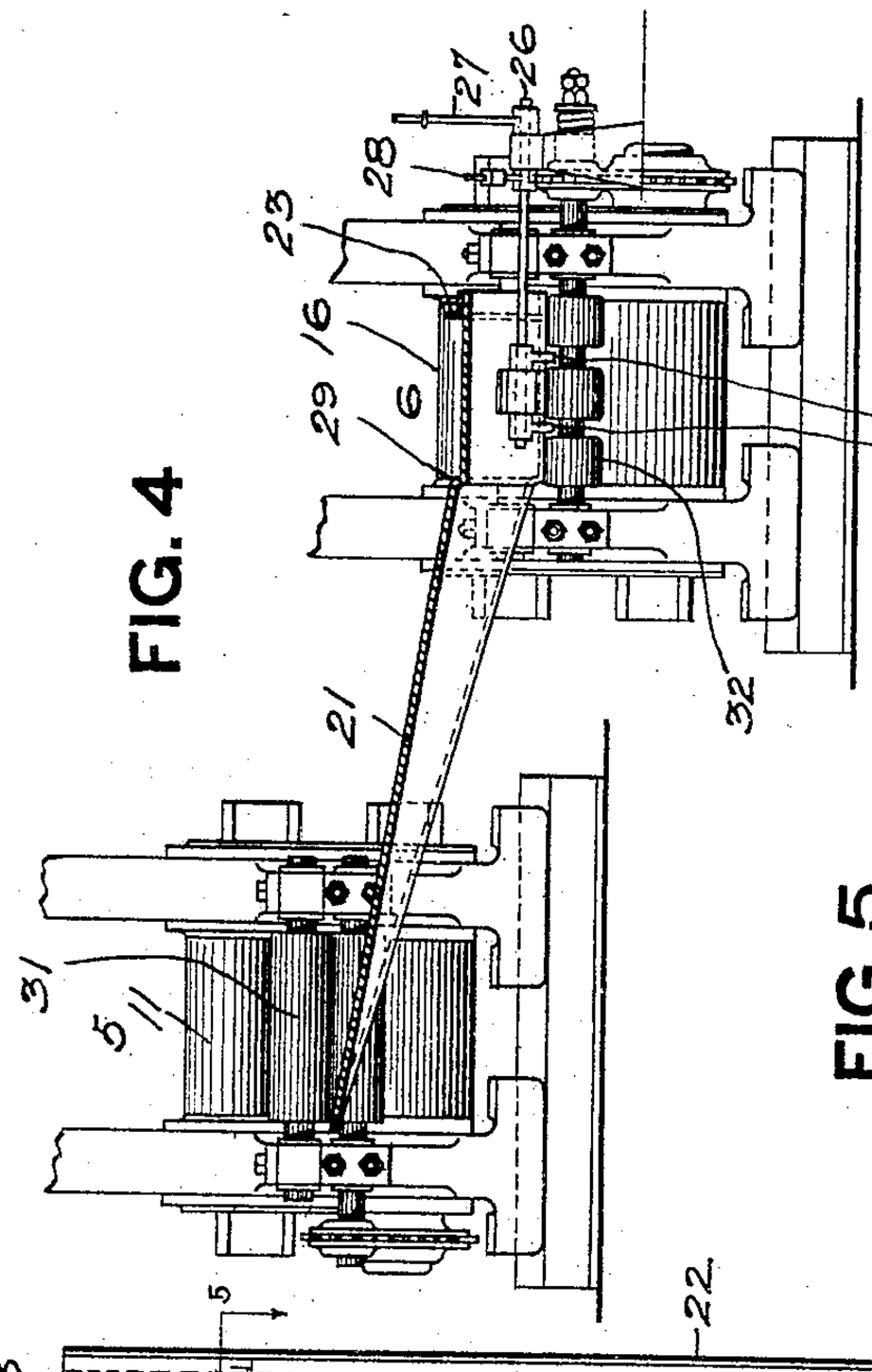
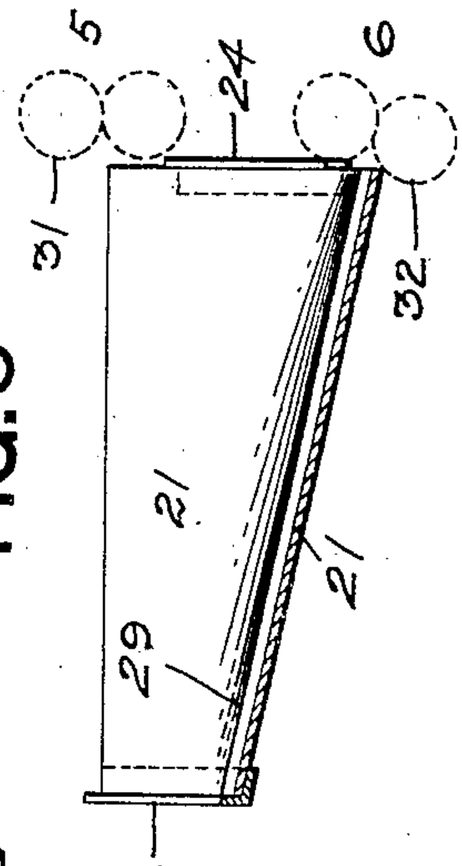



FIG. 5

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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR ROLLING SHEET AND TIN PLATE.

No. 803,567. Specification of Letters Patent. Patented Nov. 7, 1905.

Application filed September 14, 1904. Serial No. 224,456.

*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 advantageously 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 necessitated manually-operated mechanism for matching the edges of the plates. There are numerous objections to the old arrangement, one being the manual work necessary for edging up the sheets, which to some extent delays the entrance of the matched-up sheets into the second reducing-train, thus giving the sheets an opportunity to unduly cool. Another objection is that the placing of the second train in line with the first train necessarily makes an exceedingly long train, so that it cannot be placed on many mill-floors or ground sites. Another objection is that the matcher being located between two trains located in line with each other is not easily accessible for repairs, only the two side edges thereof being exposed. The construction of the matcher, moreover, is quite complicated.

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

To this end the invention consists, generally stated, in placing the second reducing-train at the side of the first reducing-train and preferably parallel therewith and in providing a matching device located at the ends of the two trains and which is so arranged that it will receive the plates from the first train and deliver the same to the other train rear end foremost and with the side edges and rear end edges accurately matched. Preferably this matching device will be inclined in two directions from the horizontal, one inclination being downwardly and sidewise with reference to the line of travel of the plates and the other being downwardly and to the rearward from the direction in which they were received. By this arrangement the sheets as they emerge from the first reducing-train will of their own weight and by gravity slide downwardly sidewise into line with the second reducing-train and against a suitable stop or stops to match up their side edges and will then slide rearwardly with reference to the direction in which they emerge from the first reducing-train against retractable stops which will match up the rear end edges thereof. In this condition they will be ready for entering the second reducing-train rear end foremost, and this result will be accomplished without any manual manipulation other than to withdraw the retractable stops, so that no delay will occur in the sheets at once entering 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 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 at a lower level than the first train and 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 placed side by side, as shown in Fig. 1, and preferably parallel with each other, as shown in said figure. As a result the two trains will occupy a very small amount of floor area or ground-space. The mechanism for matching up the sheets will be placed at the ends of these two trains and will be so arranged as to receive the plates from the last set of rolls of the first reducing-train and to deliver the same to the first set of rolls of the second train. This matching device may be of any suitable or desirable construction, that shown in the drawings being so arranged that the sheets will by gravity slide from the first train into position to enter the second train, said matcher having a double inclination downwardly, one inclination being sidewise with reference to the direction of travel of the plates and the other being to the rearward with reference to the direction in which the plates are received from the first reducing-train. This arrangement, however, is largely illustrative, as different arrangements of the matching device are possible for matching up the side edges and rear end edges of the sheets and delivering the same from the first reducing-train to the second reducing-train and entering the same rear end foremost into said second train.

As shown in the drawings, the matcher is supported upon a suitable frame and has a top surface 21 formed of plates or bars sloping downwardly sidewise from the rolls 11 of the first train to the rolls 16 of the second train. The upper surface of the matcher has a twist therein, so that the upper end—that is, the portion in line with the first reducing-train—is practically horizontal from front to rear, while the other side portion—namely, that in line with the second reducing-train—is lower on the edge contiguous to the rolls than it is on the opposite edge. This matcher will be provided at its forward edge with a suitable stop 22 to prevent the plates from being shot over the matcher, this stop serving to arrest the forward travel of the plates as they emerge from the first reducing-train and to guide said forward end as the plates slide sidewise down into line with the second reducing-train. On its lower side edge the matcher is also provided with a suitable stop 23 for limiting the sidewise movement of the plates and matching the side edges thereof and also serving as a gage for properly positioning the plates for entering into the second reducing-train. Preferably this stop will be adjustable, so that its position may be varied to properly guide into the rolls plates of different widths.

At its rear edge the matcher is provided with a stop 24 and at its lower rear end with suitable retractable stops against which the rear end edges of the plates will contact and be matched. These retractable stops are shown as fingers 25, mounted on a suitable rock-shaft 26, actuated by a lever 27 and normally held elevated by a counterweighted arm 28 on said shaft. In order to insure the plates passing one on top of the other as they slide sidewise down the matcher, the delivery side of said matcher—that is, the por-

tion in line with the second reducing-train—is slightly depressed, so that the plate or plates resting thereon are a little below the surface of the main portion of the matcher, this depressed portion being indicated by the shoulder 29. It is also desirable that the delivery edge at the stops 25 be horizontal, so as to be in line with the bite of the second reducing-train. The opposite side may also be made horizontal; but this is not necessary. In any event the plates by gravity slide against the side stop 23 and then backwardly with reference to the direction in which they were received against the retractable stops 25 and having both their side and rear end edges matched up. As the bars or plates emerge from the last set of rolls 11 of the first reducing-train they pass over a supporting-plate 30 into the bite of a pair of feed-rollers 31, which act to feed them into the matching device, the stop 22 serving to limit the forward movement of the plates. The plates then slide by gravity sidewise down the matcher into position for entering the second reducing-train. At the entrance of the second train is placed another pair of feed-rollers 32, which feed the plates into said train over a suitable stationary table or plate 33. Both the feed-rollers 31 and 32 will be 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 the first reducing-train, being carried from one set to the other by the feed-tables described. As the plates emerge from the last set of rolls of the first reducing-train they pass over the table 30 and through the feed-rollers 31, which serve to feed the same forward onto the matcher, their forward travel being stopped by the ledge or stop 22. They then slide by gravity sidewise down the matcher until the edges thereof strike the side stop 23. After one plate has come to rest in this position the next succeeding plate will slide down sidewise in the same manner and on top of the first plate, with its edge also bearing against said side stop. If desired, a third and even a fourth plate will slide down in the same way and on top of the preceding plates. The twist in the matcher-floor is such that the rear ends of the plates—that is, the ones last emerging from the first reducing-train—drop down farther than the front ends thereof, and as a consequence when the plates come to rest against the side stops 23 they will have a downward slope toward the second reducing-train and will slide by gravity against the stop-fingers 25. In this position the plates will be superimposed one upon the other with their rear ends accurately matched and their side edges also matched and positioned by the stop 23 for immediate entry into the second reducing-train. The operator will then manipulate the lever 27 to depress the stop-fingers 25, and as the sheets in this position are inclined they slide backward slightly and into the bite of the feed-rollers 32, by which they are fed into the second reducing-train. To facilitate this movement, the feed-rollers 32 are grooved, as shown in Fig. 3, and the ends of the stop-fingers 25 lie in these grooves, so that the ends of the plates while being held by said stop-fingers are almost in touch with the faces of the rollers. As a consequence when the fingers are depressed only a very slight sliding movement is necessary in order to bring the plates into the bite of the rollers. As soon as the lever 27 is released, the counterweight 28 will at once return the stop-fingers 25 to their elevated position, so as to hold in place the next succeeding plates until such time as they also are to be admitted to the second reducing-train. The piled sheets pass through the second reducing-train continuously and in succession and will then be fed to the doubler 20, which may be either in line with the second reducing-train or out of line therewith. Here they are doubled and will then be manipulated in the same manner as has heretofore been the practice—that is, reheated and rerolled and redoubled as often as is necessary to reduce the same to the desired gage. When the sheets emerge from the second reducing-train, they will be from sixteen to twenty-six gage, depending upon the thickness and character of the sheet-bar used. In this condition they are suitable for certain purposes, and therefore need not be doubled and reheated and rerolled. For tin-plate and many other purposes, however, the gage will often have to be further reduced, and consequently such sheets will have to be doubled, reheated, and rerolled.

The advantages of my rolling apparatus result from the very small amount of floor or ground space occupied thereby and also from the practically automatic action thereof. Since the two trains are placed side by side, the necessary length of the mill-floor is very much reduced and adapts this arrangement to mill-floors and ground sites of comparatively restricted area. Furthermore, no manual operation is necessary from the time the bars enter the first set of reducing-rolls until they leave the last set of reducing-rolls, except that is necessary to depress the stop-fingers 25. In all other particulars the operation is entirely automatic. The plates are accurately matched both at their side edges and at the ends which are to enter the second set of reducing- rolls, and in being matched they are placed in position for immediate entry into the second reducing-train.

In this way no delay occurs during matching, and the sheets will lose practically no heat during this operation.

It will be understood that many modifications in the arrangement shown may be made. For instance, the two trains instead of being placed parallel with each other may be placed at a slight angular relation; but in all cases the second train will be at the side of the first train, so that the plates in passing through the same will travel in substantially the opposite direction from their travel through the first train. Many varieties of matchers may also be employed, the essential being a device which will move the plates sidewise to transfer them from the first reducing-train into line with the second reducing-train and will then move the same slightly rearward against suitable stops for matching up their rear ends. If desired, the matcher may be substantially horizontal from side to side and the plates moved sidewise thereon by means substantially such as shown and described in my application, Serial No. 224,453, filed concurrently herewith. In such case the two mills 5 and 6 may be at substantially the same level. I may even use a lifting-matcher somewhat similar to that described and claimed in my application, Serial No. 224,455, filed concurrently herewith.

What I claim is—

1. In apparatus for rolling sheet metal, the combination of two sets of reducing-rolls arranged side by side and so as to feed in opposite directions, and a matching device located at the exit side of the first set and entrance side of the second set and arranged to receive the plates from the first set, move the same sidewise into line with the second set and deliver the same rear end foremost to said second set, said matcher being provided with suitable stop mechanism and having that portion thereof in line with the second set of rolls inclined toward the rear.

2. In apparatus for rolling sheet metal, the combination of two sets of reducing-rolls arranged side by side and so as to feed in opposite directions, and a matching device located at the exit side of the first set and entrance side of the second set and arranged to receive the plates from the first set, move the same sidewise against a stop in line with the second set and then deliver the same to said second set rear end foremost, said matcher being provided with suitable stops for squaring up the rear ends of the plates and having that portion thereof in line with the second set of rolls inclined toward the rear.

3. In apparatus for rolling sheet metal, the combination of two sets of reducing-rolls arranged side by side and so as to feed the plates in opposite directions, and a matching device extending from the exit side of the first set to the entrance side of the second set and having a double downward inclination from the horizontal, whereby the plates are moved sidewise with reference to the direction in which they are received and are moved backward with reference to said direction, said matcher being provided with suitable stop mechanism.

4. In apparatus for rolling sheet metal, the combination of two sets of reducing-rolls arranged side by side and so as to feed the plates in opposite directions, and a matching device located on the exit side of the first set and entrance side of the second set and having a double downward inclination from the horizontal, said matcher being provided with side and end stops adjacent to the second set of rolls, whereby the plates will slide sidewise from the first set of reducing-rolls into line with the second set of reducing-rolls with their edges against the side stop, and then slide endwise toward said second set of reducing-rolls with their end edges against the end stop.

5. In apparatus for rolling sheet metal, the combination of two sets of reducing-rolls arranged side by side and so as to feed the plates in opposite directions and being located at different levels, and a matching device located at the exit side of the first set and entrance side of the second set and having a double downward inclination with its higher end in proximity to the rolls at the higher level and its lower end in proximity to the rolls at the lower level, said matcher having a side stop in position to act as a guide for directing the plates into the second set of reducing-rolls and also having retractable stops in front of said second set of reducing-rolls, and means for retracting said last stops, whereby the plates will slide downwardly against the side stop and in position for entering the second set of rolls and will then move endwise against the retractable stops for squaring up their rear end edges.

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

PERCY E. DONNER.

Witnesses:
ROBERT C. TOTTEN,
G. C. RAYMOND.