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ROLL FOR ROD MILL AND MOUNTING ARRANGEMENT THEREFOR

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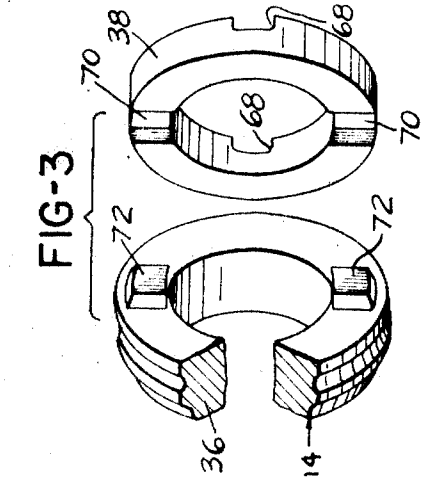


FIG-3

FIG-1

FIG-2

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ROLL FOR ROD MILL AND MOUNTING ARRANGEMENT THEREFOR

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ABSTRACT OF THE DISCLOSURE

A form roll of hard material, such as cemented tungsten carbide, for example, is mounted on a driving shaft. A driving ring abuts one side of the roll and is keyed thereto by interfitting lugs and notches on the roll and ring. A bar-like key engages the notches in the shaft and ring and keys the ring to the shaft and is engaged by a screw which clamps the ring to the roll. A split sleeve is forced between a cylindrical central bore in the roll and a tapered portion on the shaft which the roll surrounds.

The present invention relates to the connection of forming rolls to drive shafts for the rolls and is particularly concerned with the application of the invention to rod mills and the like.

Rod mills and tube mills are well known and consist of a frame having a plurality of pairs of driven rolls through which the material being treated is passed for forming. The forming of the material is accomplished by forming rolls having contoured grooves therein which progressively shape the member passing therethrough to the desired cross sectional configuration and size. A typical rod mill, for example, might take a round rod of a certain size and reduce it by progressive stages to a round rod of a smaller size. Other cross sectional shapes are also possible.

The work load on such forming rolls is extremely heavy and in order to insure an accurate end result and to eliminate slippage and breakage of the rolls and deflection thereof, it is extremely important that the roll be firmly connected to its driving shaft. The extremely heavy service to which the rolls are subjected requires that they be made of a hard material, such as cemented tungsten carbide. Heretofore, it has been difficult and expensive to attach rolls of tungsten carbide to the supporting shafts therefor and the present invention is particularly directed to an improved mounting arrangement for rolls of this type.

Accordingly, the primary objective of the present invention is the provision of an improved mounting arrangement for connecting forming rolls to the drive shafts in a rod mill or the like.

Another objective of this invention is the provision of a cemented tungsten carbide forming roll for a rod mill and a novel mounting arrangement therefor for fixedly connecting the roll to its supporting and driving shaft.

Other objectives and advantages of the present invention will become more apparent upon reference to the following detailed specification taken in connection with the accompanying drawings in which:

FIG. 1 is a schematic representation of a rod mill;

FIG. 2 is a fragmentary sectional view indicated by line II—II on FIG. 1 and showing more in detail the connection of a typical forming roll to its supporting and driving shaft; and

FIG. 3 is a perspective view showing the forming roll together with the ring which keys the roll to the roll drive shaft.

In the present invention large, heavy shafts are provided

firmly mounted in a supporting frame and arranged in pairs so that rolls mounted on the shafts will be presented to each other to receive a work member such as a rod therebetween.

The rolls are mounted on a tapered portion of the shaft by a split tapered sleeve pressed into the space between the roll and the shaft and the rolls are, furthermore, keyed to the shaft by a ring having notches on one side to receive lugs on the forming roll and notches on the other side to receive a bar extending through a hole or notch provided in the drive shaft for this purpose. In this manner the rolls are firmly held on the shaft against slipping thereon and are also supported against deflection in any direction so that breakage of the rolls is minimized.

Referring now to the drawings somewhat more in detail, in FIG. 1 the frame of the rod mill is indicated at **10** and rotatably mounted therein are shafts **12** arranged in opposed pairs and each carrying a forming roll **14**. A rod **16** of a larger size passes rightwardly through the rod mill and emerges therefrom at the right and as a rod **18** of smaller size and predetermined cross sectional configuration.

Turning now to FIG. 2 a typical shaft **12** is shown which is journaled in frame **10** as by a bearing **20** and, at the outside of the frame has a first reduced diameter portion **22**, a tapered portion **24**, and a second reduced diameter portion **26**.

The first reduced diameter portion **22** receives a pair of rings **28** which have substantial annular cross sections thereof in abutting relation and which rings together confine a cavity **30** in which is a seal member **32**, carried on a member **34** which is sealingly attached to frame **10** of the rod mill.

Abutting the outer ring **28** is a forming roll **36** according to the present invention and abutting the outer side of roll **36** is a drive ring **38**.

The roll **36** surrounds the tapered portion **24** of shaft **12** and positioned between the cylindrical central bore of roll **36** and the tapered portion **24** of shaft **12** is the split tapered end region **40** of a sleeve member **42** which extends outwardly a substantial distance beyond ring **38**. At its outer end sleeve **42** has an inwardly directed flange **44** and a retainer ring **46** is connected to the end of sleeve **42** by screws **48** to define an annular cavity for receiving the radial flange **50** of a nut **52**. Nut **52** is threaded on a large bolt **54** having an exposed head **56**, which at its inner end, is threaded through a disc member **58** connected to the end of shaft **12** by cap screws **60**.

The second reduced diameter end portion **26** of shaft **12** has a transverse slot therein and closely receives a transversely extending bar-like key **62**. Key **62** is confined within the slot **64** provided therefor in the end of shaft **12** by disc **58** and, furthermore, has a conical recess **66** engaged by the conical end of screw **54**. Key **62** extends through apertures provided therefor in sleeve **42** and engages notches **68** in the outer side of ring **38**. In this manner ring **38** is keyed to shaft **12** so as to rotate therewith.

Ring **38** on its side facing roll **36** is also provided with radial notches **70** into which extend the lugs **72** formed on the adjacent side of roll **36**. The roll **36** is, thus, in turn, fixedly keyed to shaft **12** to rotate therewith while being firmly supported thereon by the split tapered portion **40** of sleeve **42**.

The roll **36** is clamped tightly against rings **28** by turning screw **54** so that key **62** is forced against ring **38** which in turn clamps roll tightly against rings **28**. thereafter, nut **52** is rotated to press sleeve **42** toward roll **36** and this will press the tapered region **40** of the sleeve firmly into the space between roll **36** and tapered portion **24** of shaft **12**.

To permit the best bearing between the parts, lugs **72**

on the roll **36** do not bottom in notches **70** of drive ring **38**, and the bar-like key, similarly bottoms only in the notches **68** in drive ring **38**.

After the foregoing adjustments have been made, lock nut **74** on screw **54** can be tightened up against nut **52**.

From the foregoing, it will be seen that the forming roll is extremely solidly supported on its drive shaft and fixed thereon against rotation so that high work loads can be opposed on the roll without the chance of it slipping or its supporting shaft or becoming loose on the supporting shaft. The roll, furthermore, is also supported so that it has little tendency to break and thus can deliver the maximum useful life.

In connection with the strength of the roll, it will be evident that the solid roll illustrated in this application has considerably greater strength than would be possible if the roll were made in sections as, for example, an outer roll part mounted on an arbor. The gain in strength of such a solid roll over a composite roll is calculated in the manner in which the strength of a beam is calculated. In the case of a composite roll the strength would be calculated by the strength of the cubes of the radial thickness of the composite parts whereas in the case of a solid roll the strength is measured by the cube of the total radial thickness of the roll.

In the particular case where the roll is made of tungsten carbide, which is a material having three times the resistance of deflection of steel, it will be evident that the solid carbide roll without a central arbor disposed between it and the shaft has much greater strength than a carbide roll of less radial thickness and having a steel sleeve interposed between it and the support shaft.

Modifications can be made in the present invention falling within the scope of the appended claims.

What is claimed is:

1. In a mill, such as a rod mill having a frame, a shaft rotatable in the frame with one end projecting from the frame and a roll mounted on the projecting end of said shaft; said projecting end of said shaft having a tapered portion in the axial plane of said roll and a shoulder between the tapered portion and the frame, said roll having a cylindrical central bore larger in diameter than the largest diameter of said tapered portion of said shaft, said roll on the side facing said frame abutting said shoulder, a sleeve element having a region tapered on the inside and cylindrical on the outside, said region of said sleeve being disposed in the bore in said roll and about the tapered portion on said shaft, a ring surrounding said sleeve and abutting said roll on the side thereof facing away from said frame, first means keying said ring to said roll, second means keying said ring to said shaft, means operable for forcing said ring toward said roll to clamp the roll against said shoulder, and means operable for forcing said sleeve axially on said shaft to wedge the said region thereof between said roll and said shaft.

2. An arrangement according to claim **1** in which said first means comprises interfitting lug and notches on the adjacent faces of said roll and ring.

3. An arrangement according to claim **2** in which the lugs are on the roll and the notches are on the ring and the notches are deeper than the height of the lugs so that the ring bears directly on the adjacent face of the roll.

4. An arrangement according to claim **2** in which said second means keying said ring to said shaft comprises laterally extending notches in said shaft and in the side of the ring facing away from said roll, and a bar-like key extending through the said notches.

5. An arrangement according to claim **4** in which the said notch in the shaft is in the outer end thereof, a retainer disc secured to the end of the shaft and confining the bar-like key in the notch in the end of shaft, and said means for forcing the ring toward the roll comprising a screw threaded through said retainer disc and engaging said bar-like key.

6. An arrangement according to claim **5** in which said region of said sleeve is split.

7. An arrangement according to claim **6** in which said means for forcing said sleeve element axially on said shaft comprises a nut threaded on said screw and rotatably engaging said sleeve.

8. An arrangement according to claim **7** in which said nut has a peripheral flange, said sleeve element having a recess in the outer end for receiving said flange, and a retaining ring secured to the outer end of said flange and loosely confining the flange on the nut in said recess.

9. An arrangement according to claim **8** in which said screw has a lock nut threaded thereon for locking said nut with the flange to the screw.

10. An arrangement according to claim **1** in which the portion of said sleeve element in said roll is radially thin and the roll from the outer surface of said sleeve element outwardly comprises a solid uninterrupted mass of metal.

11. An arrangement according to claim **10** in which said roll is formed of cemented tungsten carbide.

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