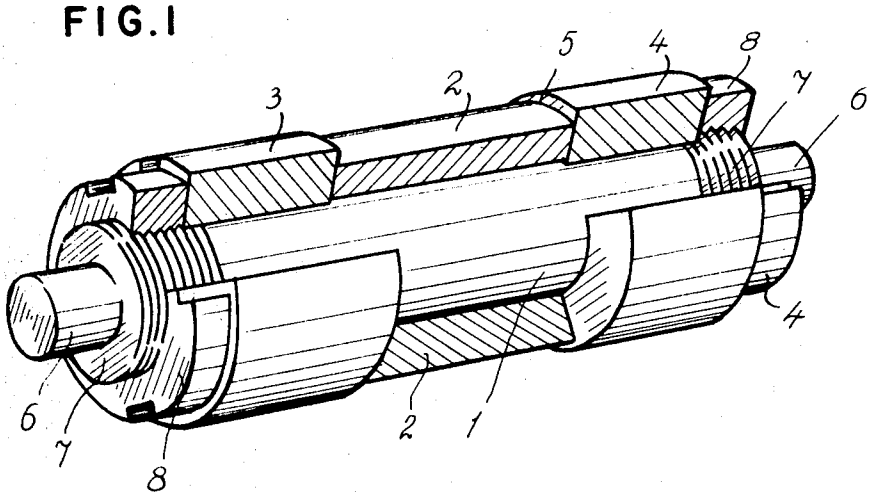
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FIG. 1



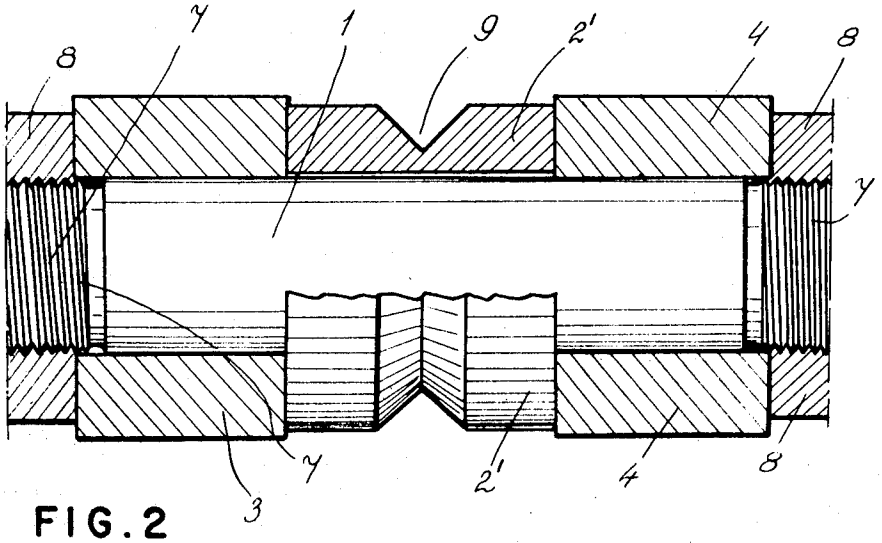


FIG. 2

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[32] Priority **Feb. 9, 1966**
[33] **Sweden**
[31] **1,659/66**

[54] **METHOD OF MANUFACTURING COMPOSITE HARDMETAL ROLLS**
2 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **29/148.4,** 29/123, 29/125, 29/132
[51] **Int. Cl.** **B23p 11/00,** B21b 27/00, B21b 31/08
[50] **Field of Search** ..... 29/148.4, 148.4 (D), 123, 125, 132

[56] **References Cited**

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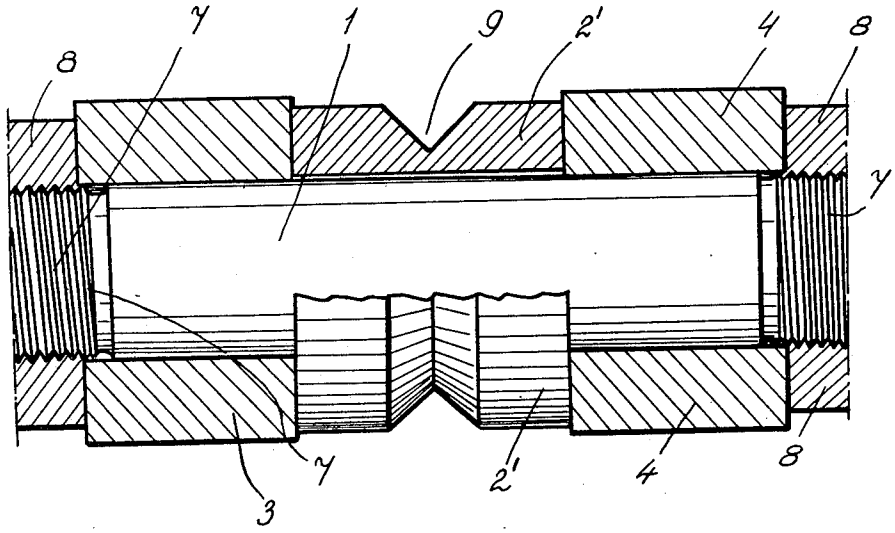
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Attorney—Stevens, Davis, Miller & Mosher

ABSTRACT: A method for manufacturing working rolls for rolling mills of the type formed by a roll core with a roll ring attached to the core, the roll ring being made of some hard material, such as hard metal or ceramic material. The roll ring is mounted with a clearance fit on the heated roll core and is secured thereto by pressure means which act axially against only the flat end surfaces of the roll ring, the pressure means imparting to the roll ring the force necessary for fixing and prestressing the ring so that it is capable of withstanding the rolling forces.



METHOD OF MANUFACTURING COMPOSITE HARDMETAL ROLLS

The present application is a division of my application Ser. No. 614,227 filed Feb. 6, 1967, now U.S. Pat. No. 3,461,527, granted Aug. 19, 1969 and titled "Rolls for Rolling Mills."

BACKGROUND

The present invention relates to a method for manufacturing rolls for rolling mills of the type having a roll core on which a ring or sleeve of hard material having a high degree of hardness and resistance to wear is fixed.

When material passes through the rolls of a rolling mill, the surface of the rolls leave a certain imprint on the surface of the rolled material. Therefore, the surface topography of the roll barrel is of considerable importance to the surface quality of the rolled product.

The surface of the rolls are subjected to considerable wear, particularly in the case of hot rolling, which in addition to impaired microgeometry also contributes to deviations in measurements. This is particularly noticeable in the case of so-called calipered rolls which are intended to give a certain configuration, determined by the groove in the roll. Worn rolls must of necessity be periodically removed from the mills for regrinding, resulting in reduced effective production time.

The smaller the diameter of the roll and the higher the requirements placed upon the product, the more frequent the rolls must be changed. In the case of rolls of relatively small dimensions, it is therefore economically and technically advantageous to use a high quality wear resistant material, for instance, sintered carbides of hard metals, such as tungsten, tantalum, titanium, vanadium, or a ceramic material. A material possessing admirable properties in this respect is hard metal which, however, is very brittle and can only withstand low tensile stresses or bending stresses.

An object of the invention is to eliminate these deleterious stresses by means of a special roll structure produced by the inventive method.

In accordance herewith the invention is mainly characterized in that said ring or sleeve is mounted with a clearance fit on a roll core, and is fixed to the core by means of pressure means urged axially solely against the end surfaces of the sleeve, the pressure means providing the force necessary for fixing the sleeve and enabling it to take up the forces created under rolling conditions.

The means for accomplishing the foregoing objects and other advantages, which will be apparent to those skilled in the art, are set forth in the following specification and claims, and are illustrated in the accompanying drawings dealing with a basic embodiment of the present invention. Reference is made now to the drawings in which:

FIG. 1 is a perspective view, partly in section, of a working roll in accordance with the invention; and

FIG. 2 shows a longitudinal section of a similar caliper roll, designed according to the invention.

DETAILED DESCRIPTION OF INVENTION

The roll shown in the drawing is intended to be used in rolling mills of the type which utilize backing rolls, i.e. a rolling mill where the material is worked between two working rolls supported by backing rolls, which take up the rolling forces.

Shown in the drawing is a roll body or core 1, suitably made of tempered steel of high strength. A ring or sleeve 2 which has a circular cross section, is mounted and capable of being mounted, respectively, with a clearance fit on the roll core. The ring or sleeve 2 is made of a material having a high degree of hardness and wear resistance, e.g. a suitable hard metal. Abutting each end of said sleeve 2 is a sleeve-shaped pressure means 3 and 4, suitably made of metal of high pressure and tensile strength, e.g. tempered steel. The outer diameter of the pressure means are preferably at least slightly larger than the diameter of the hard metal sleeve 2, the difference in diameter being shown, although in an exaggeration, at 5 on the drawing.

The end portions of the roll core 1 are provided with trunnions 6 and also with threaded portions 7, on which are tightened nut members 8 by means of which the pressure means 3 and 4 can be tightened against the ends of the hard metal sleeve 2 so that said sleeve is fixed in position axially as well as radially relative to the core 1.

According to a modification of the invention (not shown on the drawing), the roll core 1 can be made integral with one of the pressure means 3 or 4, the remaining pressure means, naturally, comprising a separate detail with respect to the core.

In conventional rolls provided with a hard metal ring arranged on a steel roll core it has been the common practice to shrink the hard metal ring onto the steel core and fix the same with nuts. The design, according to the present invention, differs to the prior method in that, as indicated above, a certain radial clearance exists between the hard metal ring and the steel core, which serves to prevent the occurrence of critical stresses deleterious to the hard metal ring. The hard metal sleeve is thus secured in position, according to the invention, solely by the friction created by the pressure means 3 and 4 against the ends of the hard metal sleeve.

The rolls according to the invention are primarily intended to be used for hot rolling in which the rolls become hot and consequently expand to a certain extent. Since the coefficient of thermal expansion of the hard metal is only half of that of the steel, there is a grave risk that the hard metal ring will fracture unless a certain clearance exists between the roll core and the roll ring. The clamping force between the pressure members 3 and 4 is so high that the friction between the outer faces of the hard metal ring and the steel surfaces of the pressure means is sufficient to take up roll forces as well as torque. This is opposed to conventional structures, in which the roll forces urge the hard metal ring against the jacket surface of the core, the jacket surface taking up the forces created during rolling.

Grooved rolls are used when rolling sections. An example of such a roll, designed according to the invention and provided with a groove, which in cooperation with a similar groove in a similar roll gives the workpiece a square cross section, is shown in FIG. 2. The roll members, according to FIG. 2, are the same as those shown in FIG. 1, with the exception of the slightly modified hard metal sleeve 2' which presents a profile groove 9. This groove in itself causes a substantial weakening of the hard metal sleeve, and if the roll were of a conventional design, the brittle hard metal ring would easily fracture under the lateral forces which occur in the groove during rolling. In the case of the roll, according to the invention, the metal ring is retained under axial pressure forces which are so powerful that the lateral forces can be completely overcome.

Since the pressure means 3 and 4, according to FIGS. 1 and 2, have a slightly larger outer diameter than the hard metal ring, the ring does not lie against the barrel of the backing roll. This arrangement thus avoids difficulties caused by scale and also prevents the ring from fracturing under the load existing between the working roll and backing roll. Moreover, when the roll is used in backing roll mills having friction driven working rolls, the torque transfer is effected, steel against steel, which is favorable since steel against hard metal gives essentially lower friction.

To ensure that the position of the roll ring does not change during the rolling operation, it must be fixed to the core with a comfortable safety margin. A safety factor of 8 to 10, for instance, may be necessary. With respect to the high forces which must be applied axially to the roll ring 2 or 2', it may be convenient to preheat the roll core or the complete roll, with the exception of the roll ring, prior to securing the ring by means of nuts 8, whereby the extent to which the roll core decreases in length as it cools can be advantageously used for the purpose of obtaining the axial tightening forces.

In one example of a roll of the type shown in FIG. 2, the roll ring was comprised of hard metal and had an outer diameter of 80 mm., and an inner diameter of 50 mm. and a length of 30 mm. The largest outer diameter of the roll core was 45 mm.

and the pressure means, on opposite sides of the roll ring, had an outer diameter of 81 mm. The complete roll, with the exception of the roll ring, was made of tempered steel. The roll ring was provided with a V-shaped groove, the sides of which were at right angles to each other and had a length of 11 mm. in cross section. The roll was intended to reduce the area of an oval workpiece by 40 percent, forming a square section having sides of 11 mm. in cross section. The workpiece could have comprised a plain carbon steel having a carbon content of 0.15 percent or a high-alloyed high-speed steel. The anticipated forces on the hard metal ring reached to approximately 2 tons for the carbon steel and 6 tons for the high-speed steel. An axial force, corresponding to the force necessary for stretching the roll core three-thousandths of its length, acting against the flat side surfaces of the roll ring was required to prestress and fix the hard metal ring, so that it could withstand a roll force of approximately 60 tons. This axial force was obtained by preheating the steel portions of the roll to a temperature of 270° C. prior to mounting the roll ring. Since the coefficient of thermal expansion of the hard metal is half of that of steel, the nuts could be easily backed off and the pressure means and hard metal ring then removed from the roll core, subsequent to heating the complete roll to approximately 540° C. The hard metal ring and the remaining portions of the roll, comprising tempered steel, are well capable of withstanding this temperature.

In addition to the possibility of using the roll for hot rolling purposes, without risk of roll ring fracture, the invention also offers the advantage that the inner surface of the roll ring of hard material need not be worked. Machining of the interior of a hard metal ring is very expensive and can absorb upwards to half the total cost of the ring. However, to facilitate the centering of the roll ring relative to the core, the ring can be provided with an internal lining of easily machined material, for instance, an aluminum or copper ring lining, fitted by shrinking, the lining being easily machined at low costs so that a centrally positioned hole having but a small clearance to the roll core is obtained.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore to be embraced therein.

I claim:

1. A method of manufacturing composite hard metal rolls in which a hard metal roll sleeve is mounted upon a roll core which has a coefficient of linear expansion higher than that of said sleeve, comprising the steps of heating the core, mounting the hard metal roll sleeve, which is preshaped to present end surfaces extending perpendicular to the roll axis, onto the heated roll core so as to leave a radial gap between the respective internal and external surfaces of said roll sleeve and roll core, mechanically clamping the hard metal roll sleeve on the roll core between pressure means which are preshaped to present engagement surfaces similar to the end surfaces of the roll sleeve and extend perpendicular to the roll axis, and allowing the roll core to cool, to prestress the roll sleeve and to amplify the frictional forces at the interface between the engaging ends of said sleeve and the pressure means.

2. The method of claim 1, in which the composite roll is heated in a furnace and the pressure means then additionally tightened against the ends of the roll sleeve.