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[33] **Austria**
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[54] **ROLLING MILL TRAIN**
11 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **72/222,** 72/231, 72/250
[51] **Int. Cl.** **B21b 39/16**
[50] **Field of Search** 72/222, 227, 231, 250, 252

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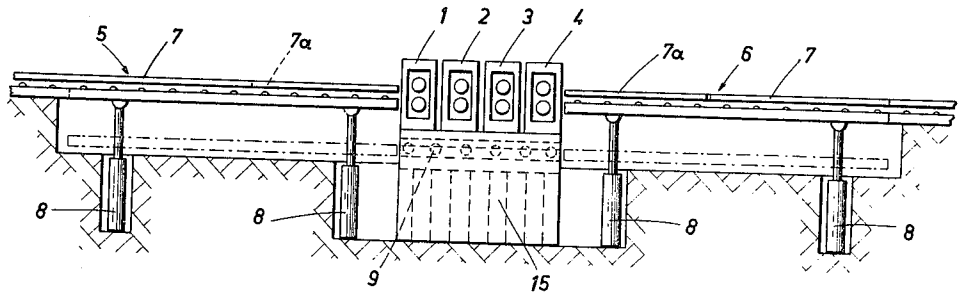
ABSTRACT: A plurality of nonreversible two-high rolling mill stands define a plurality of pass groove lines disposed one beside the other. A first roller bed unit precedes said rolling mill stands. A second roller bed unit succeeds said rolling mill stands. An additional roller bed unit extends under said rolling mill stands between said first and second roller bed units and is operable to return stock from said second roller bed unit to said first roller bed unit. Each of said first and second roller bed units comprises a plurality of roller bed sections disposed one beside the other, and guide means laterally defining guide paths on said roller bed sections. At least two of said roller bed sections of each of said first and second roller bed units are reversible and adapted to be lowered to the level of said additional roller bed unit. Each of said first and second roller bed units is provided with deflecting means, which are adapted to deflect stock onto a desired one of said reversible roller bed sections of the respective roller bed unit.



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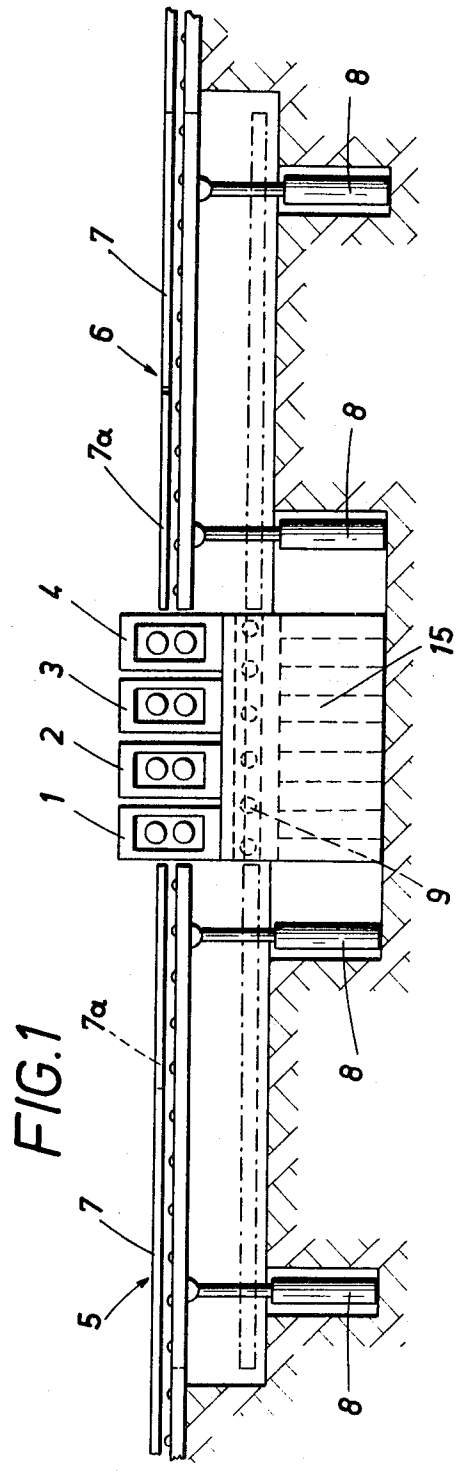

FIG. 1

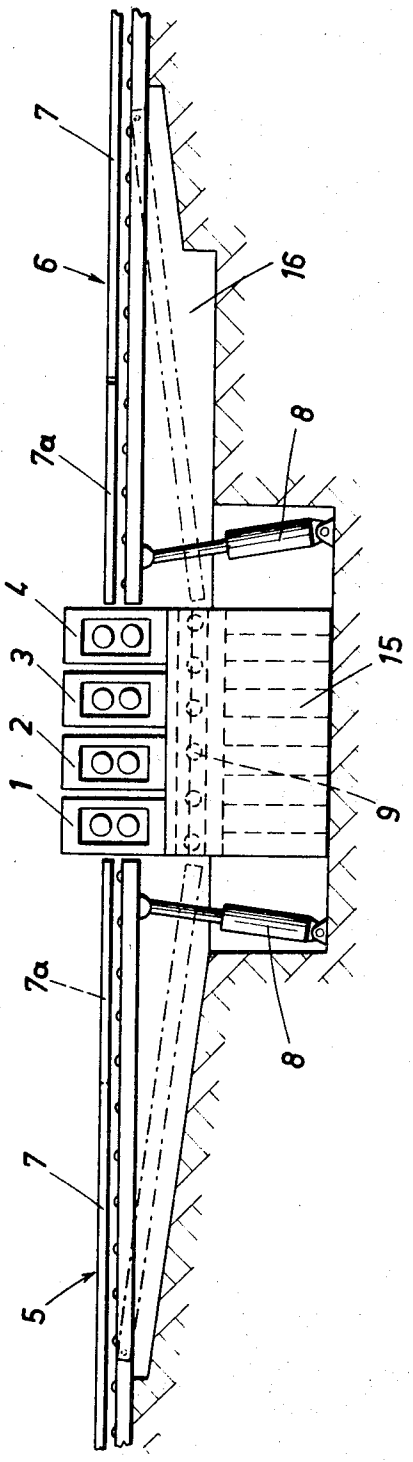

FIG. 2

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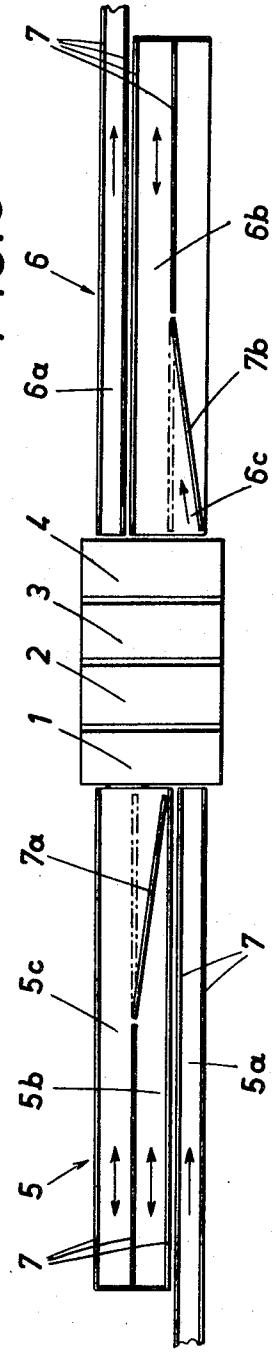
FIG. 3



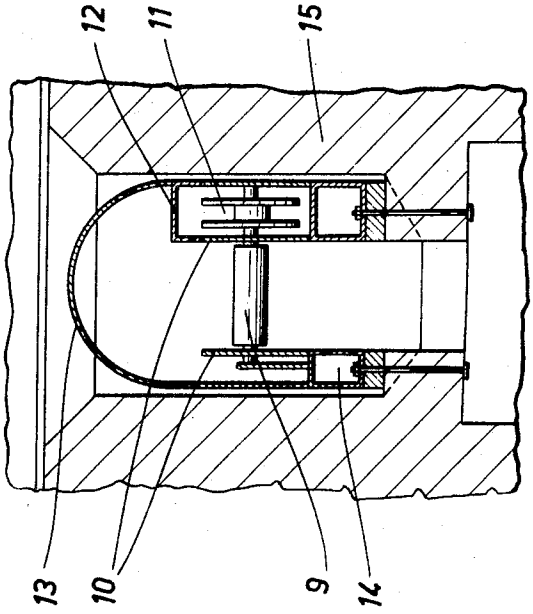


FIG. 4

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ROLLING MILL TRAIN

This invention relates to a rolling mill train for the production of billets, sections and the like, which train consists of a plurality of nonreversible two-high rolling mill stands which define a plurality of groove lines disposed one beside the other, and roller bed units preceding and succeeding the rolling mill stands.

Such rolling mill trains involve relatively low capital requirements and are provided for a small or medium annual output. Because the two-high rolling mill stands are nonreversible but comprise each a plurality of rows of pass groove lines disposed one beside the other, the stock must be returned two or more times from the delivery end to the receiving end of the rolling mill train. This involves a considerable loss of time and temperature so that the number of passes which can be performed from one heat is relatively small. The stock was previously returned by means in which the stock was laterally shifted on the floor level at the delivery end of the rolling mill train and was then returned parallel to the rolling mill train and subsequently shifted once more to the correct position relative to the desired pass groove line. Such conveying devices are comparatively complicated and also have a large space requirement.

Hence, it is an object of the invention to provide a rolling mill train which is of the kind described first hereinbefore and in which the stock is returned from the delivery end to the receiving end as fast as possible and on the shortest route and with a minimum temperature loss and which also requires much less space.

This object is accomplished according to the invention essentially in that an additional roller bed unit is provided under the rolling mill stands, preferably at the center of the train, and the roller bed units which precede and succeed the rolling mill stands define a plurality of roller bed sections, which are disposed one beside the other and are laterally limited by guide bars or the like, at least two of said roller bed sections are adapted to be lowered at a time to the level of the additional roller bed and are reversible in known manner, the roller bed sections having associated with them a deflecting device, which may consist, if desired, of pivoted guide bar sections. In such an arrangement, the stock which has passed through the rolling mill stands for the first time can be delivered to the additional roller bed unit under the rolling mill stands when the roller bed section at the delivery end has been lowered and the additional roller bed unit will then return the stock to the receiving end, more particularly to the next roller bed section which is disposed at the receiving end and has been lowered, said roller bed section at the receiving end is then lifted and its rollers are reversed to initiate the next pass. These operations will be repeated until the stock has passed through the last pass groove line and has entered the delivery roller bed section. Because the stock is returned on the additional roller bed unit under the rolling mill stands, the transit time is much reduced, particularly because the transverse displacement is restricted to the deflection from one roller bed section at one end of the rolling mill stand to that roller bed section which is adjacent to the aligned roller bed section at the other end. Because the returning time is reduced, the number of passes which can be performed from one heat can be increased. Additional space on the side of the rolling mill train is not required so that in spite of the provision of the returning means the floor space requirement is restricted to the requirement for the rolling mill train itself.

Adjacent to the pivoted deflecting guide bars, the roller bed sections may be provided with rollers which are inclined to the longitudinal direction of the train in order to facilitate the transfer of the stock from one roller bed section to the laterally offset roller bed section at the other end.

A particularly desirable arrangement will be obtained if three different pass groove lines are provided one beside the other, three roller bed sections precede and succeed the rolling mill stands, the additional roller bed unit is somewhat wider than the intermediate roller bed sections, and the receiving and delivery roller bed sections are disposed on different longitudinal sides of the train and preferably narrower than the adjacent roller bed sections. Although, the additional roller bed unit has only a relatively small width, such an arrangement ensures a satisfactory transfer of the stock and prevents a clamping of the stock as it enters the laterally offset roller bed section at the other end. In this arrangement, the receiving and delivery roller bed sections may be stationary so that they cannot be lowered. Alternatively, all roller bed sections may be adapted to be lowered so that the rolling of two workpieces with a time overlap will he facilitated. Generally, the rolling mill train according to the invention has the advantage of enabling a simultaneous deformation of two workpieces resulting in a higher output.

The roller bed sections which may be lowered may consist of lifting or tilting tables and hydraulic or pneumatic piston-cylinder units are recommendable as lifting means. Alternatively, strictly mechanical positioning means, such as screws, cranks or the like, may be used to lift and lower the roller bed sections.

In a development of the invention, the additional roller bed unit is provided with a heat-insulating protecting hood, which shields that roller bed unit also against scale which drops from the rolling mill stands and from water. Above all, the hood reduces the temperature losses of the returning stock.

It is also a feature of the invention that the additional roller bed unit together with its drive means constitutes a unit of construction, which is detachably secured to the foundation for the rolling mill stands and can be laterally removed so that the installation and dismantling in the case of repairs are much facilitated.

The subject matter of the invention is diagrammatically shown by way of example in the accompanying drawings, in which

FIGS. **1** and **2** are side elevations showing two embodiments of a rolling mill train,

FIG. **3** is a corresponding top plan view and

FIG. **4** is an enlarged transverse sectional view showing the additional roller bed unit.

The rolling mill train consists of four nonreversible two-high rolling mill stands **1–4**, which define three different pass groove lines disposed one beside the other. The rolling mill stands are preceded by a roller bed unit **5** and succeeded by a roller bed unit **6**. The two roller bed units **5**, **6** are divided into three roller bed sections **5***a*, **5***b*, **5***c* and **6***a*, **6***b*, **6***c*, respectively, which form guide paths that are laterally defined by guide bars **7**. The roller bed sections **5***a* and **6***a* constitute receiving and delivery roller bed sections, respectively, and are disposed on different longitudinal sides of the train. Guide bar sections **7***a* are pivotally movable like deflectors between positions which are respectively indicated in solid and dash-dot lines in FIG. **3**. The roller bed sections **5***b*, **5***c*, on the one hand, and the roller bed sections **6***b*, **6***c*, on the other hand, may be lowered by means of a lifting table, shown in FIG. **1**, or a tilting table, shown in FIG. **2**. Hydraulic or pneumatic piston-cylinder units **8** are provided for this purpose. An additional roller bed unit **9** is disposed under the rolling mill stands **1–4** on the center line of the train and serves to return the stock from the delivery end to the receiving end of the rolling mill train. As is indicated in dash-dot lines in FIGS. **1** and **2**, the roller bed sections **5***b*, **5***c* and **6***b*, **6***c* are lowered to the level of that additional roller bed unit **9**.

The roller bed unit **9** comprises two guide bars **10**. The spacing of the guide bars defines the width of the path on the roller bed unit **9** and is somewhat larger than the width of the intermediate roller bed sections **5***b*, **6***b*. The roller bed sections **5***c*, **6***c* are about as wide as the roller bed sections **5***b*, **6***b* whereas the receiving and delivery roller bed sections **5***a*, **6***a* are narrower. The roller bed sections **5***b*, **5***c* and **6***b*, **6***c* are reversible, which means that the sense of rotation of their rollers can be reversed.

The rollers of the additional roller bed unit **9** are operated from a common drive means **11** by chains, ropes or the like. The drive means **11** is protected by a cover **12**. The entire

roller bed unit comprises a heat-insulating protecting hood **13**, which protects the roller bed unit also against an ingress of scale and water. It is apparent from FIG. **4** that the roller bed unit **9**, its drive means **11**, the protecting hood **13** and the supporting structure **14** form a unit of construction, which is detachably secured to the foundation **15** for the rolling mill stands and can be horizontally removed. For this purpose, the foundation pit **16** at the delivery end is correspondingly offset, as is shown in FIG. **2**.

The movement of the stock is indicated by arrows in FIG. **3** The rolled stock is supplied to the roller bed section *5a* of the roller bed unit **5** and passes through the first pass groove line defined by the rolling mill stands **1–4** and at the delivery end is deflected by the bar section *7b* from the roller bed section *6c* to the roller bed section *6b*. The roller bed sections *6b*, *6c* are then lowered to the position which is shown in dash-dot lines in FIGS. **1** and **2**, whereafter the guide bar section *7a* is swung back from the position shown in solid lines to the position indicated by dash-dot lines and the roller bed sections *6b*, *6c* are reversed. The rolled stock is now carried back on the additional roller bed unit **9**. At this time, the roller bed sections *5b*, *5c* are also in a lowered position and the pivoted bar section *7a* at the receiving end is in the position indicated by dash-dot lines. The lowered roller bed sections are now lifted and the roller bed sections *5b*, *5c* and *6b*, *6c* are reversed for the second pass through the second groove line. For the second return movement, the roller bed sections *6c*, *6b* and *5b*, *5c* are lowered and reversed and the bar section *7a* at the receiving end is now in the position shown in solid lines so that the stock moves from the additional roller bed unit **9** into the roller bed section *5c*. For the third pass of the stock through the rolling mill stands, the roller bed sections *5b*, *5c* are raised and the bar section *7a* is swung back to deflect the stock from the reversed roller bed section *5c* onto the roller bed section *6a*. The directing action of the bar sections *7a* which are pivoted like deflectors may be assisted by rollers which are inclined to the longitudinal direction of the train and incorporated adjacent to said bar sections. During the last pass of the stock through the rolling mill stands, the next workpiece can be received by the roller bed section *5a*.

Twist bushings or twist frames, not shown, are incorporated in known manner between the rolling mill stands **1**, **2**, **3**, **4** so that a fully mechanized operation can be obtained, particularly because the control of the lowering operations of the roller bed sections, the reversing thereof and the pivotal movement of the bar sections like deflectors can readily be controlled by a program control system.

What is claimed is:

1. A rolling mill train, which comprises

a plurality of nonreversible two-high rolling mill stands defining a plurality of pass groove lines disposed one beside the other,

a first roller bed unit preceding said rolling mill stands,

a second roller bed unit succeeding said rolling mill stands, and

an additional roller bed unit extending under said rolling mill stands between said first and second roller bed units and operable to return stock from said second roller bed unit to said first roller bed unit,

each of said first and second roller bed units comprising a plurality of roller bed sections disposed one beside the other, and guide means laterally defining guide paths on said roller bed sections,

at least two of said roller bed sections of each of said first and second roller bed units being reversible and adapted to be lowered to the level of said additional roller bed unit, and

each of said first and second roller bed units being provided with deflecting means, which are adapted laterally to deflect stock onto a desired one of said reversible roller bed sections of the respective roller bed unit.

2. A rolling mill train as set forth in claim **1**, in which said additional roller bed unit extends on the center line of said train.

3. A rolling mill train as set forth in claim **1**, in which said guide means comprise guide bars.

4. A rolling mill train as set forth in claim **1**, in which said deflecting means comprise pivoted guide bar sections.

5. A rolling mill train as set forth in claim **4**, in which said rolling mill sections comprise rollers which are disposed adjacent to said pivoted guide bar sections and inclined to the longitudinal direction of said train.

6. A rolling mill train as set forth in claim **1**, in which

said rolling mill stands define three pass groove lines disposed one beside the other,

each of said first and second roller bed units comprises three of said roller bed sections, two of which are reversible and adapted to be lowered to the level of said additional roller bed unit,

one of said reversible roller bed sections of each of said first and second roller bed units is an intermediate roller bed section of the respective unit,

said additional roller bed unit is wider than said intermediate roller bed sections, and

the remaining roller bed sections of said first and second roller bed units constitute receiving and delivery roller bed sections, respectively, and are disposed on opposite sides of said train.

7. A rolling mill train as set forth in claim **6**, in which said receiving and delivery roller bed sections are narrower than said reversible roller bed sections.

8. A rolling mill train as set forth in claim **1**, in which said reversible roller bed sections are carried by lifting tables.

9. A rolling mill train as set forth in claim **1**, in which said reversible roller bed sections are carried by tilting tables.

10. A rolling mill train as set forth in claim **1**, which comprises a heat-insulating protective hood covering said additional roller bed unit.

11. A rolling mill train as set forth in claim **1**, which comprises

foundation means carrying said rolling mill stands, and

drive means operatively connected to said additional roller bed unit,

said additional roller bed unit and said drive means being combined in a unit of construction, which is detachably secured to said foundation means and adapted to be horizontally removed from said train.

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