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[54] ROLLING STAND, PARTICULARLY FOR SHAPING A CAST BAR IMMEDIATELY UPON LEAVING A CONTINUOUS CASTING PLANT, AND ROLLING MILL

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Apr. 23, 1969 Austria ..... A 3912/69

[52] **U.S. Cl.** **72/238**, 72/249

[51] **Int. Cl.** **B21b 31/08**, B21b 35/00

[58] **Field of Search** 72/238, 239, 249

[56] **References Cited**

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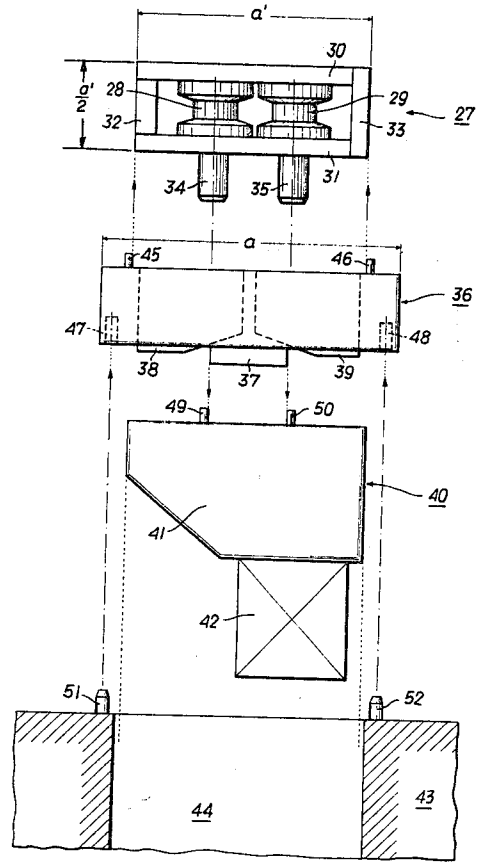
[57] **ABSTRACT**

A unitized construction system for rolling stand assemblies and rolling mills, particularly intended for shaping cast bars immediately upon leaving a continuous casting plant, is proposed. In the rolling stand assemblies of the invention, which are mounted on base frames or baseplates, the rolling stand, or the rolling stand with part of its driving gear system, is vertically removably mounted on the base frame or plate, the driving gear system, or a part thereof, is detachably mounted on the base frame or plate, and the base frame or plate is vertically removably mounted on the base so that either the base frame or plate together with the driving gear system or with part thereof is removable from the base following removal of the rolling stand or of the rolling stand with part of the driving gear system, or the base frame or plate together with the rolling stand and the driving gear system is vertically removable as a compact unit. The multibar rolling mill comprises several adjacent trains of such rolling stand assemblies having base plates and base frames uniformly dimensioned with respect to the size of the rolling stands, so that they can be interconnected to structural units up to the size of the entire rolling mill.

7 Claims, 8 Drawing Figures



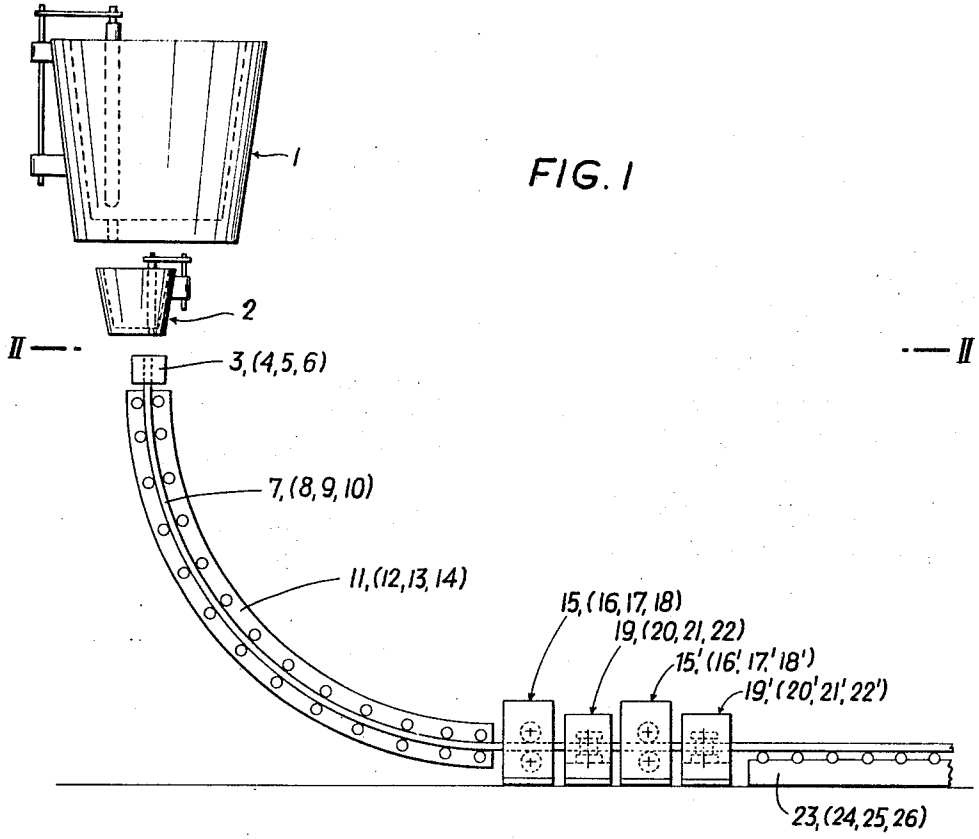


FIG. 1

FIG. 2

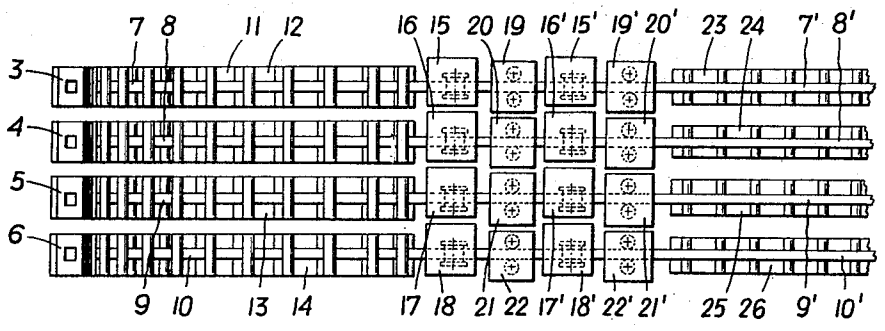


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FIG.3

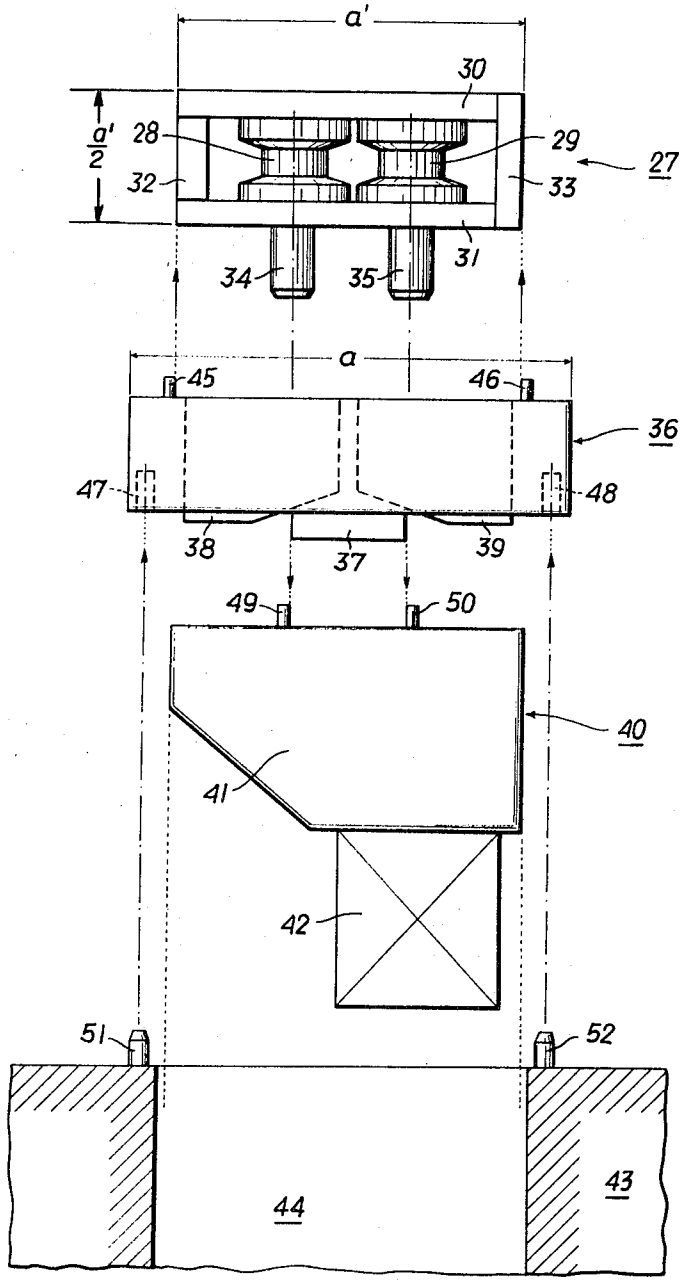

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FIG. 4

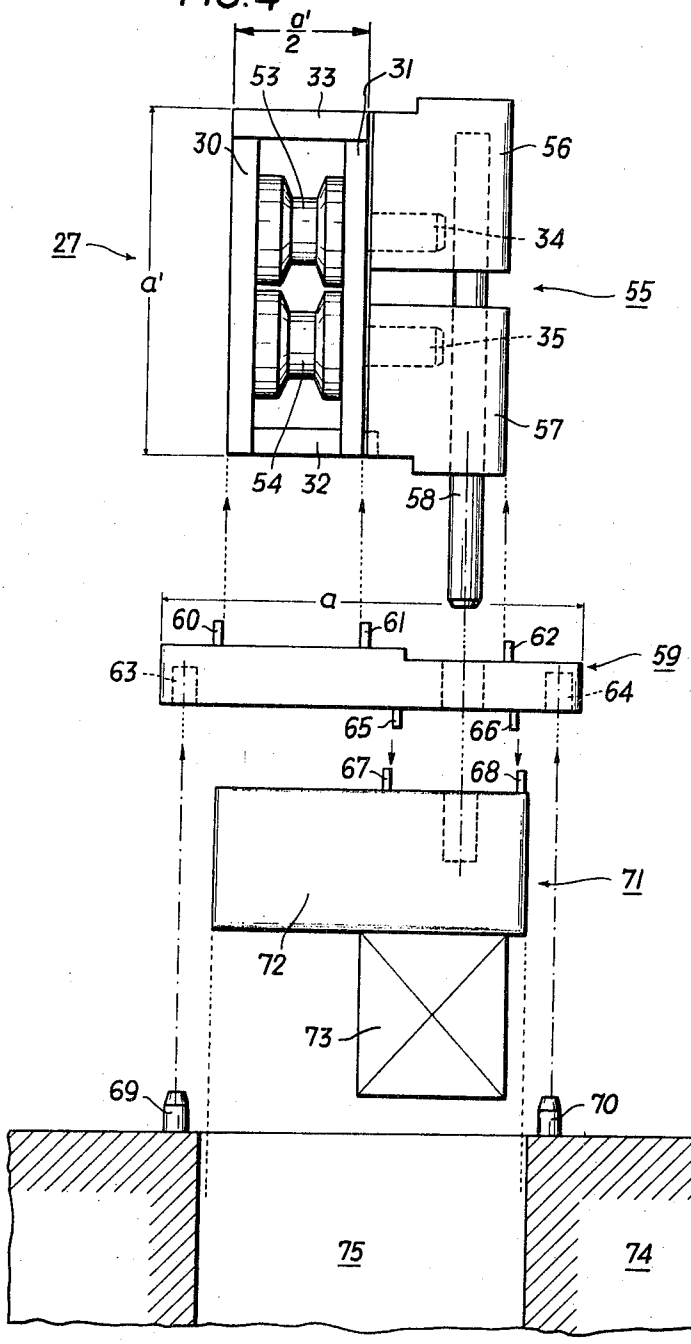

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FIG. 5

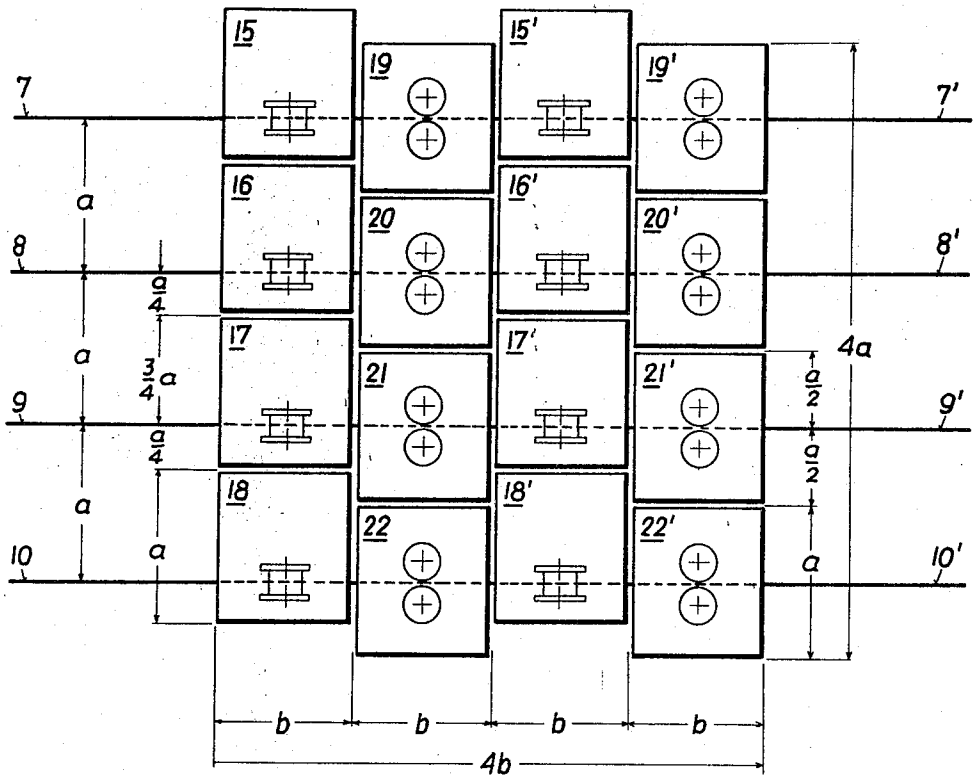

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FIG. 6

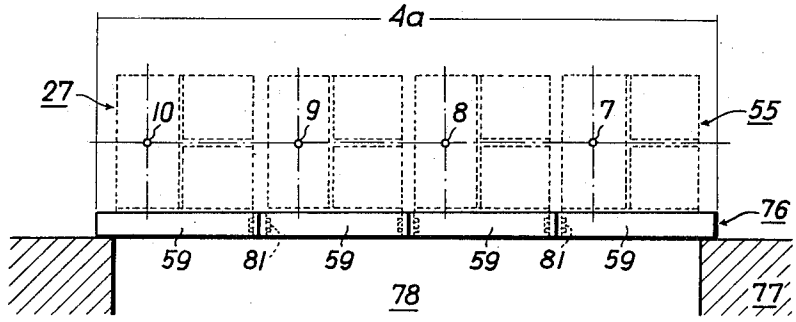


FIG. 7

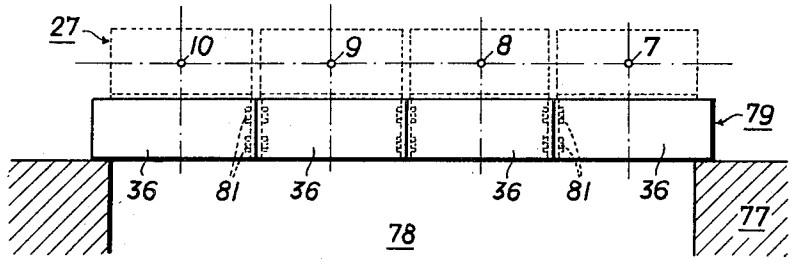
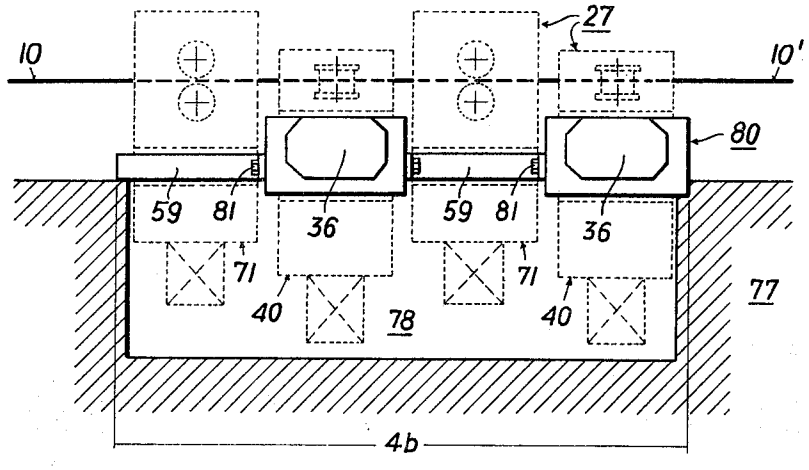


FIG. 8



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ROLLING STAND, PARTICULARLY FOR SHAPING A CAST BAR IMMEDIATELY UPON LEAVING A CONTINUOUS CASTING PLANT, AND ROLLING MILL

The present invention relates to a rolling stand arranged on a base frame or a baseplate, in particular for shaping a cast bar immediately upon leaving a continuous casting plant as well as a rolling mill with several trains of stands arranged side by side.

The problem with continuous casting plants, in particular with multibar continuous casting plants is to arrange the rolling stands used for further shaping of the castings subsequent to the casting process so as to save most space. The aim is to achieve the closest possible side-by-side arrangement of the rolling stands so that the tundish located above the continuous casting molds may be small and any loss in temperature of the liquid steel kept at a minimum. The individual rolling stands have also to be placed in the closest possible tandem arrangement. Due to the low casting speed in continuous casting the feed speed of the casting in the rolling stands is much smaller than with conventional rolling trains, resulting in an undesirably high loss in temperature in the casting to be shaped in case of considerable distances between the individual rolling stands. The compact structure of the rolling stands makes roll changing rather difficult and time consuming. As rolling stands following continuous casting plants cannot work independently from the casting and melting operations, any roll changing must be carried out as quickly as possible in case of a change of the rolling program or repairs so that the metallurgical operations will remain unaffected.

The compact structure of the rolling stands requires an at least partial below-floor arrangement of the roll drive. This adds to the problems of accessibility for maintenance or repair works. It has, so far, not been possible in case of repairs to make use of a unitized construction with its small number of structural members and spare parts. A steel mill suffers always from a lack of room and from the intensified effect of dust and heat. It is, therefore, desirable to repair and maintain the high-duty installations outside the foundry plant and to install fully assembled and adjusted rolling stands and drive parts as quickly and simply as possible.

The present invention aims at avoiding the disadvantages and difficulties described and solves the given problems by a combination of the following features:

a. the rolling stand or the rolling stand with part of its driving gear system, respectively, is detachable from the base frame or the baseplate, respectively, and is vertically removable therefrom;

b. the driving gear system or part of the driving gear system, respectively, of the rolling stand is detachably mounted on the base frame or the base plate, respectively, and

c. the base frame or the baseplate, respectively, is detachably mounted on the base and vertically removable therefrom;

so that either the base frame or plate together with the driving gear system or with part of the driving gear system, respectively, is removable from the base upon removal of the rolling stand or of the rolling stand with part of the driving gear system, or the base frame or plate together with the rolling stand, and the driving gear is vertically removable as a compact unit.

The external dimension of the rolling stand measured perpendicular to the roll gap is preferably twice as large as the one measured in the roll gap plane, so that this rolling stand can be installed and operated without any structural changes with vertical as well as with horizontal rolls, the fixing to the base frame or plate being effected by clamping devices acting therefrom, said clamping devices engaging a roll support or a rigid cross connection thereof, respectively, and being readily releasable.

Suitably centering devices for the rolling stand or for the rolling stand and part of the driving gear system, respectively, as well as centering devices for fixation on the base through centering bolts fixed to the latter are provided on the base frame or plate.

The present invention furthermore comprises a rolling mill characterized in that each base frame or plate has a uniform length a and a uniform width b, the dimension a substantially corresponding, on the one hand, to the distance between the cast bars and being, on the other hand proportional to and slightly larger than the external dimension a' of the rolling stand perpendicular to the roll gap, and the roll pass axes of the cast bars lying respectively at the distance $a/2$ from the margins of the individual base frames or at the distance $a/4$ from the margins of the individual baseplates.

The base frames or plates may be rigidly connected with each other.

Suitably several base frames and baseplates, respectively, arranged side by side are rigidly connected with each other so that they form structural units, or several base plates in tandem arrangement are connected with several intermediate base frames to form rigid structural units.

According to a further embodiment of the present invention all the base frames or plates or the structural units built therefrom, respectively, may be rigidly connected with each other and form a compact structural unit, so that the entire rolling mill consisting of the rolling stands, the gears and the drives may, upon release of the anchor screws, be vertically removed from the base.

In order that the invention may be more fully understood it will now be described by way of example with reference to the accompanying drawings.

FIG. 1 shows a side view of a continuous casting plant with shaping stands for the casting.

FIG. 2 a top plan view below the line II—II of FIG. 1.

FIG. 3 and FIG. 4 show simplified and not-true-to-scale presentations of the various phases of the removal of a rolling stand with vertical and horizontal rolls as well as of the pertinent base frames or baseplates, respectively, of the transmission gears and drives.

FIG. 5 is a simplified plan view of the entire rolling mill.

FIG. 6 a side view of several rolling stands with horizontal rolls arranged side by side.

FIG. 7 a similar view of a series of rolling stands with vertical rolls.

FIG. 8 a side view of a rolling train comprising a number of stands in tandem with alternating vertical and horizontal rolls as well as of the drives suspended in the base pit.

Liquid steel is poured from a stopper ladle **1** into one or two tundishes **2** and from there into several—e.g., four—continuous casting molds **3, 4, 5, 6**. The cast bars pass a curved secondary cooling line **11, 12, 13, 14** and are subsequently cogged down in units **15, 19, 15', 19'** or **16, 20, 16', 20'**, respectively, and so on. The shaped bars **7', 8', 9', 10'** proceed along roller tables **23, 24, 25, 26** to the dividing means and the like.

FIG. 3 shows a rolling stand **27** with vertical grooved rolls **28, 29** displaceably arranged together with their inserts within the roll supports **30, 31** in a position removed from the base frame **36**; arrows indicate the direction of motion. The external dimension a' measured perpendicular to the roll gap is twice as large as the external dimension measured in the roll gap plane, designated by $a'/2$. Within the rolling stand the rolls are symmetrically arranged, i.e., the roll gap is approximately in the center of the rolling stand. The roll supports **30, 31** are on one side rigidly connected by a cross connection **32** and on the other side by a detachable cap connection **33**. The roll shafts are designated by the numerals **34, 35**.

FIG. 3 shows also a base frame **36** which has been vertically removed in the direction of the arrows from the base **43** and consists of two parts having a cross connection **37**. Within the base frame **36** there are horizontally movable transmission gears **38, 39**, which cooperate with the roll shafts **34, 35** as well as with the driving gear **41**. Centering devices **45, 46** for the rolling stand **27** are located on the base frame **36**. Below the base frame **36** the driving gear **41** is aligned and fixed to the cross connection **37** by the centering devices **49, 50**.

FIG. 3 shows also the drive **40** after the driving gear **41** has been downwardly removed in the direction of the arrows, fol-

lowing the lifting of the base frame **36**. The motor **42** is flanged to the driving gear **41** and forms together with the latter the drive **40**.

FIG. **3** shows furthermore the base pit **44**, wherein the drive **40** is suspended when the base frame **36** rests on the base **43**, to which it is fixed by the centering bolts **51**, **52**—which fit into the corresponding guides **47**, **48**—and secured by anchor screws.

When in operation, each installation **19**, **20**, **21**, **22**, **19'**, **20'**, **21'**, **22'** consists of a rolling stand **27**, a base frame **36**, the transmission gears **38**, **39** and the drive **40**. The drawings show that—upon release of the anchor screws—the entire installation **19**, **20** etc. is vertically removable from the base **43** as a compact unit. When it is being assembled, each installation **19**, **20** etc. is accurately fixed in the direction of rolling by the centering bolts **51**, **52** and the corresponding guides **47**, **48**, without any time-consuming alignment operations. When the rolling stand is designed for a maximum bar cross section of 250 × 250 mm. the length of the base frame *a* is approximately 2,000 mm. The length *a* somewhat exceeds the external dimension *a'* of the rolling stand **27**, which amounts to approximately 1,800 mm. The width *b* of the base frame (FIG. **5**) is somewhat less than *a* and amounts to approximately 1,700 mm. The diameter of the grooved rolls **28**, **29** is approximately 600 mm.

FIG. **4** is a similar presentation as FIG. **3**, yet for a rolling stand **27** with horizontal grooved rolls **53**, **54**. The rolling stand proper is designed like the one in FIG. **3**, which means that the rolling stands are interchangeable at will without any structural changes. The rolling stands are fixed to the base frame **36** or the baseplate **59**, respectively, by clamping devices, not shown, secured thereto, which act from below on the roll support **31** or the rigid cross connection **32**, respectively, and together with the centering devices **45**, **46** or **60**, **61**, respectively, effect a readily releasable connection of the rolling stand **27** with the base frame **36** or the baseplate **59**. FIG. **4** shows a rolling stand **27**, which is, together with part **55** of the gear system, vertically removed from the baseplate **59**. Said gearing **55** consists of the transmission gears **56**, **57**, which are detachable from the roll shafts **34**, **35** as compact units and connected with each other through a vertical drive shaft **58**.

The baseplate **59** is provided with centering devices **60**, **61** for the rolling stand **27**, centering devices **61**, **62** for the gearing **55**, centering devices **65**, **66** for the drive **71** and centering devices **63**, **64** for fixation on the base **74** by the centering bolts **69**, **70**. The drive **71**, which consists of the driving gear **72** and the motor **73** flanged thereto, is provided with centering devices **67**, **68** for its fixation below the baseplate **59**.

When in operation, each installation **15**, **16**, **17**, **18**, **15'**, **16'**, **17'**, **18'**, consists thus of a rolling stand **27**, a baseplate **59**, the gearing **55**, and the drive **71**.

FIG. **5** shows the arrangement of the four rolling trains for the shaping of the cast bars **7**, **8**, **9**, **10**, whose distance corresponds roughly to the dimension *a*. The base frames **36** as well as the baseplates **59** have identical external dimensions—*a* and *b*—resulting in an overall space required for the entire rolling mill of $4a \times 4b$, neglecting minor safety distances. With a continuous casting plant designed for four cast bars with a cross section of 250 × 250 mm. each, the size $4a \times 4b$ amounts to approximately 60 m.², which illustrates the extraordinarily compact structure. With said installation the distance of the roll pass axes of the individual cast bars from the respective edges of the baseplates is $a/4$ and from the respective edges of the base frames $a/2$, again neglecting minor safety distances.

FIG. **6** shows the side-by-side arrangement of several stands **27** with parts **55** of the gear systems on a structural unit **76** consisting of four baseplates **59**, which are rigidly interconnected by screws **81**. Said structural unit **76** carries thus four rolling stands with horizontal rolls together with their transmission gears and drives and can, upon release of the anchor screws, be vertically removed from the base **77** and the base pit **78**, respectively, as a compact unit.

FIG. **7** shows a structural unit **79** for four rolling stands **27** with vertical rolls, which consists of four base frames **36** rigidly connected by screws **81**.

FIG. **8** shows a structural unit **80** with two baseplates **59** and two base frames **36**, which are rigidly interconnected by screws **81**; the structural unit comprises four rolling stands **27** in tandem, with alternating horizontal and vertical rolls. Together with the gears **55**, **38**, **39** and the drives **40**, **71** it is—as a compact unit—vertically removable from the base **77** and the base pit **78**, respectively.

Provided that the overall weight of the rolling mill does not exceed reasonable limits, it is possible to rigidly connect either all the base frames **36** with the baseplates **59**, or all the structural units **76** with the structural units **79**, or interconnect the structural units **80**, so that the entire rolling mill, consisting of the rolling stands **27**, the gears **55**, **38**, **39** and the drives **40**, **71** is vertically removable as a unit.

What I claim is:

1. A rolling mill for shaping a number of metal bars supplied in parallel, comprising, in side by side and tandem arrangement on a base, a plurality of rolling stand assemblies each composed of a rolling stand with a vertical pair of rolls, a gear-containing base frame, and a drive arranged as vertically separable exchangeable units, and a plurality of rolling stand assemblies each composed of a gear-supporting rolling stand with a horizontal pair of rolls, a baseplate, and a drive arranged as vertically separable exchangeable units, said base frames and baseplates having uniform lengths *a* and uniform widths *b*, *a* substantially corresponding, on the one hand, to the distance between two adjacent bars and being, on the other hand, proportional to and slightly larger than the external dimension of said rolling stands measured perpendicular to the roll gap, and the roll pass axes of said bars lying respectively at a distance of $a2$ from the margins of said base frames and at a distance of $a/4$ from the margins of said baseplates.

2. The rolling mill set forth in claim **1** wherein a series of base frames and a series of base plates are rigidly connected.

3. The rolling mill set forth in claim **1** wherein several base frames and baseplates, respectively, arranged side-by-side are rigidly connected with each other so as to form structural units.

4. The rolling mill set forth in claim **1** wherein several baseplates in tandem arrangement are rigidly connected with several intermediate base frames to form structural units.

5. The rolling mill set forth in claim **1** wherein all base frames and baseplates are rigidly connected to form a compact structural unit so that the entire rolling mill including said roll stands, gears, and drives can be vertically removed from said base.

6. A rolling stand assembly for shaping rolling stock comprising

a base,

a foundation detachably mounted on and vertically removable from the base,

a rolling stand containing a pair of rolls defining a roll gap, the rolling stand detachably mounted on and vertically removable from the foundation and comprising a cagelike frame whose external dimension measured perpendicular to the plane of the roll gap is twice as large as the one measured in said plane, and

drive means for driving the rolls of the rolling stand, the drive means detachably mounted below and vertically removable from the foundation,

whereby the rolling stand, foundation and drive means are vertically removable from the base as divisible structural units.

7. The rolling stand assembly set forth in claim **6** further comprising clamping means to releasably secure the rolling stand to the foundation.

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