United States Patent [19]

Gould

[11] **3,866,283**

[45] **Feb. 18, 1975**

[54] **MULTI-GROOVE ROLL MOUNTING**

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[73] Assignee: **Morgan Construction Company,** Worcester, Mass.

[22] Filed: **Dec. 26, 1973**

[21] Appl. No.: **423,431**

[52] **U.S. Cl.** ..... **29/121 R,** 72/221, 72/238

[51] **Int. Cl.** **B21b 27/02**

[58] **Field of Search** ..... 72/247, 222, 221, 238, 72/199, 234, 366; 29/121 R, 121 A, 125, 129.5

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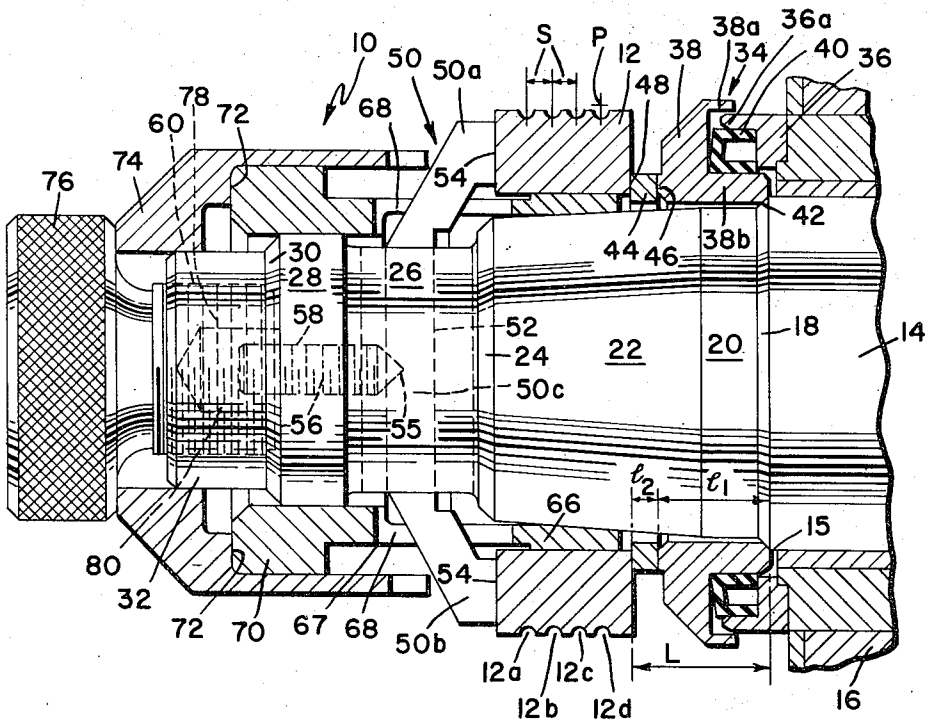
Primary Examiner—Milton S. Mehr

Attorney, Agent, or Firm—Thompson, Birch, Gauthier & Samuels

[57] **ABSTRACT**

Apparatus for mounting a multi-groove work roll on a roll shaft in a rolling mill. The apparatus includes a shoulder on the roll shaft, a spacer assembly on the roll shaft in engagement at one end with the shoulder, the opposite end of the spacer assembly being in engagement with a work roll axially received on the roll shaft, and a retainer assembly for holding the work roll against the spacer assembly in an operative position with one of the roll grooves aligned with the mill pass line. The spacer assembly includes at least one removable element, the presence or absence of which will change the axial length of the spacer assembly by a distance equal to the spacing between the centers of adjacent grooves on the work roll.

6 Claims, 6 Drawing Figures



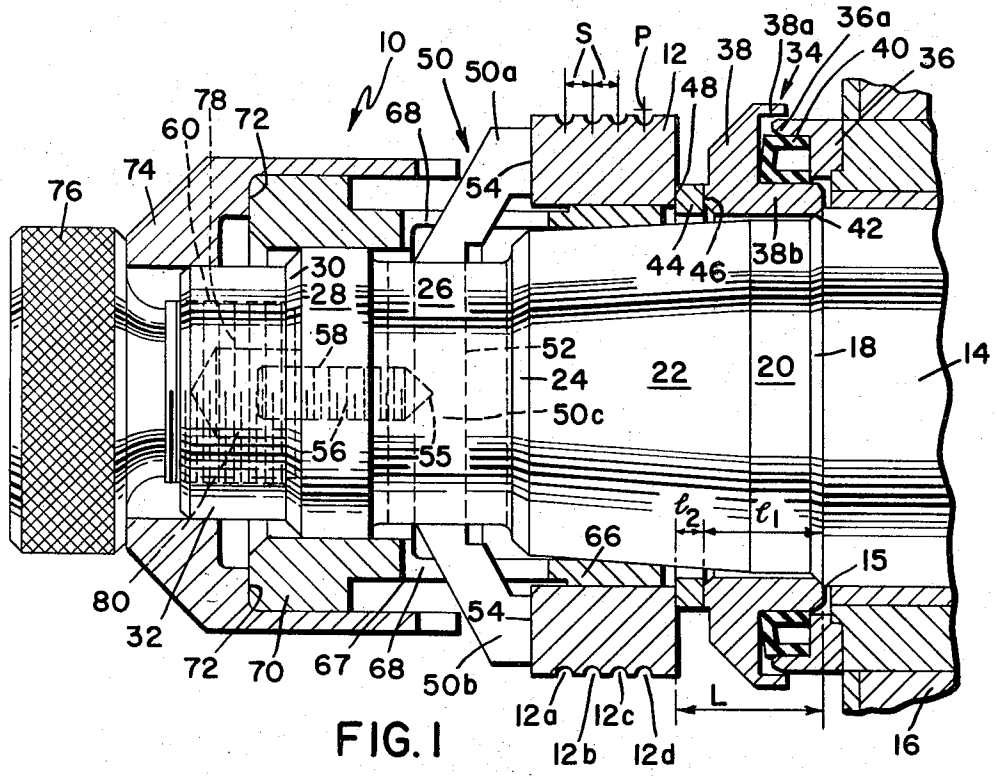

10
50
50a
S
P
12
38
38a
34
36a
40
36
48
78
60
72
68
74
76
54
42
44
46
38b
30
28
26
58
52
24
22
20
18
14
50c
56
55
ℓ_2
ℓ_1
66
15
80
32
72
70
67
68
50b
54
12a
12b
12c
12d
L
16

FIG. 1

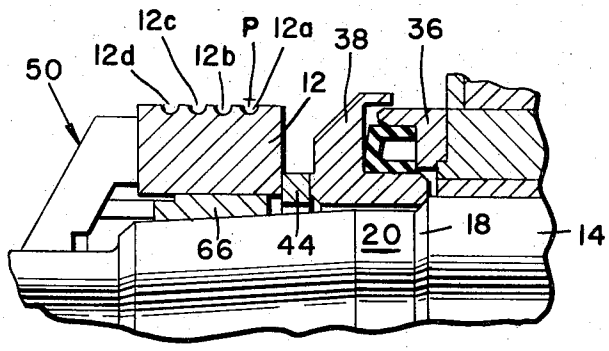


FIG. 2A

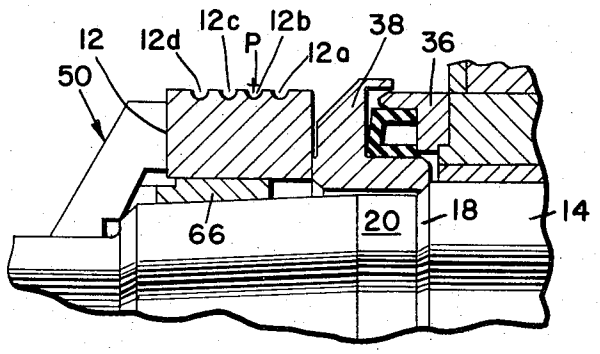


FIG. 2B

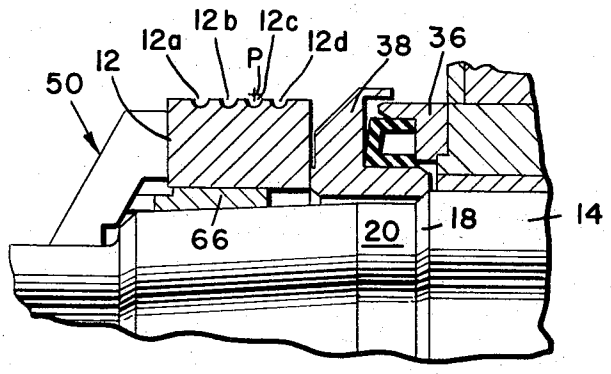


FIG. 2C

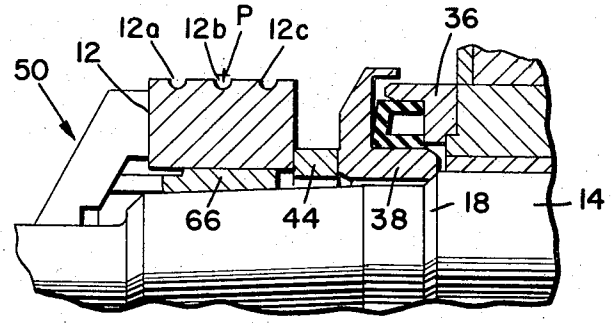

12a
12b
P
12c
36
12
50
66
44
38
18
14

FIG.3

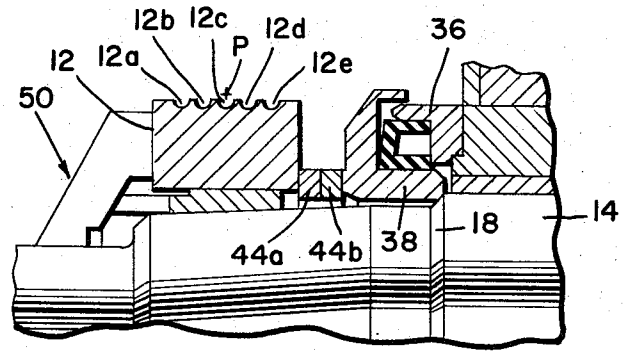

12b
12c
12d
36
P
12
12a
12e
50
44a
44b
38
18
14

FIG.4

MULTI-GROOVE ROLL MOUNTING

DESCRIPTION OF THE INVENTION

This invention relates generally to rolling mills, and is concerned in particular with a new and improved apparatus for mounting multi-groove work rolls.

As herein employed, the term "multi-groove work roll" is defined as a work roll adapted for mounting on the end section of a roll shaft and having at least three grooves on the exterior surface therof, with the axial spacing between the centers of adjacent grooves as well as the axial spacing between each outside groove and the adjacent roll end being equal.

In the past, a number of arrangements have been employed in the mounting of grooved work rolls on the end sections of roll shafts. In the earlier arrangements, the work rolls were provided with a single groove, and this in turn necessitated frequent roll replacement each time the groove becomes worn. After removal, a roll with a worn groove was either reground, or if this was no longer possible, the roll was simply discarded.

In order to improve roll life, double-groove rolls were later developed. With such rolls, after one groove was worn, the roll was reversed to make use of the other groove, and hence a significant improvement in roll life was realized. Other prior art arrangements made use of rolls having more than two grooves, with means for axially adjusting the roll shafts in order to align the roll grooves with the mill pass line. However, because of the need to accommodate axial adjustment of the roll shafts when aligning different roll grooves with the mill pass line, these arrangements involved the use of expensive and complicated shaft bearings and drive gearing.

It is, accordingly, an object of the present invention to provide an apparatus for mounting multi-groove work rolls in a manner which makes possible significant improvements in roll life as compared with the above-mentioned prior art roll mounting arrangements. To this end, the present invention makes use of a spacer assembly axially mounted on the roll shaft between the multi-groove work roll and a shoulder on the roll shaft. A retainer assembly holds the work roll against the spacer assembly, with one of the roll grooves aligned with the mill pass line. After this one groove is worn, the retainer assembly is disengaged temporarily and the work roll is reversed to make use of another roll groove. Thereafter, the axial length of the spacer assembly is changed, either by adding or removing one or more spacer elements, the result being that when the roll is remounted, it is shifted along the roll axis through a distance equal to the spacing between the centers two adjacent roll grooves, and this in turn enables other grooves to be aligned with the mill pass line. Thus, by selectively adding or removing spacer elements, and by selectively reversing the position of the roll relative to the roll shaft, all of the grooves of a multi-groove work roll can be utilized. This advantage is achieved without axially shifting the roll shafts, and hence complicated and expensive shaft bearings and drives are also avoided.

Other objects of the present invention include the provision of an apparatus for mounting multi-groove work rolls which is rugged, of simple and inexpensive design, easy to maintain, and capable of being rapidly assembled and disassembled, the latter feature being of primary importance in minimizing non-productive mill down-time.

These and other objects and advantages of the present invention will become more apparent as the description proceeds with the aid of the accompanying drawings, wherein:

FIG. 1 is a sectional view through a roll mounting apparatus embodying the concepts of the present invention;

FIGS. 2A to 2C are further illustrations of a portion of the apparatus shown in FIG. 1, showing the different adjustments required to align the remaining roll grooves with the mill pass line; and

FIGS. 3 and 4 are additional views similar to FIGS. 2A–2C showing two other embodiments of the invention.

With reference initially to FIG. 1, there is generally indicated at 10 an apparatus for mounting a multi-groove work roll 12 on a roll shaft 14. The shaft 14 has an end section which protrudes axially from an opening 15 in a housing 16, the latter containing the shaft bearings, drive mechanisms and other conventional components which are not shown because they form no part of the present invention. As viewed from right to left in FIG. 1, the protruding shaft end section includes a shoulder 18, a short cylindrical section 20 of slightly reduced diameter, a truncated conical section 22 which leads from section 20 to another shoulder 24, another reduced diameter cylindrical section 26 which leads from shoulder 24 to an enlarged diameter cylindrical section 28, the latter terminating in a shoulder 30 which leads to a cylindrical end 32.

A seal generally indicated at 34 surrounds the housing opening 15 and serves to retain the bearing lubricant in the housing while excluding contaminants such as cooling water, mill scale dirt, etc. The seal includes a ring 36 fixed relative to the housing 16, and a flinger 38 removably mounted on the shaft 14 for rotation therewith. The flinger 38 supports a resilient seal 40 which has inner and outer flanges sealingly engaging the flinger 38 and ring 36. The flinger 38 has an outer axially extending flange 38a which cooperates with an axially extending flange 36a on the ring 38 to provide an interlocking sealing labyrinth. Flinger 38 also has an inner flange 38b, one end of which engages the shaft shoulder 18 as at 42, and the other end of which engages a spacer element 44 as at 46. The spacer element 44 is in engagement at its opposite end as at 48 with one end of the multi-groove work roll 12.

In the arrangement shown in FIG. 1, the work roll has four axially spaced grooves 12a, 12b, 12c and 12d on its exterior surface, the latter of which is in alignment with the mill pass line P. The spacing between the centers of adjacent grooves are all equal to a distance indicated schematically at s. Also, the spacing between the centers of the outside grooves and the adjacent ends of the roll are equal to thereby permit the position of the roll to be reversed on the shaft end.

The flinger 38 has an axial length l_1 and the spacer element 44 has an axial length l_2. The flinger and spacer element form a combined spacer means or assembly having an over all axial length L, with the axial length l_2 of the spacer element being equal to the spacing *s*.

A retainer means or assembly is employed to hold the flinger 38 against shoulder 18, the spacer element 44 against the flinger, and the roll 12 against the spacer el-

ement. The retainer means or assembly includes a key **50** extending through a transverse slot **52** in the cylindrical section **26** of the roll shaft. Key **50** has two legs **50***a* and **50***b* which engage the work roll as at **54**, and an intermediate section **50***c* which extends through the slot **52**. The intermediate key section has a depression **55** adapted to receive the shaped end of a socket head screw **56**. Screw **56** is threaded into an axial threaded bore **58** leading from the transverse slot **52** to another larger diameter threaded bore **60** in the shaft end **32**.

A collect member **66** is seated axially between the work roll **12** and the truncated conical section **22** of the roll shaft. The collet has an intermediate tubular section **67** which is slotted at opposite locations as at **68** to accommodate the key **50**, and a head **70** which is engaged as at **72** by a cap member **74**. The cap member **74** is in turn held in place by the knurled head **76** of a large-diameter threaded stud **78** which is received in threaded bore **60**. The end of the stud **78** is recessed as at **80** to accommodate the socket head screw **56**.

In light of the above, it will be seen that with spacer element **44** in place and with the socket head screw **56** and the threaded stud **78** properly tightened as shown in FIG. **1**, the work roll **12** will be fixed relative to the roll shaft **14** in an operative position with its roll groove **12**d in alignment with the mill pass line. This arrangement is maintained until the roll groove **12**d becomes worn, at which point alternate grooves can be employed in the following manner:

Groove **12***a*

With reference to FIG. **2**A, it will be seen that groove **12**a can be aligned with the mill pass line P by simply reversing the roll **12**. This is accomplished by removing stud **60**, cap **74**, collect **66** and key **50**, reversing the roll **12**, and then reassembling the foregoing components.

Groove **12***b*

When the two outside grooves **12***d* and **12***a* are worn, and it becomes necessary to employ one of the inside grooves, for example groove **12***b*, the roll is removed in the manner described above, and the spacer element **44** is also removed. Thereafter, the roll is remounted and pushed against the flinger **38**, as shown in FIG. **2**B. This produces an axial shift of the work roll **12** in relation to the roll shaft **14** through a distance l_2, which as previously stated is equal to the spacing *s*. Thus, the roll groove **12***b* is now in alignment with the mill pass line.

Groove **12***c*

As shown in FIG. **2**B, groove **12***c* may be brought into alignment with the mill pass line P by reversing the position of the roll from that shown in FIG. **2**B.

In light of the above, it will now be understood by those skilled in the art that use of the present invention is not restricted to multi-groove rolls having four grooves. To illustrate, FIG. **3** is a view showing the invention employed with a multi-groove roll having three grooves **12***a*, **12***b* and **12***c*. Here, the insert member **44** would be employed while rolling with the center groove **12***b*. Thereafter, the insert member **44** would be removed, and the roll pushed into engagement with flinger **38** to roll in groove **12***a*, and then by reversing the roll, to roll in groove **12***c*.

FIG. **4** is illustrative of another possible arrangement wherein a multi-groove work roll having five grooves **72***a*–72e is employed with two spacer elements **44** *a* and **44***b*. Both spacer elements would be employed while rolling in the central groove **12***c*. One spacer element would then be removed to enable the grooves **12***b* and **12***d* to be aligned with the mill pass line. Finally, the remaining spacer element would be removed when rolling in either groove **12***a or 12e*. As an alternative to this approach, it would be possible to use a single large spacer element when rolling in center groove **12**, a smaller spacer element when rolling in grooves **12***b* and **12***d*, and finally no spacer element when rolling in grooves **12***a* and **12***e*.

It is my intention to cover all changes and modifications to the embodiments herein disclosed which do not depart from the spirit and scope of the invention as defined by the following claims.

I claim:

1. In a rolling mill, apparatus for mounting a multi-groove work roll on the end section of a roll shaft in an operative position with one of the roll grooves in alignment with the mill pass line, said apparatus comprising: locating means on the roll shaft, spacer means positioned between and engageable at opposite ends respectively with said locating means and with one end of a multi-groove work roll which is axially received on the roll shaft, and retaining means engageable with the roll shaft and with the other end of the work roll for holding the work roll against said spacer means in a fixed position on said shaft, said spacer means including at least one removable element, the presence or absence of which will change the axial length of the spacer means by a distance equal to the spacing between adjacent grooves on the work roll.

2. The apparatus as claimed in claim **1** wherein said locating means is comprised of a shoulder on the roll shaft.

3. The apparatus as claimed in claim **2** wherein said roll shaft protrudes axially from a housing containing lubricated shaft bearings, and wherein said spacer means includes one section of a labyrinth-type seal, the said one section being in engagement with said shoulder and being rotatable with the roll shaft.

4. The apparatus as claimed in claim **3** further characterized by another section of said labyrinth-type seal fixed to the roll housing and cooperating with said one section to establish a sealing relationship between the roll shaft and the roll housing.

5. The apparatus as claimed in claim **1** wherein said retaining means includes a key member extending transversally through a slot in the roll shaft, said key member being engageable with the other end of the work roll, and adjustable means in engagement with and acting through said key member to hold the work roll against said spacer means.

6. In a rolling mill, apparatus for mounting a multi-groove work roll on the end of a roll shaft, comprising: locating means on the roll shaft; spacer means axially mounted on the roll shaft, said spacer means being in engagement at opposite ends with said locating means and with one end of the multi-groove work roll which is also axially mounted on the roll shaft; retainer means engageable with the roll shaft and the work roll for holding the work roll against the spacer means, said spacer means including at least one removable element having an axial length equal to the spacing between the centers of adjacent grooves on said work roll.

* * * * *

Dedication

3,866,283.—*David E. Gould*, Oxford, Mass. MULTI-GROOVE ROLL MOUNTING. Patent dated Feb. 18, 1975. Dedication filed Nov. 20, 1975, by the assignee, *Morgan Construction Company.*

Hereby dedicates the remaining term of said patent to the Public.

[*Official Gazette January 13, 1976.*]