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Schonfeld et al.

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[54] **MANDREL EXCHANGE FOR DIAGONAL ROLLING MILL**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **72/97;** 72/209

[51] **Int. Cl.²** **B21B 25/06**

[58] **Field of Search** 72/97, 209, 263

[56] **References Cited**

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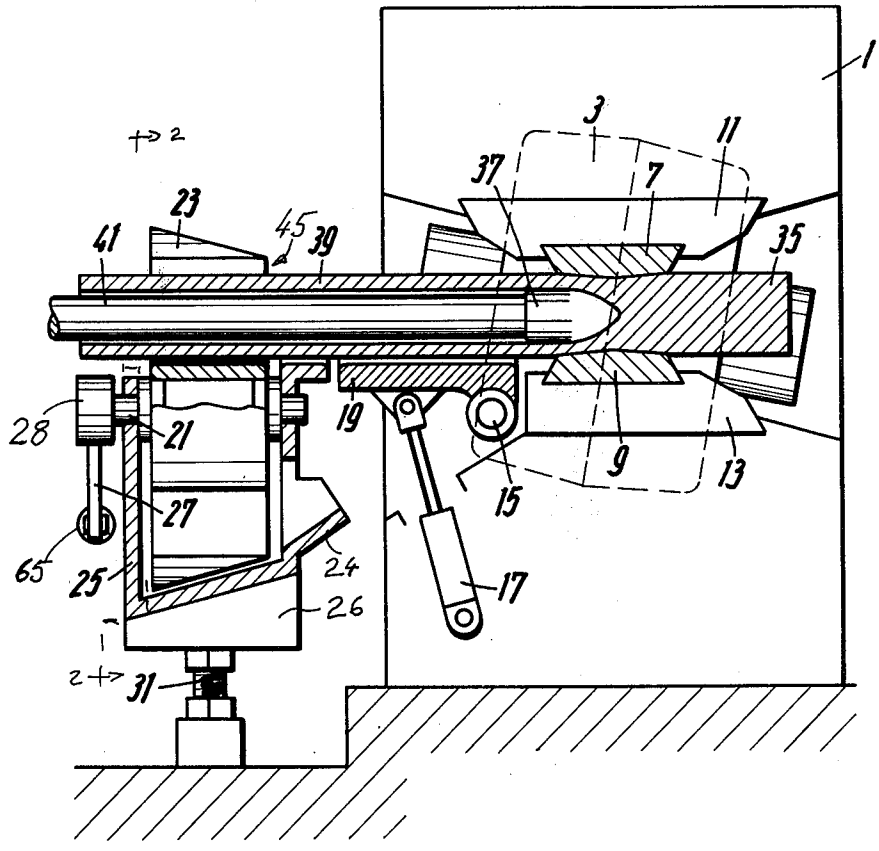
[57] **ABSTRACT**

A stepwise revolving drum with peripheral compartments is provided at the exit side of a mill stand for diagonal rolling wherein one compartment serves to guide the hollow billet on the mandrel rod during rolling and piercing. That compartment held previously a mandrel which was fastened to the advancing rod prior to piercing a billet. An empty compartment receives the mandrel following rolling. The same arrangement can also be used for stretch rolling or other operations which require insertion of a mandrel in a hollow billet.

6 Claims, 5 Drawing Figures



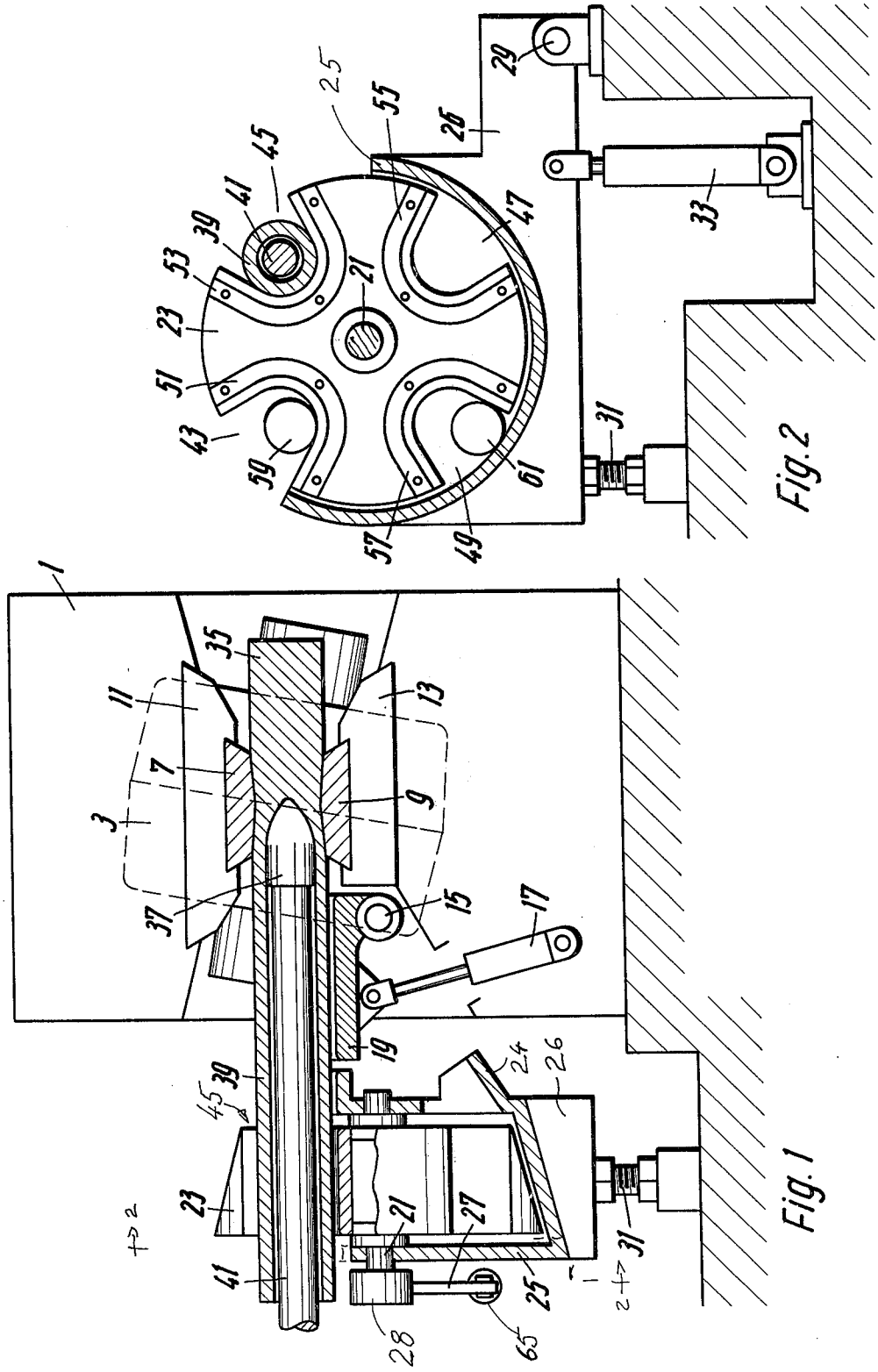

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Fig. 1

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Fig. 2

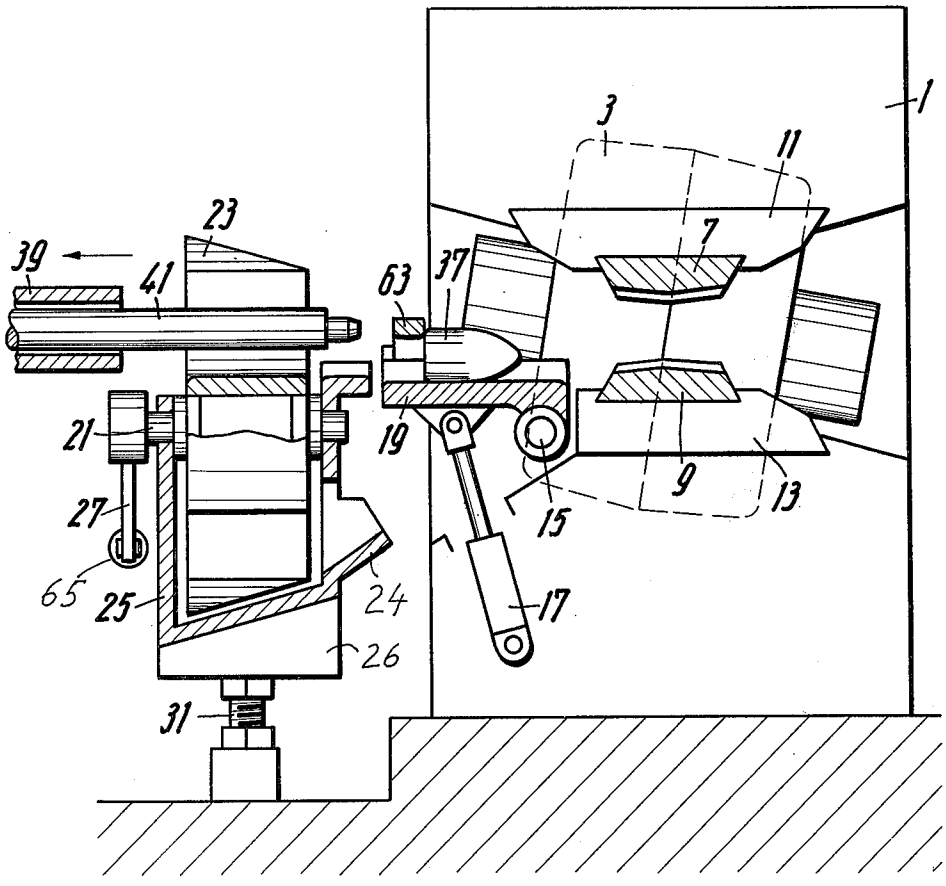

Fig. 3

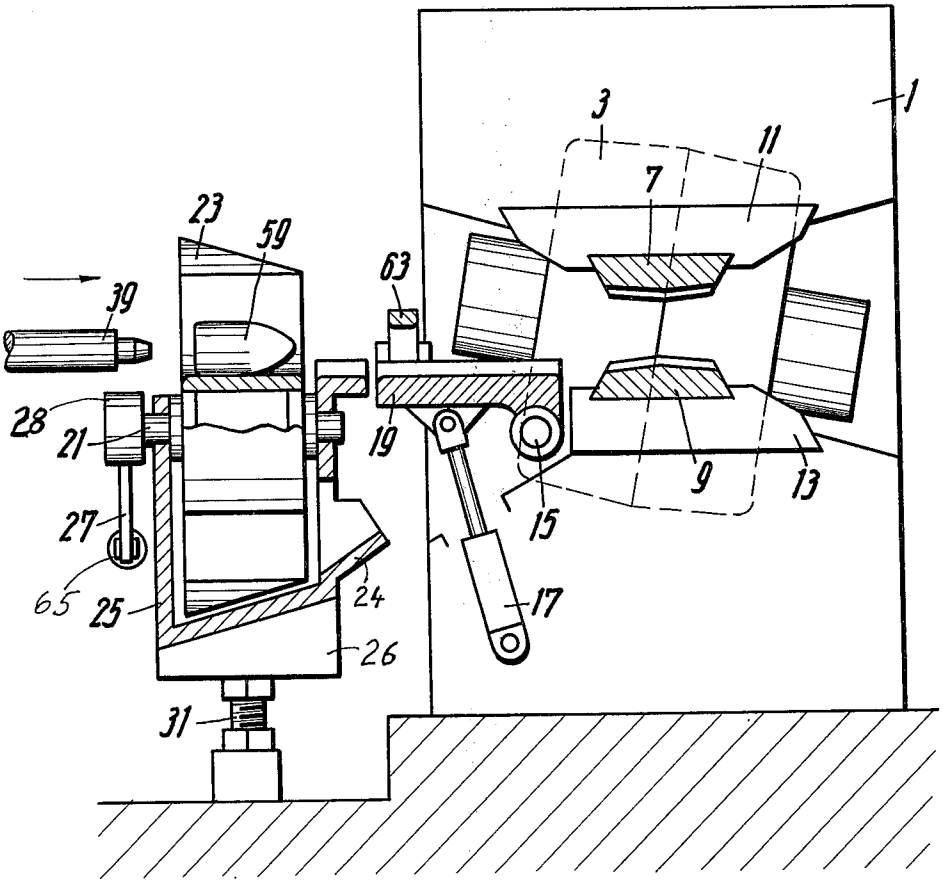

Fig. 4

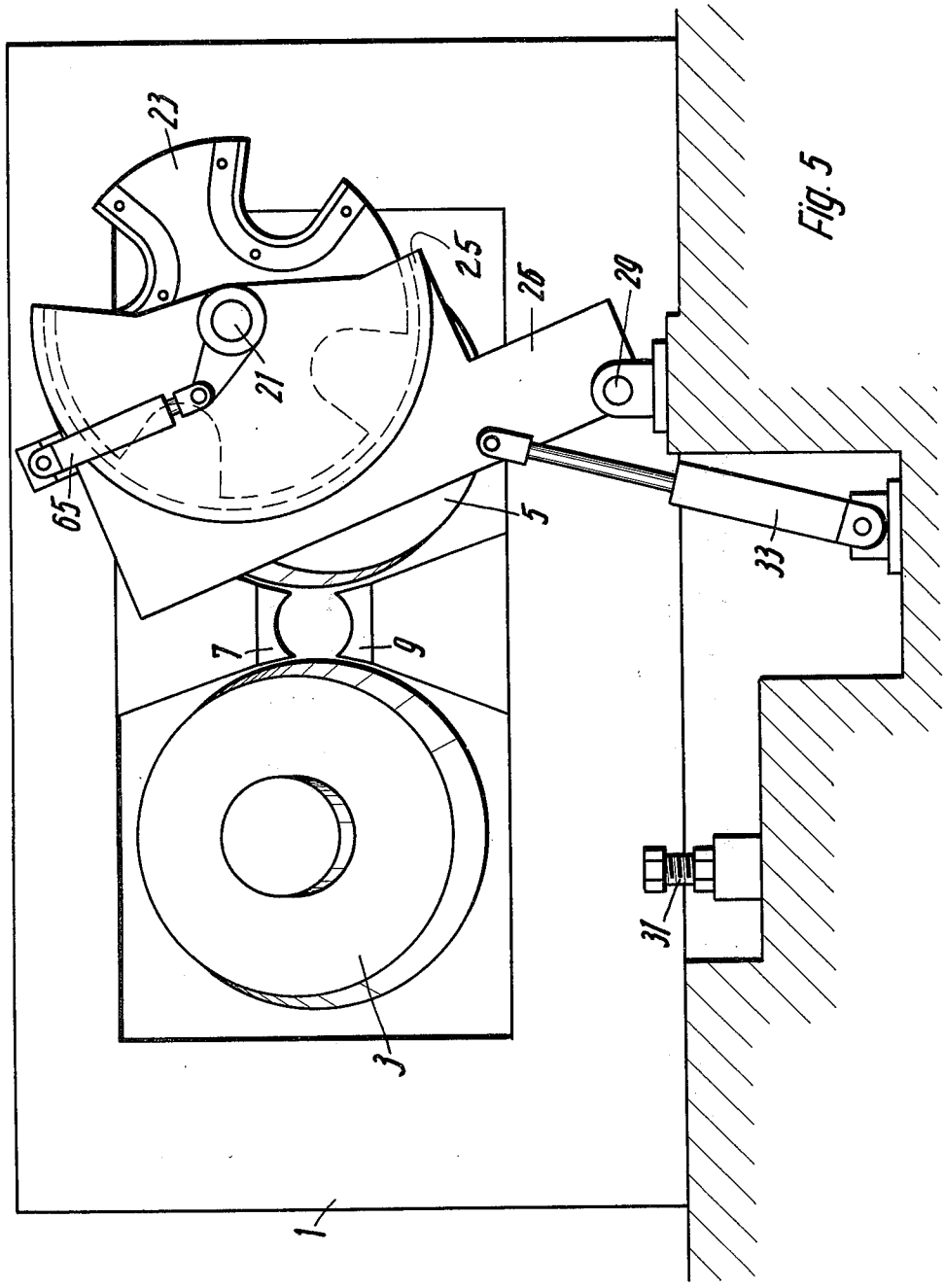

Fig. 5

MANDREL EXCHANGE FOR DIAGONAL ROLLING MILL

BACKGROUND OF THE INVENTION

The present invention relates to mandrel exchange in diagonal rolling mills.

Diagonal rolling mills for piercing billets such as round bars have usually a mandrel on a rod, and the solid billet is rolled onto rod and mandrel upon piercing. The same procedure is used for stretch rolling, sizing or the like as in all these cases a mandrel on a rod is used to receive the billet being worked. The billet as rolled in this manner is stripped off the mandrel rod and mandrel, but the mandrel is taken off the rod for cooling.

It is known to provide a drum at the input side of a two high plug mill. Upon completion of a pass, the twin cone plug drops under its own weight onto a chute and into a lower compartment of the drum for being held therein by a cover around the lower periphery of the drum. On the other hand, diagonal rolling mills require additionally that the mandrel be removed from the billet outside of the mill, as these mills have straight-edge guides arranged between the rolls preventing dropping of the mandrel when stripped off the hollow billet.

SUMMARY OF THE INVENTION

It is an object of the present invention to improve on the exchange of mandrels in diagonal rolling mills so as to permit fast and reliable replacement of one mandrel by another one. The mandrel exchange should not interfere with the holding of the hollow billet as emerging from the mill stand and twisting onto the mandrel rod. Moreover the mandrel rod must not be subjected to bending by the end of the billet as tending to move transversely.

It is another object of the invention to provide for proper guiding and holding of a rolled hollow billet in a mandrel removal device which should be amenable to rather easy matching to different contours of the billet.

In accordance with the preferred embodiment of the present invention it is suggested to provide a drum with peripherally arranged axially extending but open compartments on the side of a diagonal rolling mill from which the hollow billet emerges whereby billet with inserted mandrel and mandrel rod are guided by and through one of the contoured compartments in tight sliding fit as to a portion of the periphery of hollow billet. The drum stores and receives mandrels for subsequent use as well as subsequently to removal from a rolled hollow billet whereby the drum revolves to place a new compartment with new mandrel into the line of rolling in preparation of a new pass.

The device and here particularly the drum prevents lateral escape of the hollow billet as part of it is still being rolled, and the bending stress on the mandrel rod is relieved accordingly. As the drum serves primarly for the mandrel exchange it is interposed in the normal receiving bed for the hollow billet as rolled onto the mandrel and along the rod, but the drum actually guides and holds the billet better than the bed, particularly as far as holding it against lateral deflection is concerned.

The drum compartments are preferably provided with wear resistant linings of cross-sectional contour approximating a semicircle in the deepest portion and

have outwardly slightly flaring flanks also made of friction wear resistant material. The drum is preferably adjustable as to height so as to trim alignment of the operating compartment in each instance particularly if billets of different diameter are being rolled. A particular range of different diameters can be accomodated in that manner without structural change in the drum, just through height adjustment of the drum.

The drum should additionally be mounted for pivoting or sliding it on rails and out of the way, for easy access to the mill stand proper.

DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention, it is believed that the invention, the objects and features of the invention and further objects, features and advantages thereof will be better understood from the following description taken in connection with the accompanying drawings in which:

FIG. **1** is a longitudinal section view of a diagonal rolling mill with mandrel exchange in accordance with the preferred embodiment of the invention;

FIG. **2** is a view along lines **2—2** in FIG. **1**;

FIGS. **3** and **4** are views similar to FIG. **1** but showing the mandrel exchange in different stages of progression; and

FIG. **5** is an end view without billet and showing the mandrel exchange equipment pivoted out of the way.

Proceeding now to the detailed description of the drawings, a pair of skew or diagonal rolls, **3** and **5,** are arranged in a mill stand **1,** and straightedges **7** and **9** for holding the billets in the piercing zone are arranged in holders **11** and **13.** Particularly in FIGS. **1, 3** and **4** round bar billets such as **35** are fed from the right, pierced and withdrawn as seamless tubes or hollow billets **39** from the left. A trough **19** is provided here, pivotable on an axis **15** by means of a pneumatically operated cylinder/piston arrangement **17.** The trough **19** can be deemed a first portion of the bed for the pierced billet.

The billet is pierced by a mandrel **37** held on a rod **41** which in turn is held in a conventional manner on a thrust block or the like (not shown) to the left of the Figures. The mandrel exchange device is disposed to the left of trough **19,** i.e., downstream as far as the progress of the rolled billet is concerned and will be described next.

The mandrel changing device is comprised of a drum **23** which rotates on axles **21,** rotation being provided by a stepwise operating hydraulic or pneumatic device **65** linked to shaft by a rod/lever **27** to obtain stepping e.g. by pawl and ratchet action in **28.** The lower part of drum **23** is partially enveloped by a cover **25.** The drum **23** has recesses extending in axial direction and defining compartments **43, 45, 47** and **49.** Guide elements or linings **41, 53, 55** and **57** are respectively provided in these compartments. The linings are made of wear resistant material, as the billet is going to slide there along. These linings are exchangeable, not only for renewal after they have worn out, but also for adapting the diameter of the bottom of each compartment to a different diameter billet.

The compartments each have circular (or semi-circular) bottoms from which emerge the side walls of the compartment in slightly flaring, radial extension. The compartments are open at the top but the round bot-

toms particularly as defined by the lining therein matches quite accurately the round contour of the pierced billet as emerging from the mill.

Compartments **43** and **49** as per FIG. **2** hold mandrels **59** and **61** respectively whereby particularly cover **25** has contour to hold one mandrel, here **61**, in recess **49**. The currently pierced hollow billet **39** as resulting from rolling of the billet **35** being worked, is held and guided in compartment **45**. The pipe **39** is traversed by the mandrel rod holding the particular mandrel **37** which was previously held in compartment or recess **45** of drum **23**.

As also shown in FIG. **2** (and in FIG. **5** as well) cover **25** is situated on a holder **26** which is pivotally mounted on a shaft **29** whose axis is located outside of the drum's cross-sectional area, so that the drum with holder **26** can be pivoted away from the line of rolling in its entirety. Holder **26** for drum **23** is held on a height adjustable support **31** in cantilever fashion. Holder **26** is additionally linked to a hydraulic or pneumatic drive **33** which is capable of lifting holder **26** with cover **25** off their support **31** (FIG. **5**). This way one can pivot the assembly **23/26** out of the way for easy access to the mill from the exit side. The holder **26** is provided with a chute **24** whose entrance is brought into alignment with the trough **19** when pivoted down. The chute **24** is aligned with one of the compartments in drum **23**, which in the instance shown in FIG. **2** is compartment **47**.

Rolling operation per se proceeds conventionally; the billet **35** is rolled by skew or diagonal rolls **3** and **5** and pierced by the currently used mandrel e.g. **37** which is held on mandrel rod **41**. The resulting pipe or hollow billet **39** is shifted and twisted onto the mandrel rod while it is being held in compartment **45** of drum **23** to avoid lateral displacement. Additional holding means (not shown) could retain pipe **39** in recess **45** from above. A billet receiving bed may be provided to the left in FIG. **1** (not shown) for continuing the guiding and holding of compartment **45**.

As stated above, the mandrel rod **41** is held in a thrust block. A stripper **63** is provided to take the mandrel **37** (or any other mandrel) off the rod **41**. The rod with pipe **39** can be retracted upon completion of rolling and piercing the one billet. The hollow billet or pipe **39** is stripped from mandrel rod **41** while in the meantime the mandrel is exchanged by the device of the invention. The removal of the hollow billet **39** from the mandrel rod is not part of the invention and is carried out conventionally.

Turning now to the mandrel exchange operation, reference is made first to FIG. **1** showing the rolling in progress, the currently used mandrel **37** is held between rolls **3** and **5**. Upon completion of piercing billet **35** the thrust block retracts, taking along the mandrel rod **41** as stated. Stripper **63** is swung into position to hold back the mandrel **37** which falls onto trough **19**. The hollow billet **39** is now stripped from mandrel rod **41** in a separate operation (FIG. **3**). Rod **41** has been retracted sufficient to clear drum **23**. In the meantime, trough **19** is swung down by operation of cylinder **17** to remove the used mandrel. The trough **19** particularly is aligned with chute **24** so that the mandrel **37** will slide into empty compartment **47** (FIG. **2**). Next, drum **23** is rotated by one "notch" (i.e. by 90°) to place the compartment **43** with mandrel **59** into the range of rod **41**.

As billet stripping has been completed, the mandrel rod **41** is advanced, and mandrel **59** is fastened thereto for advance towards the next billet to be pierced which completes the cycle.

It will be understood, that the mandrel **61** in FIG. **2** is actually an old one that was previously stripped off and which has cooled in the meantime. As mandrel **59** is placed into alignment with rod **41**, compartment **49** is swung up and mandrel **61** can be removed for a new one if that is necessary. One compartment is always empty to receive the mandrel that is being removed from the retracting rod **41** upon completion of piercing.

The swung up position shown in FIG. **5** shows how the entire drum arrangement and holder **25** can be swung out of the way for easy access to guides **7** and **9** and rolls **3** and **5**. Instead of pivoting at **29**, the holder **26** could be a carriage running on rails extending transverse to the line of rolling for removing the assembly **23/25** from the exit side of the mill stand.

The level or height adjustment **31** permits accurate alignment of the one compartment with the line of rolling, so that each emerging hollow billet will be securely guided in and along the bottom of the respective drum compartment.

The invention is not limited to the embodiments described above but all changes and modifications thereof not constituting departures from the spirit and scope of the invention are intended to be included.

We claim:

1. In a diagonal rolling unit having rolls cooperating with a mandrel removably disposed on a retractible mandrel rod and onto which the rolls roll a hollow billet, the improvement comprising:

a drum-like mandrel holder having a plurality of peripheral, axial extending compartments each having a bottom contour matching the periphery of a rolled billet, the drum disposed along the line of rolling so that one compartment of generally upward orientation is in line to receive the rolled hollow billet as emerging from the mill during rolling and in tight slidable fit on the bottom of the one compartment, and being held thereon and guided along during rolling;

means disposed between the drum and the rolls for holding a mandrel to remain outside of said one compartment without passing through when the mandrel rod and rolled billet are retracted;

means for rotating the drum when the mandrel rod with hollow billet has been completely withdrawn for placing another compartment holding a new mandrel in line with the mandrel rod and the line of rolling; and

guide means at the exit side of the mill and adjacent the drum for guiding the mandrel, which was removed from the mandrel rod out of the line of rolling in down direction and into an empty compartment of the drum, the empty compartment being open at least to some extent and having orientation in a more down direction, there being holding means for retaining the mandrel therein once having been guided into that compartment.

2. In a rolling mill as in claim **1**, each compartment in the drum having contour of a semicircular bottom and sides extending in slightly spread apart relation to each other towards the periphery of the drum.

3. In a mill as in claim **1**, each compartment having an exchangeable lining.

4. In a mill as in claim **1**, the drum being mounted adjustable as to its height relative to the line of rolling.

5. In a mill as in claim **1**, the drum mounted for removal from the line of rolling.

6. In a mill as in claim **5**, the drum mounted for pivoting about an axis outside of the drum cross-section area.

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