July 22, 1969 G. P. LESSMANN ET AL 3,456,400

PORTABLE POLISHING TOOL FOR IN-PLACE POLISHING OF THRUST RUNNER BEARINGS

Filed July 26, 1967 4 Sheets-Sheet 1

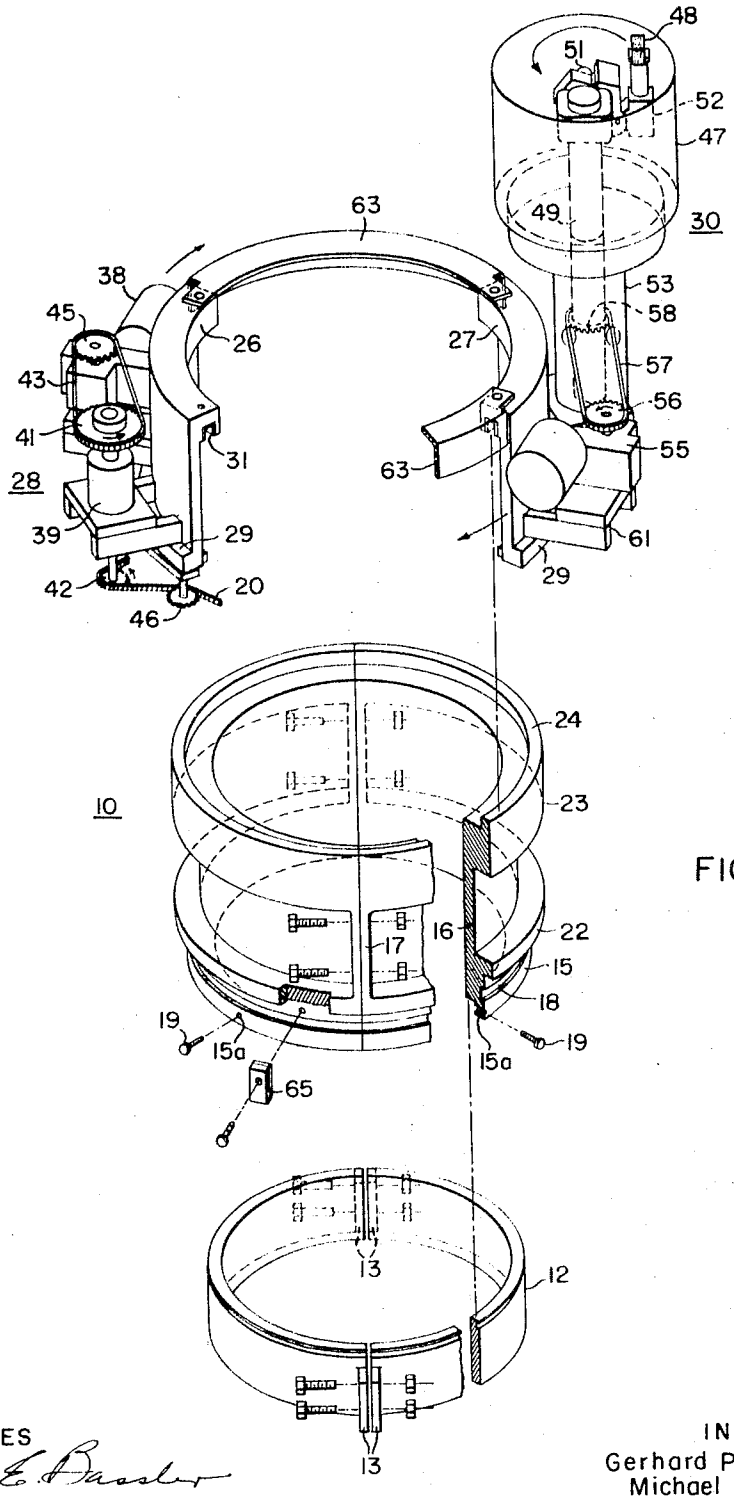


FIG. 1.

WITNESSES

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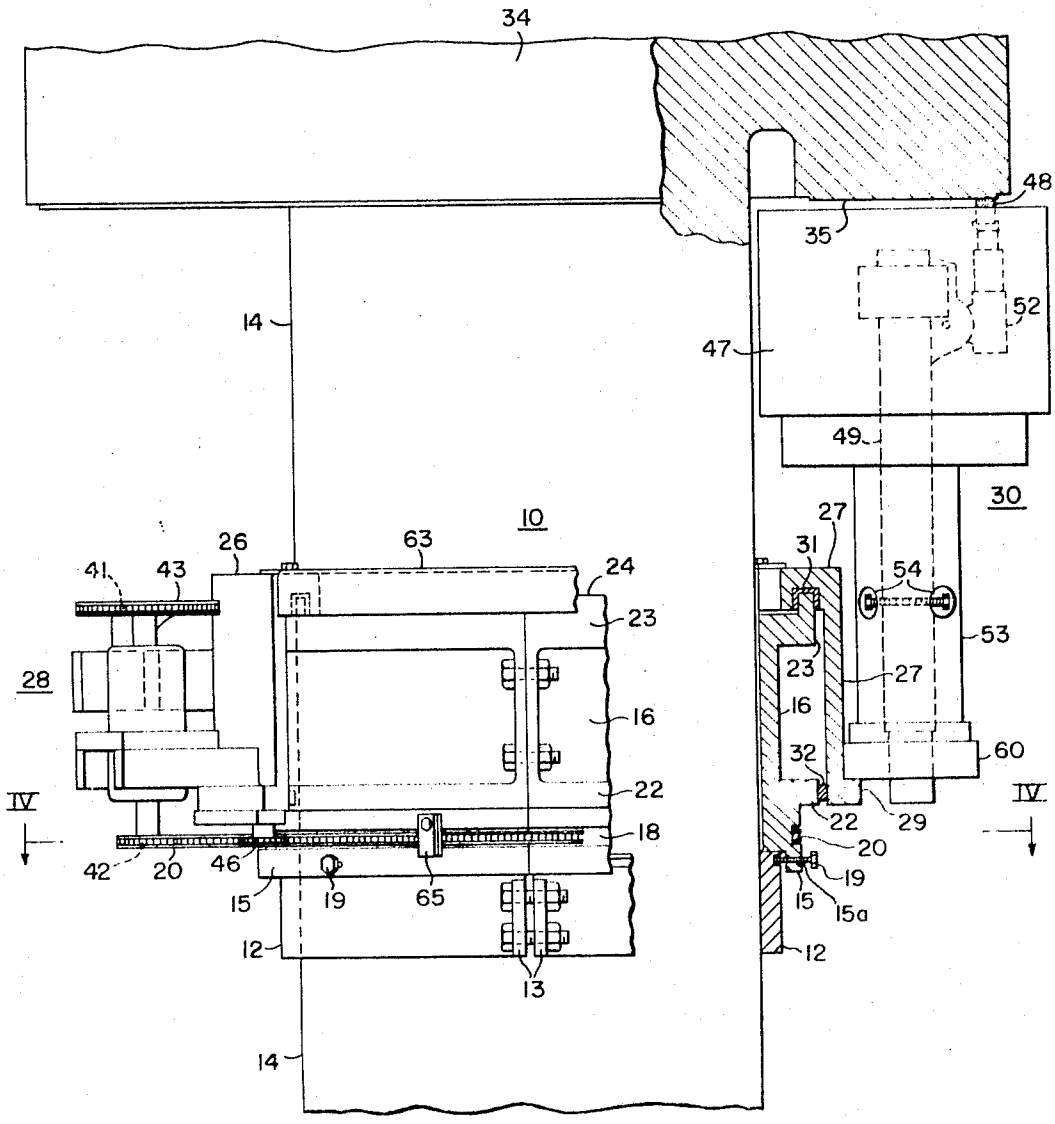

34
48
35
52
47
14
49
30
10
27
31
54
53
26
63
24
41
43
23
28
16
60
32
IV
IV
22
29
20
42
46
19
15
65
15a
12
13
14

FIG. 2.

July 22, 1969 G. P. LESSMANN ET AL 3,456,400

PORTABLE POLISHING TOOL FOR IN-PLACE POLISHING OF THRUST RUNNER BEARINGS

Filed July 26. 1967 4 Sheets-Sheet 3

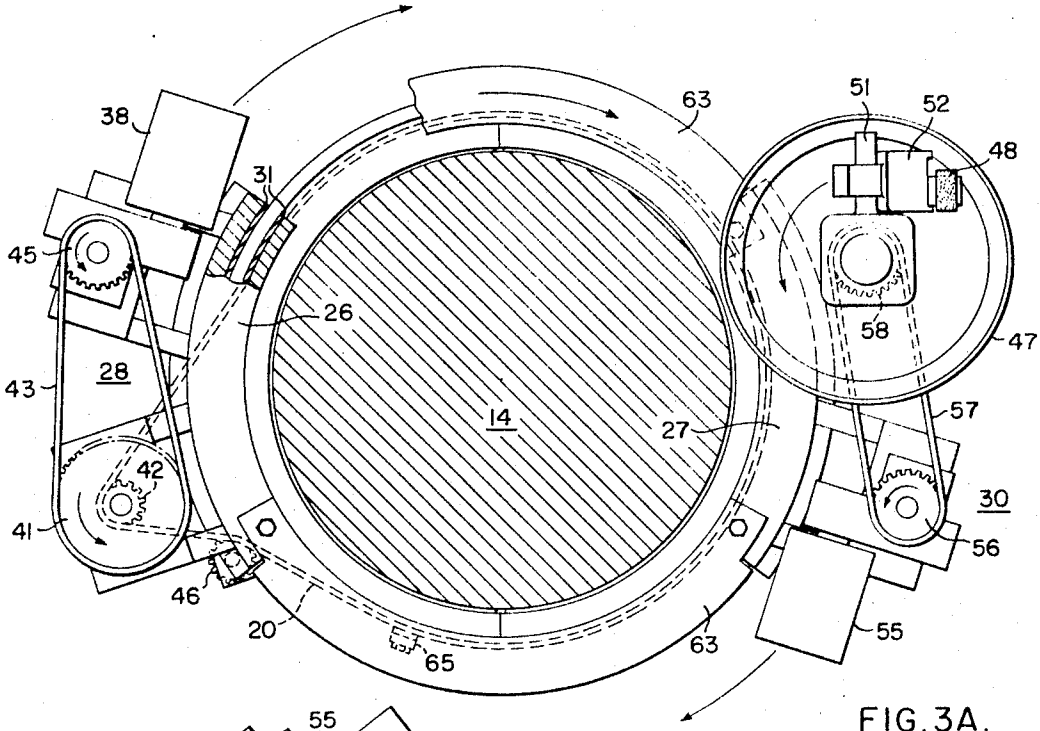


FIG. 3A.

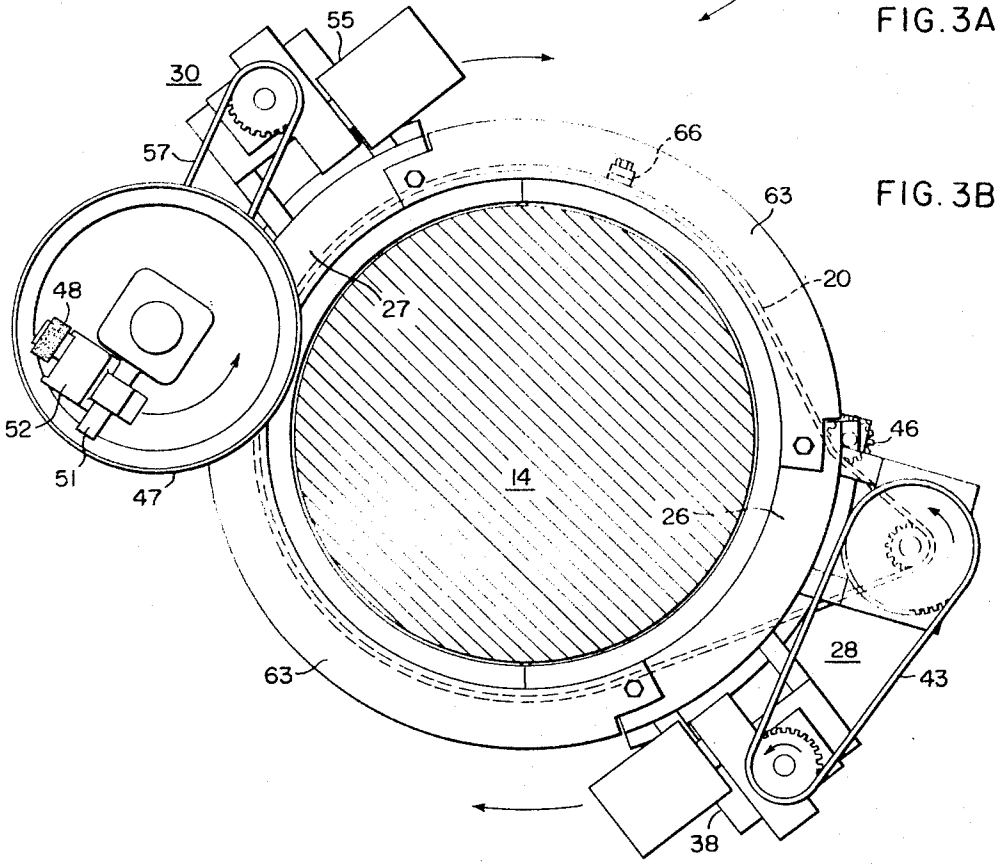


FIG. 3B.

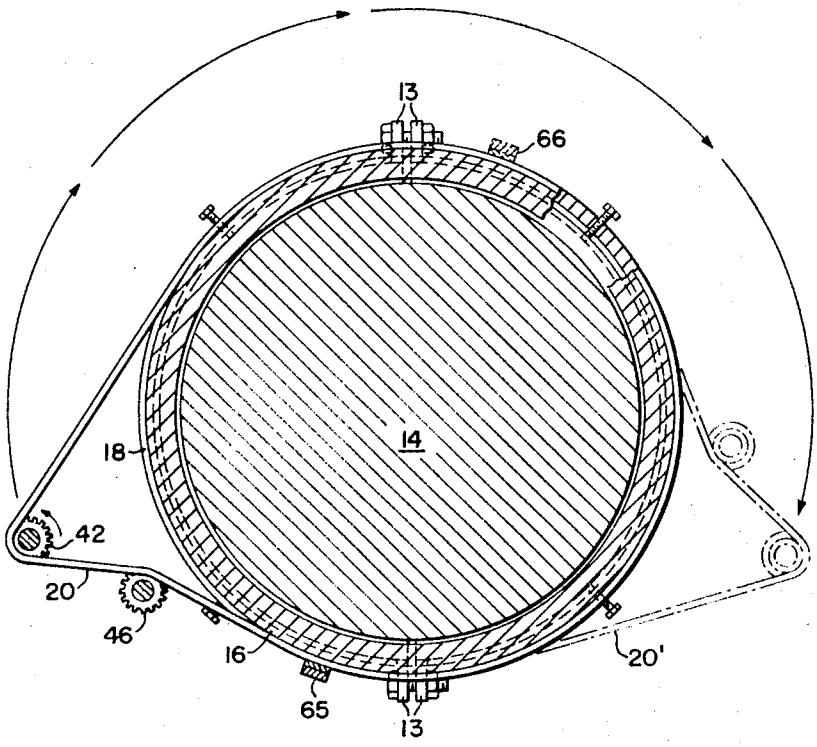


FIG. 4.

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3,456,400

PORTABLE POLISHING TOOL FOR IN-PLACE POLISHING OF THRUST RUNNER BEARINGS

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Int. Cl. B24b 19/06
U.S. Cl. 51—241 5 Claims

ABSTRACT OF THE DISCLOSURE

A polishing tool for polishing a runner bearing surface of a thrust bearing in-place so that removal of the runner bearing for polishing is not necessary.

The tool comprises a split collar, a split sleeve having annular ridge or shoulder portions, a polishing or grinding unit and a main driving unit. The split collar is tightly secured to the thrust bearing shaft, and the split sleeve is disposed around the shaft above the collar to seat on the collar. The main driving and polishing units are provided with bracket means having bearing surfaces which are hung on the annular ridge portions of the sleeve for travel therearound. Two curved spacers, linking the two units together, maintain the units in diametrically disposed relationship with each other about the sleeve and shaft. The main driving unit, when energized, drives the polishing unit around the thrust bearing shaft. The polishing unit is provided with a honing stone which is disposed aganst the runner bearing surface when the tool is fixed in place on the shaft. The polishing unit includes further a driving means for propelling the stone in a circular motion.

Background of the invention

The present invention relates to a portable, versatile, relatively lightweight polishing tool for polishing a thrust runner bearing surface in place. The invention is particularly useful with large Kingsbury type thrust bearings used on waterwheel generators.

Waterwheel generators are usually vertical machines with large thrust bearings capable of supporting very heavy loads. Waterwheel generator-motor arrangements are also being increasingly employed by the power companies as means for providing supplemental power during periods of peak load. Such arrangements utilize large vertically disposed support shafts and large Kingsbury type thrust bearings, each thrust bearing comprising a number of separate non-rotating bearing shoes disposed about a center shaft supporting a rotating thrust block or runner. In most waterwheel machines, the thrust runner supports a separate face plate which contacts the bearing shoes with a highly polished surface.

Heretofore, if the polished surface of the face plate needed repolishing, the face plate was removed from the machine, returned to the factory or repair shop for refinishing, sent back to its original location and reassembled. This process is costly and time consuming.

In order to have the machine ready for operation, some power companies purchase and keep a spare bearing face plate on the site of the waterwheel machine for immediate installation and use when the face plate needing refinishing is removed and sent away. This involves, of course, the additional cost of an extra face plate though limiting the down time of the machine.

Brief summary of the invention

In order to avoid the costly and time consuming refinishing problems outline above, the present disclosure describes a portable, practical polishing unit for polishing a runner surface in place on the site of the machine and

thrust bearing, thereby further eliminating the need and use of the detachable face plate and the spare face plate.

The unit comprises a split collar for clamping securely about the thrust bearing shaft below the runner when the bearing shoes are removed from the area immediately under the runner bearing surface. Above the split collar and around the shaft is next disposed a stationary split sleeve which rests on the split collar. The split sleeve is provided with shoulder portions which extend circumferentially around the thrust bearing shaft. A polishing unit including a motor drive means is attached to the sleeve by way of a supporting bracket adapted to fit over and hang upon the shoulder portions. The bracket is provided with bearing surfaces where it engages the shoulder portions for travel thereon.

Diametrically opposite the polishing unit is disposed a main driving unit supported on the shaft by a supporting bracket attached to shoulder portions of the split sleeve in a manner similar to that of the polishing unit. The driving unit includes a fixed chain clamped to the shaft or a shaft sleeve bushing so that a motor, forming part of the driving unit, is operative to propel the supporting brackets with their associated units about the thrust bearing shaft and the split sleeve within the fixed chain.

The polishing unit includes a polishing stone which is pressed upwardly against the bearing surface of the runner. The drive means of the polishing unit is operative to rotate the unit and stone about an off center axis under the runner, and the main driving unit functions to rotate the polishing unit about the shaft axis so that the stone is able to polish the runner bearing surface by moving along the surface with a circular motion.

The drawings

The advantages and objects of the invention will best be understood by reading the following detailed description in connection with the accompanying drawings, in which:

FIGURE 1 is an exploded isometric view of a polishing tool constructed in accordance with the principles of the invention;

FIG. 2 is a side elevation view of the polishing tool of FIG. 1 shown in place on a thrust bearing shaft;

FIGS. 3A and 3B are plan views of the polishing tool of FIGS. 1 and 2 showing the polishing tool rotated to two different positions about the thrust bearing shaft; and

FIG. 4 is a cross-sectional view of the polishing tool taken along lines IV—IV in FIG. 2 showing two positions of a chain drive means engaging the thrust bearing shaft in accordance wtih the invention.

Preferred embodiment

Specifically, there is shown in FIGS. 1 and 2 a novel polishing tool, generally designated **10**. The tool includes a split collar **12** having lateral flanges **13** which together with suitable bolt and nut means are used to tightly clamp the collar on a thrust bearing shaft **14** as shown in FIG. 2.

Above the split collar **12** is located a split, stationary sleeve structure, generally designated **16**, for disposition around the thrust bearing shaft **14**. The sleeve is made with a diameter slightly larger than that of the shaft so that it rests loosely on the split collar **12**. The sleeve **16** is provided with flanges **17** and bolt and nut means for securing it about the shaft **14**.

The lower portion of the sleeve **16** is provided with an annular ring **15** in which tapped holes **15*a*** are provided for receiving threaded bolts **19** as shown in FIGS. 1 and 2. The bolts **19** are adapted to extend radially through the sleeve to engage an annular indented portion **19*a*** provided in the split collar **12** as shown in FIG. 2. In this manner, the split sleeve is held to the split collar,

the bolts 19 further providing a means for centering the sleeve on the thrust bearing shaft 14. The split sleeve 16 is further provided with a peripheral groove 18 for receiving and seating a main drive chain 20 (FIG. 2). Above the groove and drive chain, the sleeve is provided with two vertically spaced, annular ridge or shoulder portions 22 and 23 with the upper shoulder portion 23 formed to have an upwardly extending annular ring portion 24.

Above the split sleeve 16 are disposed two brackets 26 and 27 adapted respectively to support a main motor unit or assembly 28 and a polishing unit 30. The lower portion of each bracket has an annular lip or flange 29 for supporting the units. The upper portion of each bracket has an inverted U-shape configuration, in cross-section, dimensioned to fit over the upwardly projecting annular ring 24 of the sleeve 16 as shown in FIG. 2. The two brackets are further provided with upper and lower bearing surfaces 31 and 32 respectively which engage the shoulder portions 23 and 22 respectively of the sleeve 16 when the brackets are hung over the annular ring 24, as best seen in FIG. 2. The upper bearing surface 31 takes the inverted U-shape configuration of the upper bracket portion.

By hanging the brackets 26 and 27 on the sleeve 16, in the manner described above, the complete polishing tool 10 is supported beneath a large thrust runner 34 suitably attached to the shaft 14 or integrally formed therewith, and having a bearing surface 35.

The main driving assembly 28 comprises a ratio motor arrangement 38 appropriately geared to drive the drive assembly and the polishing unit 30 about the thrust bearing shaft 14 inside the main drive chain 20 which is fixed to the shaft. The chain is connected to the motor unit through a suitably supported housing, shaft and bearing structure generally designated 39 supporting sprockets 41 and 42 at the ends thereof. A second chain 43 mechanically connects the sprocket 41 to a sprocket 45 driven directly by the ratio motor unit 38. The drive assembly 28, including the motor unit 38 and the sprocket sizes are chosen to slowly propel the polishing unit 10 when the motor is energized.

An idler sprocket 46 is provided on drive assembly 28 for maintaining tension on the chain 20 about the lower sprocket 42. The drive assembly, as shown and described, is given by way of example only; other suitable drive means may be employed without departing from the scope of the invention.

The drive assembly 28 rests upon the flange 29 of the support bracket 26, and is suitably attached thereto so that the unit 28 can be supported upon the annular ring 24 of the sleeve 16 for movement therealong.

The polishing unit 30 is shown as comprising a polishing head portion 47 which includes a rectangularly shaped honing stone 48 suitably supported in an off-center manner on a center rotating shaft 49. The honing stone is supported by a holding structure 52 suitably secured to a laterally extending bar 51, which in turn is attached to the shaft 49 as shown in FIGS. 1 and 3. The holder 52 is preferably adjustable so that the stone 48 may be accurately positioned against the bearing surface 35 of the thrust runner 34 as shown in FIG. 2.

The rotating shaft 49 is supported and bearing mounted in a housing structure generally designated 53.

The polishing head 47 may be the type made by the Taft-Pierce Manufacturing Company of Woonsocket, R.I., and described in their Bulletin No. MT-004. Such an apparatus includes the center shaft 49 which is provided with plumbing connections and hollow portions for conducting oil and air, oil to the bearing surface 35 for the grinding operation, and air to a pneumatically actuating means (not shown) for vibrating the honing stone 48.

The polishing head 47 is driven by a ratio motor arrangement 55 suitable geared to drive the polishing head 47 in circular motion at a proper speed for polishing or grinding the bearing surface 35. The driving arrangement includes a sprocket 56 mechanically connected to the rotating shaft 49 by a drive chain 57 and a sprocket 58 disposed on the rotating shaft 49. The housing structure 53 is provided with two holes 54 (FIG. 2) for accommodating the chain 57.

A base portion 60 of the housing structure 53 (FIG. 2) and a base structure 61 (FIG. 1) supporting the motor and gear unit 55 are suitable attached to the support bracket 27 and its lower flange portion 29. In this way, the polishing unit 30 can be disposed on the shaft 14 and the sleeve 16 for rotation thereabout.

The main drive assembly 28 and the polishing unit 30 are diametrically spaced from each other across the thrust bearing shaft 14 by two spacers 63 diametrically disposed about the shaft 14, and suitably curved to fit the contour of the shaft as best seen in FIGS. 3A and 3B. The ends of the spacer 63 are suitably attached adjacent the ends of the support brackets 26 and 27 as best shown in FIGS. 1 and 3.

The main drive assembly or unit 28 and the polishing unit 30 have substantially the same weight so that with the diametrical disposition of the units on the shaft 14, a balanced polishing tool 10 is provided for effective polishing action with rotation of the units about the shaft 14.

In operation, the chain 20 is first fixed to the split sleeve 16 (in the groove 18) by two flat clamps 65 and 66 attached to the sleeve at diametrically opposed locations about the sleeve and shaft. The ratio motors 38 and 55 are next energized, which may be accomplished simultaneously by a common switch (not shown) connecting the motors to a common source of energy. If a power cord is employed to supply energy directly to the motors, it is wrapped around the shaft 14, before the motors are energized, in such a manner that the cord unwinds as the units 28 and 30 travel around the shaft 14. In a similar manner, oil and air supplying hoses for the polishing head 47 may be wound around the shaft 14 before the units are energized for the polishing operation.

With energization of the ratio motor 38 and the application of its torque to the sprockets 41 and 42, the main driving unit 28 and the polishing unit 30 (linked together by the curved spacers 63) are propelled about the shaft 14 by operation of the lower sprocket 42 engaging the inside surface of the fixed chain 20 and rotating therealong. As the units move about the thrust bearing shaft, balance is maintained between the units by virtue of the curved spacers 63 maintaining the two units 28 and 30 in the diametrically disposed relation described above and shown in FIG. 3.

As seen from drawings, the main drive chain 20 fits closely about the periphery of the shaft 14 and the split sleeve 16 except for the portion of the chain which extends or loops about the lower sprocket 42 of the main drive assembly 28. As the main drive assembly moves about the shaft 14 (in a clockwise manner as shown in the drawings), the loop in the chain 20 moves with the assembly as the lower sprocket 42 travels along the inside portion of the chain. When the loop approaches a clamp, say clamp 66, the clamp is removed by a workman until the loop passes the location of the clamp at which time the clamp is returned to its chain clamping position on the sleeve 16. While the one clamp 66 is off or removed, the other clamp 65 remains secured to the sleeve to hold the chain 20 tightly against the sleeve. The movement of the chain loop is best seen in FIG. 4 where the loop is shown on the right in phantom and designated 20'.

As the loop approaches the clamp 65, the clamp is removed until the loop passes (as in case with the clamp 66 explained above). The clamp 65 is then replaced to provide clamping action with that of the clamp 66.

As the units 28 and 30 move about the shaft 14, the honing stone 48 is driven in a circular motion against the bearing surface 35 of the runner 34. When the bearing sur-

face is sufficiently polished by the polishing action of the stone, the motors of the units are turned off and the tool **10** is removed from the shaft **14**. The thrust bearing pads (not shown) are then moved into position about the shaft and under the thrust runner **34**. The apparatus in which the thrust bearing is employed is now ready for operation.

As should be apparent from the foregoing description, no separate and spare runner bearing plates are necessary with the availability of the polishing tool **10**. The time and cost consumed in shipping a bearing plate to the factory or repair shop for grinding or polishing is thus eliminated. Further, the elimination of the separate bearing plate reduces the original cost of the thrust bearing.

These and other advantages are accomplished with the in-place polishing tool **10** described above, the polishing tool itself comprising a minimum of basic components, namely the main driving unit **28**, the polishing unit **30**, the main drive chain **20** and the split collar and sleeve (**12** and **16**) for supporting the units and chain on a thrust bearing shaft.

Though the invention has been described with a certain degree of particularity, it should be noted that changes may be made therein without departing from the spirit and scope of the invention.

We claim as our invention:

1. A polishing tool for polishing a runner bearing surface of a thrust bearing without removal of the runner bearing, the polishing tool comprising,

split collar means for tightly clamping about a thrust bearing shaft,

sleeve means for disposal about the shaft and on the split collar means, the sleeve means having at least one annular ridge or shoulder portion extending about the thrust bearing shaft,

polishing head means for polishing the runner bearing surface including a unit for driving the head in a circular motion under the bearing surface,

first bracket means for supporting the polishing means and driving unit on the shoulder portion of the sleeve means, the bracket means provided with at least one bearing surface for engaging the shoulder portion,

a main driving unit for propelling the tool about the thrust bearing shaft,

second bracket means for supporting the main driving unit on the shoulder portion of the sleeve means,

means mechanically coupling the main driving unit to the thrust bearing shaft, and

means for mechanically connecting the first and second brackets together in substantially diametrically spaced apart locations about the shaft.

2. The polishing tool of claim **1** in which the weight of the polishing means and its driving unit is substantially equal to the weight of the main driving unit so as to form a substantially balanced unit about the thrust bearing shaft.

3. The polishing tool of claim **1** in which the sleeve means is provided with means for securing and centering the sleeve about the thrust bearing shaft.

4. The polishing tool of claim **1** in which the means connecting the main driving unit to the thrust bearing shaft is a chain structure disposed about the shaft, and clamping means for tightly securing the chain to the thrust bearing shaft.

5. The polishing tool of claim **1** in which the polishing head includes a honing stone adapted to be disposed in physical contact with the runner bearing surface.

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U.S. Cl. X.R.

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