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ROLLING MILLS

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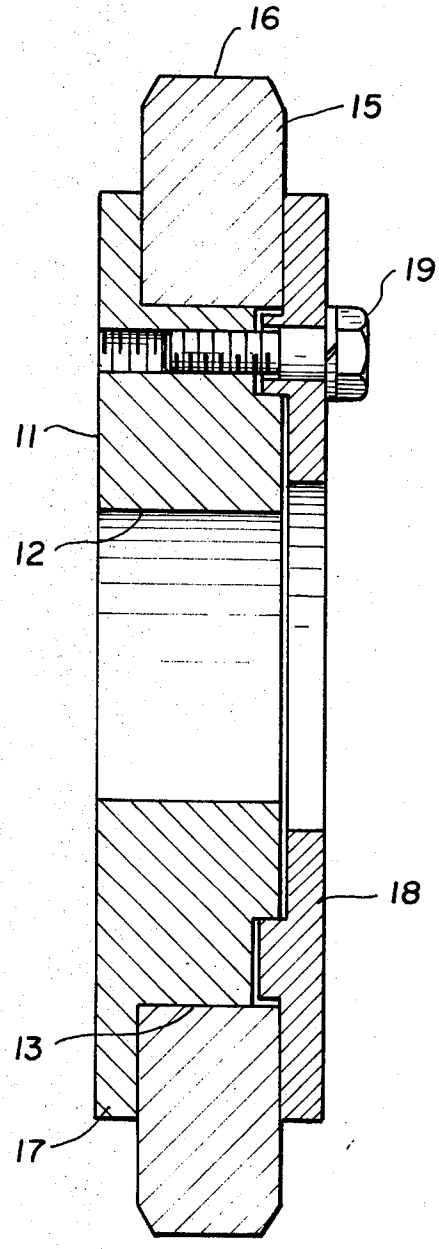


Fig. 1.

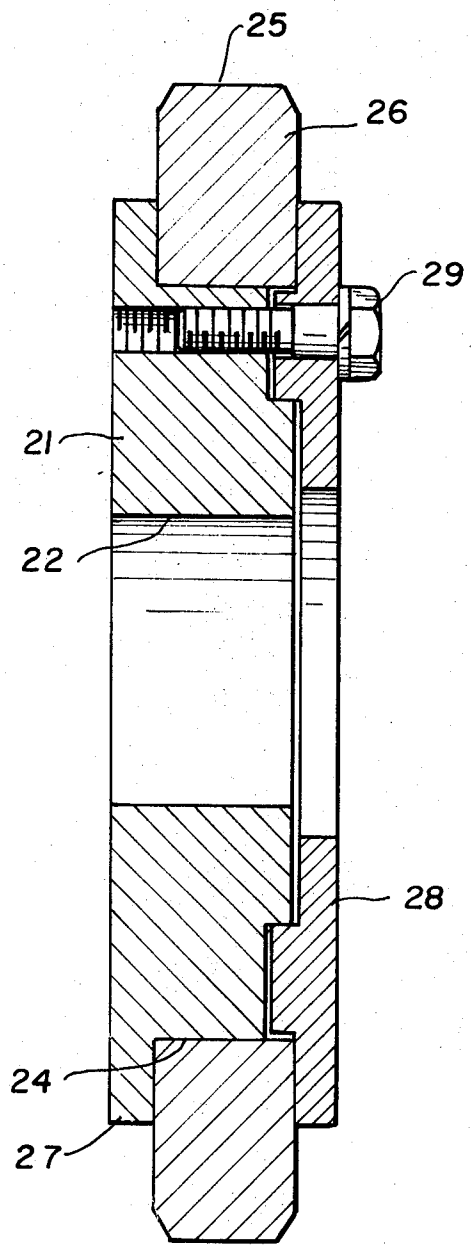


Fig. 2.

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ROLLING MILLS

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ABSTRACT OF THE DISCLOSURE

A multistand, universal rolling mill is provided with at least two sets of roll bodies interchangeable in each stand, each of said roll bodies adapted to carry a wear ring on the periphery thereof, one set having a larger outside diameter than the other whereby to receive the wear rings of said other set after expansion to a larger internal diameter corresponding to the outside diameter of said one set.

This invention relates to rolling mills and particularly to multistand, universal rolling mills and rolls used therein such as are used; for example, as the finishing train in wire rod mills having two or three roll stands.

In universal rolling mills having a plurality of stands, the nominal roll diameter is usually the same at least for certain groups of stands. For example, on two high stands the nominal roll diameter is equal to the center distance of the rolls forming the pass. In many cases the rolls are non-adjustable. In such mills, in order to gain the maximum possible utilization of the rolls, it is common practice to regrind the used rolls from one stand to a size suitable for the next larger pass. This is repeated until the largest pass opening is reached. Using this procedure the rolls move from the smallest finishing pass up to the entry pass, which is, of course, the largest pass opening. At this point the rolls are discarded.

Unfortunately, the rolls in the several stands do not wear at a uniform rate. The rolls forming the smaller passes wear much faster than the rolls forming the larger passes.

This means that more rolls are used in the finishing pass than in the entry pass and that the rolls are changed more often in the finishing pass than in the entry pass.

The desirability of obtaining a greater utilization of all the rolls is obvious and has long been the subject of considerable effort. It has, for example, been proposed to deposit, by welding, a wear resistant layer on a ductile roll body and to hard face the used rolls by welding. Experience has shown that, as a practical matter, the performance of rolls which have been hard faced by welding is not satisfactory. It is true that a longer roll life is achieved; however, the welding process damages the roll body. Moreover, the process is expensive and the hard metal facing is very sensitive to stresses developed through changes in temperature. This temperature stress sensitivity is, of course, very undesirable in rolling mill rolls. Another proposal has been to form roll bodies from ductile grade steels and provide them with an outer ring of wear resistant metal held in place on the roll body by mechanical means. Again the roll life is prolonged, but the additional expenses due to machining of the roll body and material costs for the outer rings reduce the advantage of this procedure. This is true if, on the average, less passes can be ground into these rings than there are stands in a mill until the rings are used up.

The present invention provides a novel solution to this problem. The invention is based upon the use of roll bodies of ductile steel and wear resistant rings with the pass ground in and mounted rigidly on the roll body. The significant improvement lies in the use of ductile bodies of at least two different outside diameters for every

nominal roll diameter. The used rings from the roll bodies of smaller diameter are expanded to the next larger diameter roll body and used on this next larger body.

The practice of this invention means that rings that were previously used on smaller outside diameter roll bodies are next expanded and used on larger outside diameter roll bodies. Whenever the ring is moved to another roll body, it may be expanded and used on a larger body, thereby increasing the outside diameter of the working surface. This permits the smallest, or one of the smallest passes to be again cut into the ring, thus permitting reuse of the rings in the smaller passes without the need to discard them. Compared with prior art practices, this invention eliminates the undesirable welding effects and permits the rings of wear resistant material to be used to the maximum.

Since multistand rolling mills are usually equipped with several complete sets of stands, it is the preferred practice, according to this invention, to take all stands with the same diameter on the roll bodies into one complete set of stands, providing there are stands with other diameter on the roll bodies belonging to the same mill.

It is preferred to use as the wear rings a hot forming tool steel which in the soft annealed condition can be expanded on a ring-rolling machine or a mandrel press or some similar apparatus.

Certain objects, purposes and advantages of this invention will be apparent from the foregoing general description. Other objects, purposes and advantages of the invention will be obvious from the following more specific description and from the accompanying drawings in which:

FIG. 1 is a cross-section of a roll, according to this invention, using a small outside diameter roll body; and

FIG. 2 is a cross-section of a roll, according to this invention, using a larger outside diameter roll body.

Referring to the drawings I have illustrated in FIG. 1, a roll body **11** of small outside diameter having an axial bore **12** into which a conventional input or drive shaft (not shown) is inserted. On the outside of the roll body **11** is provided a wear ring seat **13** adapted to receive a wear ring **15**. The desired roll pass is cut in the outer periphery **16** of wear ring **15**. The wear ring **15** is held in place on seat **13** by a radial shoulder **17** on roll body **11**, on one side, and by a clamping ring **18** on the opposite side. The clamping ring is preferably attached to roll body **11** by bolts **19**.

In FIG. 2, I have shown a larger roll body **21** having an axial bore **22** receiving a conventional input shaft (not shown). On the outside of the body, I provide a seat **24** receiving a wear ring **26** which has been formed by expanding the smaller ring **15** of FIG. 1. The wear ring is held in place by a radial shoulder **27** on one side and by a removable ring **28** on the opposite side. The ring **28** is held in place by bolts **29**.

According to my invention a smaller roll body **11** with wear ring **15** is used in a mill stand until its diameter is reduced to a point where it is no longer useful. At this point the wear ring **15** is removed, soft annealed expanded and hardened to form a larger internal diameter ring **26** which is placed on a larger roll body **21**. The desired roll contour is then milled into the outer periphery **25** and the roll body placed into operation. This new roll contour may be that of the smallest pass or one of the smallest passes and thereafter successively all the larger ones until the ring is used up on this particular body. The ring can then be removedannealed, expanded and used on a larger set of roll bodies until the ring has no more useful life.

While I have illustrated and described a present preferred embodiment of my invention in the foregoing speci-

fication, it will be understood that this invention may otherwise be embodied within the scope of the following claims.

I claim:

1. A multistand, universal rolling mill comprising at least two mill stands, and at least two sets of two roll bodies interchangeably mounted in each said stands each of said roll bodies adapted to carry a wear ring on the periphery thereof, one set having a larger outside diameter than the other whereby to receive the wear ring of said other after expansion to larger internal diameter corresponding to the outside diameter of said one set.

2. A multistand, universal rolling mill as claimed in claim 1 wherein the wear rings are made of a heat treatable hot forming tool steel.

3. A method of operating a multistand, universal rolling mill comprising the steps of:

(a) providing at least two sets of roll bodies for each stand of said mill, said sets having outside diameters different from one another;

(b) providing a set of wear rings adapted to fit onto the set of roll bodies having the smallest outside diameter;

(c) operating said rolling mill using the roll bodies having the smallest outside diameter with said wear rings mounted thereon until said rings are worn to a point where they are no longer satisfactory;

(d) removing the roll bodies from the mill;

(e) removing, the wear rings from the smallest bodies;

(f) annealing and expanding the wear rings to fit the outside diameter of the next larger set of roll bodies; and

(g) repeating steps (c) through (f) until the wear rings are no longer useful.

4. The process as claimed in claim 3 wherein the wear rings are ground to a selected contour on their outer periphery at each roll body change.

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