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Schonfeld et al.

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[54] **PLUG CHANGING MECHANISM FOR ROLLING MILLS, AND PLUGS FOR THE SAME**

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[52] **U.S. Cl.** **72/209**
[51] **Int. Cl.** **B21b 17/08**
[58] **Field of Search** 72/209, 250

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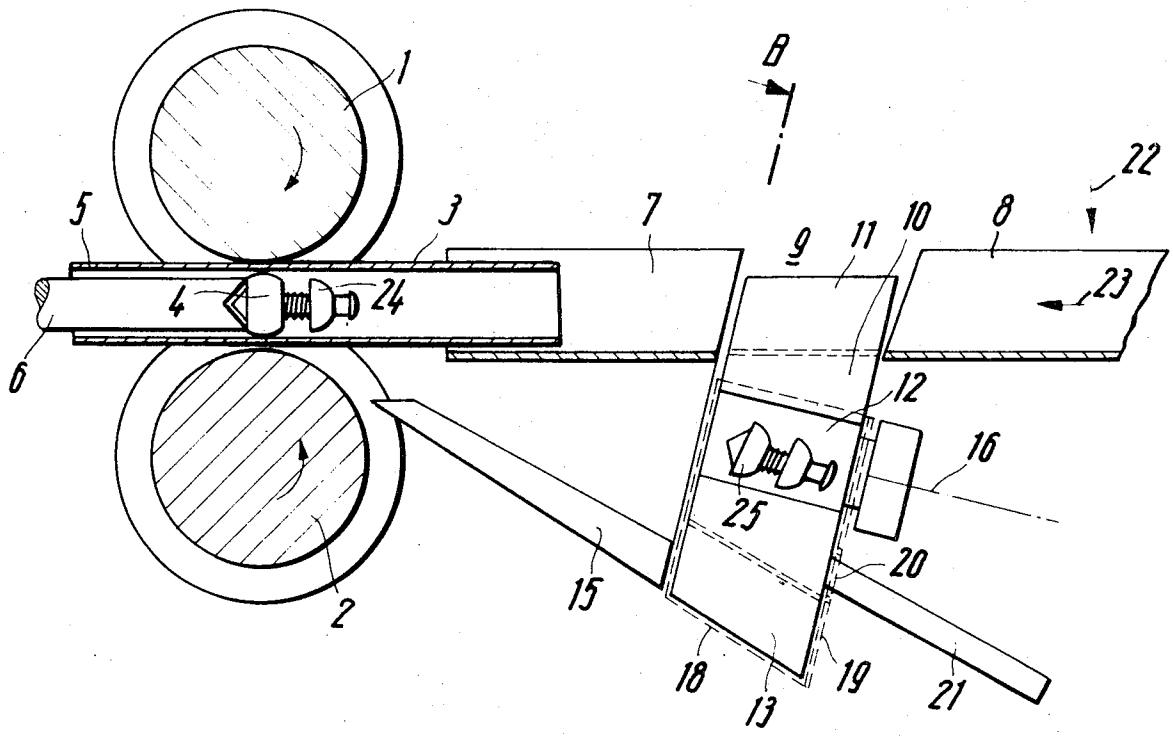
[57] **ABSTRACT**

The invention relates to mechanism for mechanically changing plugs in tube mills. Plugs are carried in peripheral pockets formed in a drum and the latter is disposed for rotation through an opening in the tube entry trough so that its pockets may be selectively aligned with the trough. As the tube is transferred in a direction toward the reducing rolls, it moves through the pocket aligned with the trough and its forward end engages the plug in such pocket and moves the plug to engagement with the mandrel bar for disposition between the work rolls. The tube is then rolled over the plug and upon completion of the rolling operation, the tube clears the plug and the latter falls to a chute and is delivered to a lower pocket of the rotatable drum. The drum is then rotated to position another plug in alignment with the entry trough for a subsequent rolling operation.

The invention also relates to improved plugs and in one aspect includes a two part plug, the parts being mounted on connecting rods with resilient means therebetween. In another aspect, the improved plug is formed as a one-piece hollow member to reduce weight, the member being symetrical about a center portion so that either end may be pointed in rolling direction.

11 Claims, 5 Drawing Figures



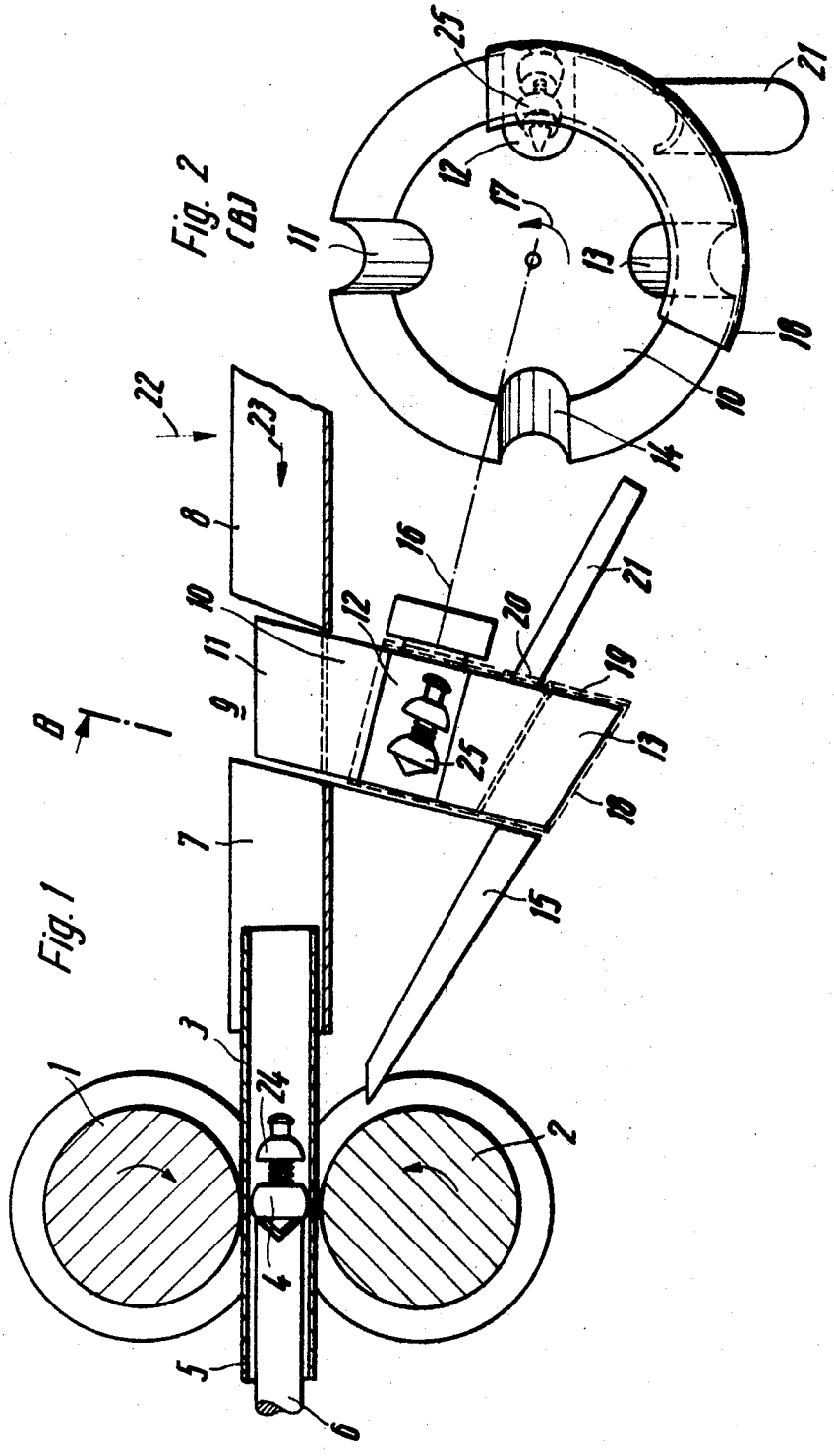


Fig. 2
(B)
Fig. 1
B
B

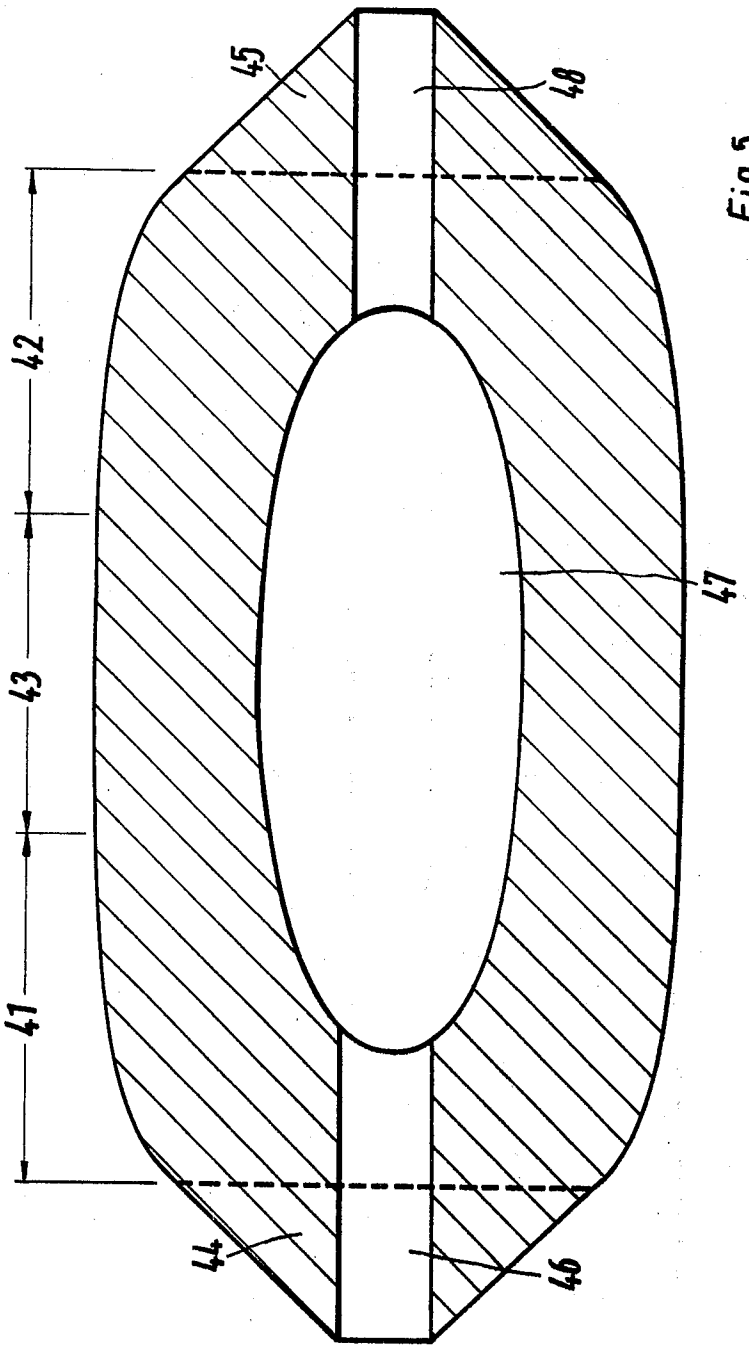


Fig. 5

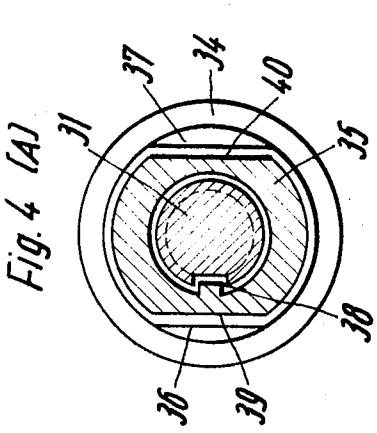


Fig. 4 (A)

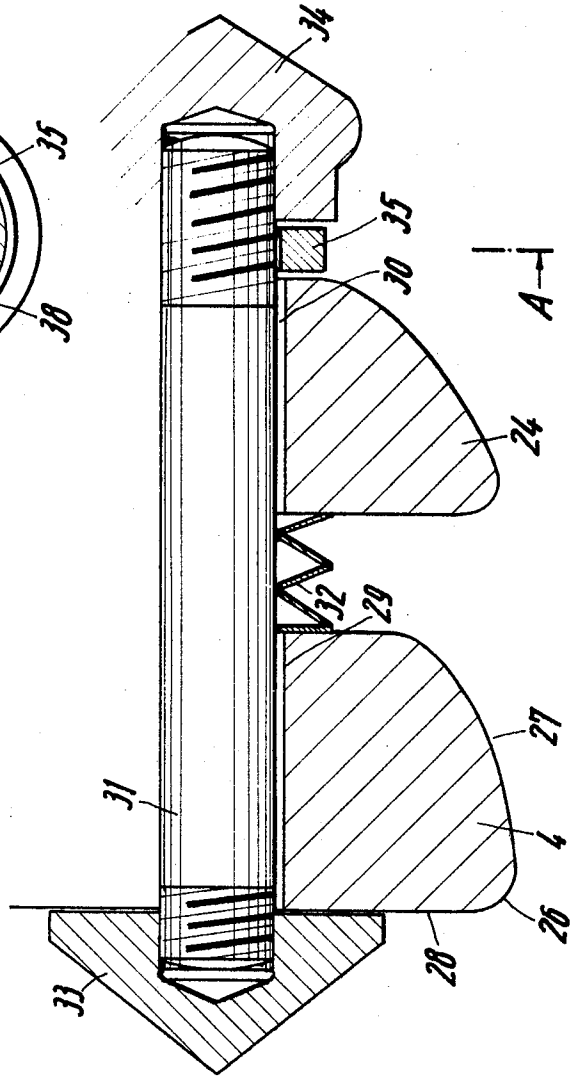


Fig. 3

PLUG CHANGING MECHANISM FOR ROLLING MILLS, AND PLUGS FOR THE SAME

BACKGROUND AND SUMMARY

The invention relates to a mechanism for mechanically changing plugs used in a rolling mill for decreasing the wall thickness of metal tubes or shells. Types of such mechanism are known, and consist of tongs, troughs and continuous bands by means of which the plugs are carried to the mill stand. However, the known mechanism has not been found satisfactory and therefore in many instances the tools are changed manually.

Since considerable heat is involved in the operation of the aforementioned mills, the operators could only work in short shifts, thus increasing the cost of labor. Also, because the plugs are of considerable weight and because of the intense heat, accidents were not uncommon in the manual changing of the plugs.

Our invention reduces the time required in positioning and aligning plugs in a tube mill and in changing the plugs following a rolling operation. Our invention also improves the useful life of the plugs and reduces the labor involved and the danger of accidents.

Briefly, our invention provides for the automatic delivery of a plug to the tube entry trough of a rolling mill, so that the forward end of the advancing tube may move the plug to proper position between the mill rolls and to connection with the mandrel bar. After the rolling operation, the plug is automatically disengaged from the mandrel bar and is delivered to a predetermined one of a plurality of peripheral pockets in a rotatable drum, for subsequent disposal in the tube entry trough, or for replacement. Our invention also provides an improved plug which has an increased useful life and which greatly improves the technology of rolling.

DESCRIPTION OF THE DRAWINGS

In the drawings accompanying this description and forming a part of this specification, there are shown, for purpose of illustration, embodiments which our invention may assume, and in these drawings:

FIG. 1 is a representation of the plug changing mechanism of a rolling mill, illustrating our invention,

FIG. 2 is a sectional view generally corresponding to the line B of FIG. 1,

FIG. 3 is a fragmentary, enlarged, sectional view of our improved plug,

FIG. 4 is a sectional view generally corresponding to the line A of FIG. 3, and

FIG. 5 is an enlarged sectional view of a plug, showing another embodiment.

DESCRIPTION OF PREFERRED EMBODIMENT

With particular reference to FIG. 1, the rolls 1 and 2 of a conventional tube reducing mill are shown, with the tube or hollow metal shell 3 being rolled over a plug 4 to effect a reduction in the wall of the tube as indicated at 5. The plug is supported at the free end of a fixed mandrel or plug bar 6, the opposite end of such bar being supported in conventional manner.

At the entry side of the mill, opposite the bar 6, is an entry trough consisting of parts 7 and 8 separated by an opening or cut-out 9. A conical drum 10 is so disposed that an upper portion fits within the opening 9 and the drum is rotatable about an axis 16 which is inclined with respect to the trough portions 7,8. The drum has longitudinal cut-outs, or pockets, 11, 12, 13 and 14,

formed in its periphery, so that an upwardly disposed pocket, such as pocket 11 in FIG. 1, is aligned with the trough portions 7,8. A sloped chute 15 is located beneath the trough portion 7.

The conical drum 10 is rotated about its axis 16 in any suitable manner, so that the pockets 11,12, 13 and 14 may be located in sequence in the space 9. To do this, the drum is rotated in the direction of the arrow 17 shown in FIG. 2. It will be noted that the radial surface of drum 10 is higher than the pass line and the bottom wall of the uppermost pocket 11 is in line with the trough portions 7 and 8. The part of the drum 10 on its upwardly turning section is enclosed by a fixed cage 18. As seen at 19, the cage 18 covers the back flat surface of the drum 10 and a cover plate 20 is provided in the back 19 which may be opened to remove a plug from the drum. Behind the opening covered by the plate 20 is a chute 21.

In operation, a tube or hollow shell is placed on the trough portion 8 at the location designated by the arrow 22. The pocket or longitudinal opening 11 of the conical drum 10 is at its top position (12 o'clock) in alignment with the trough portions 7 and 8, and a plug 4 is located in the opening 11. The tube to be rolled is transferred forward in trough 8 in the direction indicated by the arrow 23 and thus will move through the drum opening 10 and trough portion 7 to the mill rolls 1 and 2. When the tube travels through the drum opening 11, its leading end will slide over the guide body 24 of the plug and push the latter forwardly against the plug bar 6. During rolling, the plug 4 is held by the plug bar 6 between the mill rolls 1 and 2. The mill rolls drive the tube 3 forwardly, resulting in reduction of the thickness of the tube wall in conventional manner.

After completion of the rolling operation, the trailing end of the tube is beyond the plug 4 and the latter will fall out of its position between the rolls 1 and 2 and onto the chute 15, but the plug bar 6 will support the rolled tube for discharge from the mill. The lowermost pocket or cut-out 13 (in the position of parts shown in FIG. 1) will receive the plug 4 from the chute 15, and the cage 18 will prevent the plug from falling out of the pocket.

The conical drum 10 will then be rotated 90 ° in the direction of the arrow 17 so that the second plug 25 is moved to alignment with the chute portions 7, 8, and the plug 4 will occupy the position formerly occupied by the plug 25. The pocket 14 will in this condition be lowermost in position to receive a plug from a subsequent rolling operation. It will be appreciated that a pocket or longitudinal cut-out of the drum always faces the opening closed by the door 20 so that the latter may be opened and a plug removed from the drum and a replacement plug inserted therefor.

To assure trouble-free operation of the plug changing mechanism it has been found preferable to use plugs herein disclosed. The plug shown in FIG. 3, which has a special guiding section, has been found suitable. Such plug includes a part 4 of the shape of a frustrum of a cone with a cylindrical section and a radius 26 from the outside diameter surface 27 to the back surface 28. The guiding section 24 is similar to the section 4, and its diameter is the same size or a small amount larger than the inside diameter of the tubes or shell to be rolled. The outside diameter of the part 4 corresponds to the desired inside diameter of the tube after rolling.

Plug parts 4 and 24 have respective central bores or openings 29,30, through which passes a tension rod 31 having threads at its opposite ends. Special nuts 33, 34 are threaded on respective ends of the rod 31 and resilient means, such as a pack of Bellville springs 32, is disposed between the plug parts 4 and 24 and normally urge such parts away from each other. The nut 34 is formed with flat surfaces 36,37 to receive the jaws of a wrench for the purpose of tightening the nut. A spacer ring 35 is disposed between the plug part 24 and the nut 34, and this ring has oppositely disposed flat surfaces 39 and 40, as seen in FIG. 4. The spacer ring has a key 38 which engages in a key slot on the rod to prevent relative rotation, so that a wrench may be applied to the flats 39,40, to prevent relative rotation when the nut 34 is tightened. Although spaces are shown in FIG. 3 between opposed surfaces of the spacer ring 35 and adjoining parts of the guiding section 24 and the nut 34, it will be appreciated that no such spaces exist when the nut 34 is threaded on the tension rod 31 sufficiently to compress the springs 32. The resilient means 32 is of importance since it overcomes the tendency of the parts 4 and 24 to become loose on the tension rod 31, or the tension rod from breaking, which might otherwise be caused by reason of differential expansion between parts 4, 24 and the tension rod.

DESCRIPTION OF FURTHER EMBODIMENT

FIG. 5 illustrates a longitudinal cross-section through a one-piece plug whose shape consists of end sections 41,42 and an integral center section 43. The plug is tapered at both ends, as shown, to provide the respective conical surfaces 44,45. The end sections 41,42, at their points of greatest thickness have the same diameter as the central cylindrical section 43.

The plug of this embodiment is cast from a heat resistant material and is hollow, as seen at 46,47 and 48 to decrease its weight. It will be appreciated that the plug is symetrical with respect to the central portion 43 and therefore is usable on both sides thereof or in either direction. In one use of this plug, the tube to be rolled pushes the plug from left to right (as viewed in FIG. 5) until the conical surface 45 rests against the mandrel bar 6. In this use, the section 42 is located under the mill rolls 1, 2 and therefore the tube has to be pushed by a pusher from the left of FIG. 5 completely over the section 41 and the central portion 43 until the rolls grip the tube and roll it over the plug.

In another use of this plug, the mandrel bar 6 is retracted in a direction away from the mill rolls so that the plug section 41 is located under the rolls 1, 2, and the plug is guided by section 42 disposed within the tube being rolled. In this use, the tube pusher is not required and may be omitted, unless it is provided for other reasons.

If the central section 43 is not undercut, the two methods above described may be applied in combination, so that during rolling, the plug is pushed forward so far that at the beginning the section 41 is located under the rolls and at the finish of rolling the section 42 is under the rolls. Suitable devices for pushing the plug forward are known.

In view of the symmetry of the plug, it makes no difference whether section 41 or section 42 points in the roll direction. Therefore, when disposing the plug into the entry trough, its position does not have to be watched.

If desired, the plug shown in FIG. 5 may have its sections 41,42 and 43 formed as separate parts, and such parts may be held assembled on a tension rod, such as the rod 31, with nuts of the type heretofore shown at 33 threaded on opposite ends of the rod. The nuts are suggested in FIG. 5 as those parts disposed outwardly of the dotted lines. The nuts will have opposite flat surfaces, such as previously shown at 36,37 on the nut 34, for receiving a wrench. If desired, springs may be interposed between either, or both nuts, and the adjoining parts of sections 41 and 42.

We claim:

1. In a rolling mill for elongation of metal tubes, including mill rolls, a plug over which the tube is rolled, and a mandrel bar for positioning the plug within the rolls, the improvement comprising plug changing mechanism, including:

a drum spaced from the entry side of said rolls, said drum having circumferentially spaced pockets for receiving plugs,

said drum being rotatable to position a pocket and a plug therein uppermost and in alignment with the pass line of the mill, whereby said plug may be transfered along the pass line to said mandrel bar,

each of said plugs having opposite end surfaces, one end surface being contoured to fit with the leading end of said tube and the opposite end surface being contoured to fit with the free end of said mandrel bar, whereby when a plug is in the uppermost drum pocket, transfer of said tube toward said mill rolls will cause the leading end of said tube to engage said one end surface of said plug and move the latter along the pass line until said opposite end surface of said plug engages said free end of said mandrel bar.

2. The apparatus according to claim 1 wherein said drum is conical and rotatable about an axis inclined to said pass line an amount and direction so that the peripheral surface of said drum is parallel to but radially greater than said pass line, each of said pockets being of a depth whereby its bottom surface is aligned with said pass line.

3. A plug for use in a tube reducing mill having plug changing mechanism, and wherein the tube is rolled over the plug to reduce its wall thickness, said plug comprising a pair of plug portions mounted on a tension rod, the plug in use being disposed with the axis of said rod aligned with the axis of the tube being reduced, said rod having heads at its opposite ends to hold said plug portions thereon, and resilient means between said plug portions for urging them outwardly against respective heads.

4. The plug according to claim 3 wherein each plug portion is in the shape of a frustrum of a cone with an axial bore to slidably fit on said tension rod, opposite ends of said rod being threaded, and nuts threaded on respective ends to hold said plug portions assembled with said rod.

5. The plug according to claim 4 wherein Belleville washers are disposed between said plug portions to provide said resilient means.

6. In a rolling mill for elongation of metal tubes, including mill rolls, a plug over which the tube is rolled, and a mandrel bar for positioning the plug within the

rolls, the improvement comprising plug changing mechanism, including:

a drum spaced from the entry side of said rolls, said drum having circumferentially spaced pockets for receiving plugs,

said drum being rotatable to position a pocket and a plug therein uppermost and in alignment with the pass line of the mill, whereby said plug may be transfered along said pass line to said mandrel bar,

each of said plugs having a cylindrical center section and guiding and working sections extending and tapering off from respective ends of said center section,

said guiding section being adapted for engagement with the leading end of said tube and said working section being adapted for engagement with the free end of said mandrel bar, whereby when a plug is in the uppermost drum pocket, transfer of said tube toward said mill rolls will cause the leading end of said tube to engage said guiding section of said plug and move the latter along the pass line until said working section of said plug engages said free end of said mandrel bar.

7. The plug according to claim **6** wherein said cylindrical section and said working and guiding sections have substantially the same diameter at their points of greatest thickness.

8. The plug according to claim **6** wherein said plug is a hollow one-piece casting.

9. The plug according to claim **6** wherein said working and guiding sections are identical so that said plug is symetrical about its center section, whereby either section extending from said center section may be used for working or guiding.

10. The plug according to claim **6** wherein said cylindrical section and said end sections are separate parts arranged on a tension rod, opposite ends of said rods having cone-shaped heads for holding said sections assembled.

11. The construction according to claim **10** wherein said tension rod has its opposite ends threaded, and said heads are formed by cone-shaped nuts threaded on respective rod ends.

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