H. A. LEWIS.

WORK HANDLING APPARATUS FOR ROLLING MILLS.

APPLICATION FILED OCT. 23, 1919.

**1,413,600.** Patented Apr. 25, 1922.

2 SHEETS—SHEET 1.

FIG. 1

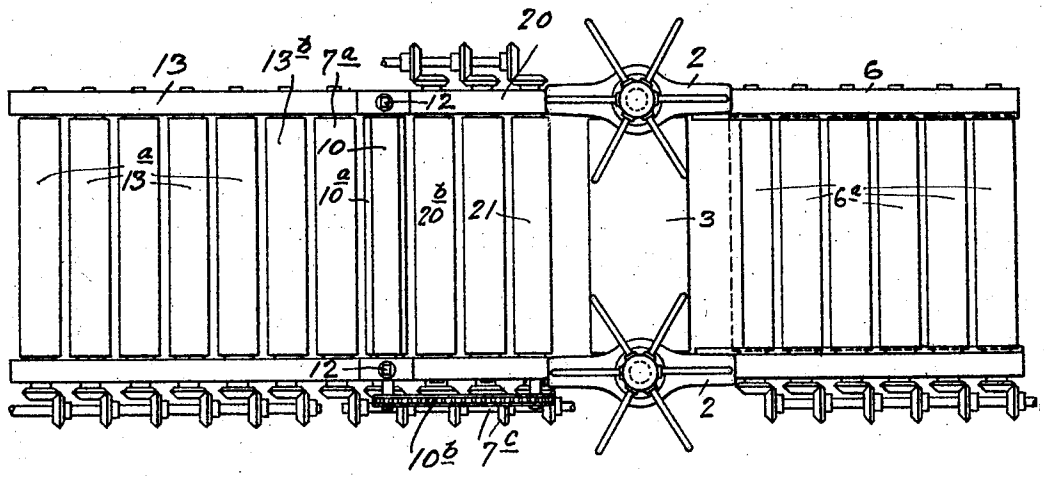
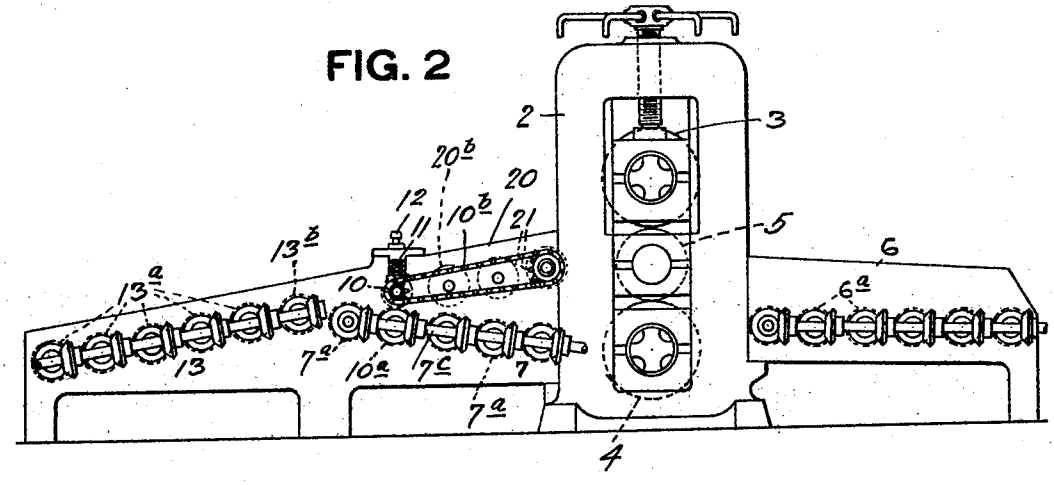



FIG. 2




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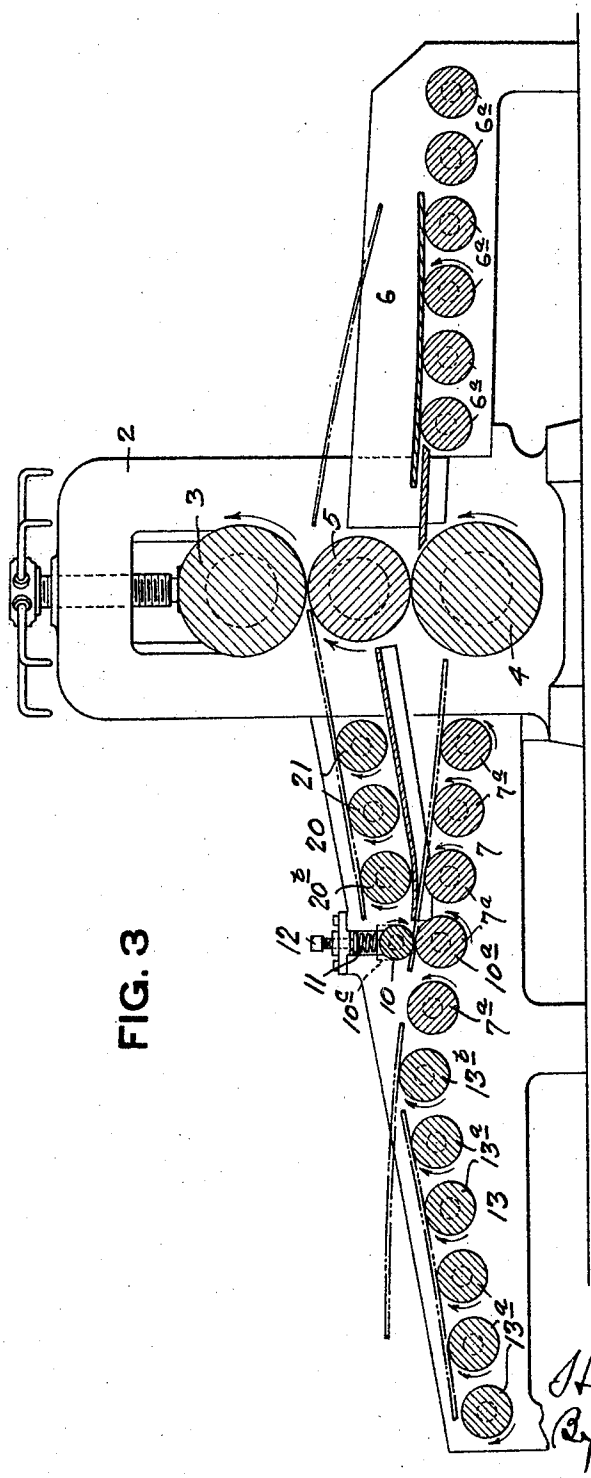



FIG. 3

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# UNITED STATES PATENT OFFICE.

HARRY A. LEWIS, OF NORRISTOWN, PENNSYLVANIA.

## WORK-HANDLING APPARATUS FOR ROLLING MILLS.

1,413,600. Specification of Letters Patent. Patented Apr. 25, 1922.

Application filed October 23, 1919. Serial No. 332,602.

*To all whom it may concern:*

Be it known that I, HARRY A. LEWIS, a citizen of the United States, and resident of Norristown, in the county of Montgomery and State of Pennsylvania, have invented a a new and useful Improvement in Work-Handling Apparatus for Rolling Mills; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the handling of metal sheets, plates, and structural shapes, and it has special reference to the handling of material of the character indicated in connection with rolling mills, as in the finishing or rerolling operation wherein the material is passed repeatedly through the same rolls or sets of rolls.

In the production of metal plates, sheets and the like, the material is "finished rolled" by giving it successive passes, either through a single stand of rolls, or through a three-high mill. In the treatment of plates, a three-high mill is generally employed, and the plate is started through the lower pass of the mill and is delivered upon a lifting table, or upon lifting levers operated by attendants, by which it is transferred to the upper pass of the mill where it is returned through the rolls to the entry side of the mill.

Sheets and the lighter plates are commonly "finished rolled" on a two-high mill, and the reversing of the material to the entry side of the mill is accomplished in a manner similar to the reversing or transferring of plates excepting that the material is commonly transferred above the top roll of the mill.

The transferring of the material from the lower pass to position it for the upper pass, or for elevating it above the rolls either by lifting tables or levers as mentioned above, is objectionable, mainly, for the reason that considerable rolling time is lost through interruption of travel of the plate incident to the starting and stopping of the lifting devices, and for the reason that manual labor is involved in manipulating the tables and levers. And further, with mills of this type, power apparatus, such as motors, hydraulic engines or air engines, are required for actuating the lifting tables in the handling of heavy plates, thus adding to the cost of rolling.

One object of my present invention is to provide simple methods and apparatus for advancing an object to be treated and automatically reversing its direction of movement in order to bring the object back to its starting point.

More specifically, this object of my invention is to provide work-handling methods and apparatus whereby the article under treatment is advanced for a given distance in one direction, and is then permitted to tilt by its own weight into position to be moved in the reverse direction.

A further object of my invention is to provide methods and apparatus for passing sheet material, structural shapes or other articles repeatedly and automatically through a rolling mill, whereby the article is passed through the mill any desired number of times without the intervention of manual labor.

A further object of my invention is to provide for the continuous movement of the material throughout the rolling operation, and thus to increase the speed of rolling.

A further object of my invention is to provide means for removing scale from the plate at both sides of the mill, and a still further object is to provide a simple design of apparatus of the above nature which may be readily installed with mills commonly in use.

To these ends, my invention comprises the novel features hereinafter set forth and claimed.

In the accompanying drawings, Fig. 1 is a plan view of a rolling mill with my invention applied thereto; Fig. 2 is a side elevational view of the apparatus shown in Fig. 1; and Fig. 3 is an enlarged longitudinal sectional view through the mill.

In the drawings, I have illustrated my invention as applied to a three-high mill adapted for rolling plate, but I do not wish to limit my invention thereto, as it will be seen from the description which follows that my invention may be employed in connection with mills for the production of slabs and billets, and for feeding other material where it is desired to re-roll it, either by passing it back through the mill or over the rolls to its starting position.

The mill illustrated comprises a housing 2, top and bottom rolls 3 and 4, respectively,

and a middle roll 5, all of which parts may be of the usual construction, and which may be driven by any suitable power element.

The mill is served by feed roller tables which act to impart a continuous movement to the plate throughout the rolling operation. This is an important feature of my invention, as distinguished from the interrupted travel of the plate in mills employing lifting tables and the like, as with the automatic continuous movement of the material the speed of the rolls may be increased and I am thus enabled to increase the output of the mill and reduce the labor cost of operation.

The table which serves the entry or starting side of the mill is indicated by the numeral 6 and has the live rollers $6^a$ which are continuously driven so as to carry the slab or plate to the lower pass of the mill. This table may be of the usual construction for mills of this type and needs no further description.

At the delivery side of the lower pass of the mill is arranged a receiving table 7 having the live rollers $7^a$ which are driven in unison by shaft and gear connections $7^c$. This table is arranged on an incline which slopes upwardly away from the mill, the purpose of which is to provide for the elevation of the plate above the reversing table, as hereinafter described.

The plate as it emerges from the lower pass of the mill is carried by the live rollers of table 7, forward and upwardly into engagement with positive forwarding means which are adapted to move the plate entirely off from this table. The forwarding means are located near the end of the table 7 remote from the mill, and comprise a pair of pinch rolls 10 and $10^a$ which grip the plate and move it forward independently of the driving effect of the table rollers $7^a$, thus insuring against delay through slippage of the plate on the rollers in its transit upwardly away from the mill.

The lower roll $10^a$ of the pinch roll set is of the same diameter as the rolls of the table 7 and is arranged as a roller in the bed of the table and in surface alignment with these rolls, and is preferably driven in unison with them. The upper roll 10 is of less diameter than the lower roll, the purpose of which will hereinafter appear. This roll is independently driven at the same surface speed as roll $10^a$ by a flexible drive connection $10^b$ preferably from a live roller or other driving connection of the feeding table 20 described below. Roll 10 is mounted in bearings $10^c$ which are adapted to permit the roller to yield upwardly away from the lower roll so that it will accommodate itself to the varying thicknesses of the material being rolled, the bearing blocks into which the roll is journaled being resiliently supported by springs 11 which permit upward yielding of the roll. The tension of the springs 11 may be varied by means of adjusting screws 12.

The pinch rolls 10 and $10^a$ feed the plate forward upon a reversing table 13 which is preferably arranged as a continuation of the receiving table 7, but which is inclined so as to slope in a direction opposite to the slope of the table 7. The tables 7 and 13 are arranged in such angular position that the first roll $13^b$ of table 13 forms the highest point of the angle formed by these tables. When the plate being rolled is moved by the pinch rolls 10 and $10^a$ from the table 7 it overlies the table 13, and upon release from the pinch rolls overbalances or tilts on the end roller $13^b$ and falls upon table 13 which slopes at the proper angle for directing the plate to the upper pass of the mill. The roller $13^b$ of the table 13 is driven in a direction opposite to the direction of rotation of the rollers 7 and when the plate is released from the pinch rolls, this roller $13^b$ acts to prevent sliding of the plate by gravity over the other rollers of table 13, and serves also as a means for removing the scale of the plate by reason of its action in opposition to the direction of movement of the plate under the treatment during the engagement of the plate with the pinch rolls. The dropping of the plate upon its release by the pinch rolls also acts to jar loose the scale of the plate at this side of the mill. The table 13 has the additional live rollers $13^a$ which, like the rollers $13^b$, are driven in a reverse direction to that of the rollers of the table 7, and which act to carry the plate back towards the mill.

When the plate is deposited upon the table 13 it is immediately moved by the rollers $13^a$ and the end roller $13^b$ and delivered to a reverse roller feed table 20 having live rollers 21 which feed the plate into the upper pass of the mill. The table 20 is arranged as a continuation of the table 13, and lies in the same plane thereof, and the plate, in transit from the table 13 to the table 30, passes above the pinch rolls 10 and $10^a$. The upper roll 10 of the pinch rolls is made of such a diameter that it lies below the upper surfaces of table 20 when in driving engagement with its co-acting roller $10^a$, the purpose of which is to bring the center of the rolls 10 below the center of the end roller $20^b$ of the table 20, so that the rolls 10 form a guard in the gap at the junction of the tables which prevents entrance of sagging material between the tables 7 and 20, and which acts to elevate such sagging material so as to bring it into driving engagement with the rollers $20^a$.

The plate after its passage through the upper pass, is returned to its starting position upon the entry table 6, the plate fall-

ing by its own weight upon the rollers $6^a$ which feed it again to the lower pass of the mill.

It will thus be seen that, by the above-described arrangement of feeding tables the movement of the material through the mill is a continuous movement except for that period of time incident to the reversal of the material at the reversing table 13. By reason of the opposing action of the end roller $13^b$ of the table 13, the plate, on being discharged by the pinch rolls 10 and $10^a$ from the table 7 is prevented from sliding by gravity over the rolls of the table 13, and when the plate has left the pinch rolls the end roller $13^b$ and the other live rollers of the table immediately act to impart a reverse movement to the plate, to convey it back to the rolls, thus reducing the time of reversing to a minimum, and by the uniform automatic travel of the material back and forth through the mill an appreciable economy is effected in rolling, and the cost of the labor reduced.

My invention may be utilized in the rolling of angle bars and other structural shapes, as well as in the rolling of sheets and plates, and the principle of my tilting reverse mechanism may be employed for a wide variety of purposes other than those which I have specifically described herein. It is therefore to be understood that the foregoing description, and the accompanying drawings, are intended to illustrate my invention without imposing any limitations thereon except such as are indicated in the appended claims.

I claim as my invention:

1. In a rolling mill, the combination with a set of rolls comprising three rolls having a pass between the lower pair and a pass between the upper pair, of a stationary feed table provided with positively driven rollers for feeding material to the lower pass, an upwardly inclined and positively driven set of rollers for receiving the material from the said lower pass and an oppositely inclined and positively driven set of rollers for receiving the material from said upwardly inclined set of rollers, and other rollers for returning the said material through the upper pass and for depositing the said material upon the said feed table, whereby the said material is automatically passed through the same pass of the mill a plurality of times.

2. In a rolling mill the combination with the rolls, of a receiving table provided with positively driven rollers for receiving the material coming through the rolls, a positively driven pinch roller co-ojerating with one of the said receiving rollers to advance the said material, and means for reversing the direction of movement of the said material and passing the material back over the said pinch roller, the said pinch roller serving as a guide to insure the proper travel of the said material in its reverse movement.

3. In a rolling mill, the combination with a set of rolls, of an upwardly inclined receiving table provided with positively driven rollers for receiving and advancing the material coming through the rolls, and a downwardly inclined and automatically operating reversing table provided with rollers that are positively driven in the opposite direction with respect to the rollers of the said receiving table, the said oppositely driven rollers serving to return the said material upwardly toward its starting point.

4. In a rolling mill, the combination with a set of rolls having a pass between the lower pair and a pass between the upper pair, of an upwardly inclined receiving table provided with positively driven rollers for receiving and advancing the material coming through the lower pass, and a table automatically operable to reverse the movement of said material, the said reversing table being downwardly inclined in alinement with the said upper pass and being provided with positively driven rollers adapted to take the said material from the said receiving table and direct the said material to the upper pass.

5. In a rolling mill, the combination with a set of rolls, of a feed table provided with positively driven rollers for feeding material to the said set of rolls, a receiving table provided with positively driven rollers for receiving and advancing the material coming through the rolls and an automatically operating reversing table provided with rollers which are positively driven in the opposite direction with respect to the rollers of the said receiving table and which serve to return the said material toward its starting point, the said receiving table and reversing table being oppositely inclined downwardly from a common point.

6. In a rolling mill, the combination with a set of rolls, of a feed table provided with positively driven rollers for feeding material to the said set of rolls, a receiving table provided with positively driven rollers for receiving and advancing the material coming through the rolls, an automatically operating reversing table provided with rollers which are positively driven in the opposite direction with respect to the rollers of the said receiving table and which serve to return the said material toward its starting point, and a set of positively driven reverse feed rollers in line with said reversing rollers for receiving the said material from the said reversing table and for returning the said material to the said first-named feed table.

7. In a rolling mill, the combination with

a set of rolls, of a feed table provided with positively driven rollers for feeding material to the said set of rolls, an upwardly inclined receiving table provided with positively driven rollers for receiving the material coming through the rolls, a positively driven pinch roller co-operating with one of the rollers of the said receiving table to advance the said material, a downwardly inclined reversing table adjacent to the said receiving table and forming an angle therewith, the said reversing table being provided with rollers that are positively driven in the opposite direction with respect to the rollers of the said receiving table, and a set of positively driven reversing feed rollers for receiving the said material from the said reversing table over the said pinch roll and for returning the said material to the said first-named feed table.

8. The method of handling sheet material that comprises automatically advancing a metal sheet, plate or the like in an upwardly inclined direction edgewise, permitting the said sheet to tilt by its own weight into a downwardly inclined position and then automatically moving the said sheet in the reverse direction.

In testimony whereof, I, the said HARRY A. LEWIS, have hereunto set my hand.

HARRY A. LEWIS.

Witnesses:

AARON S. SWARTZ, JR.,

ELIZABETH R. FORREST.