

Dec. 9, 1969

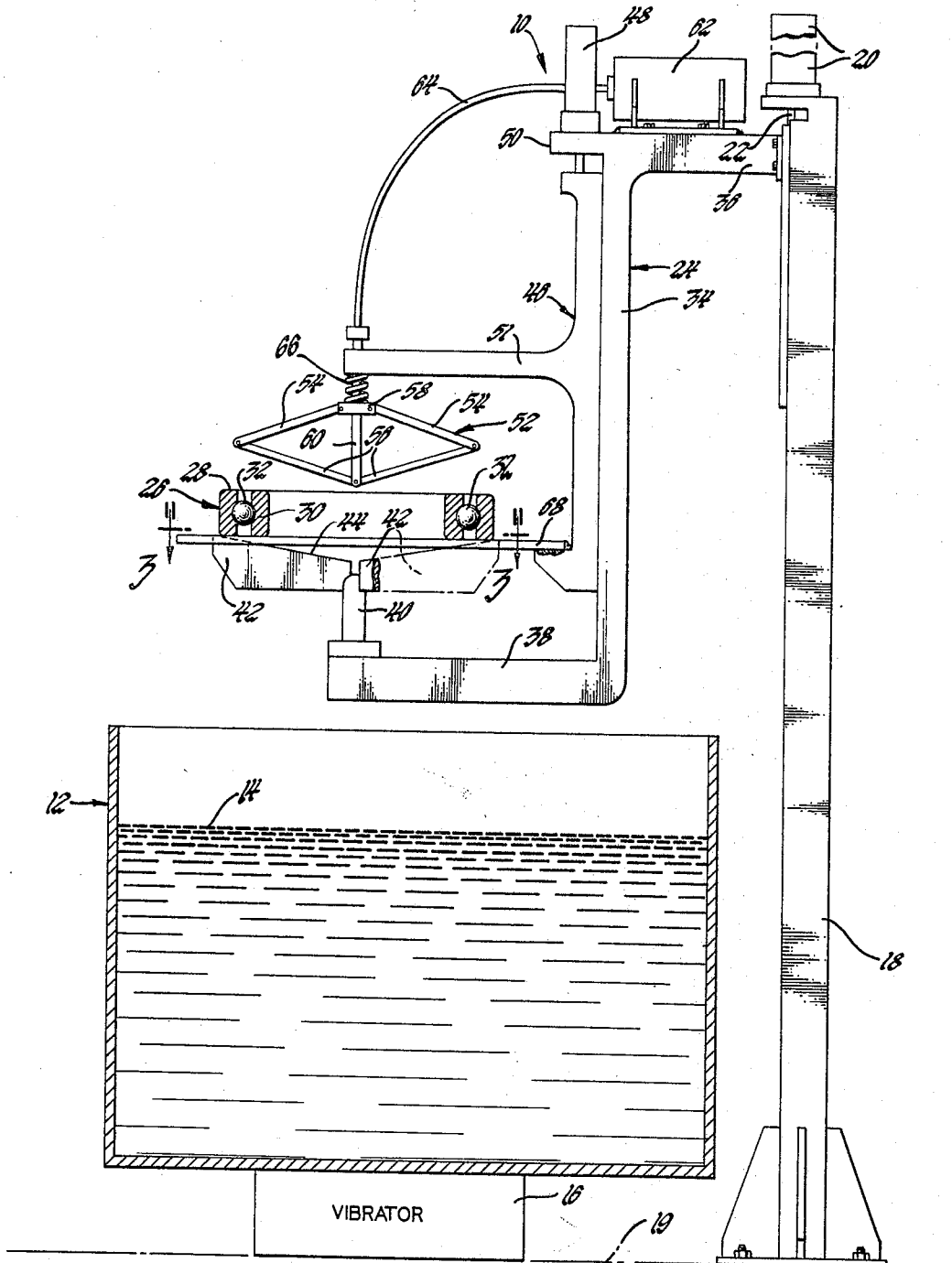
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3,482,584

APPARATUS FOR CLEANING BALL BEARINGS

Filed Aug. 23, 1967

2 Sheets-Sheet 1



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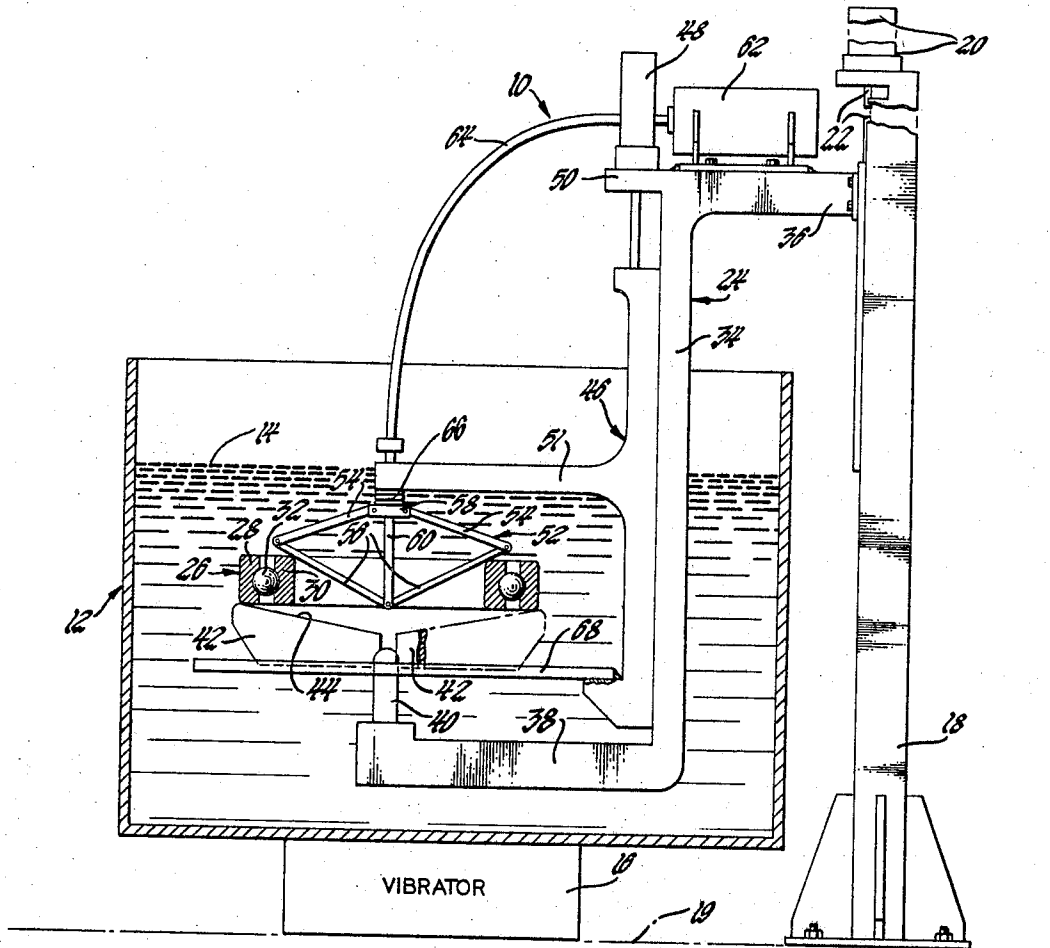


Fig. 2

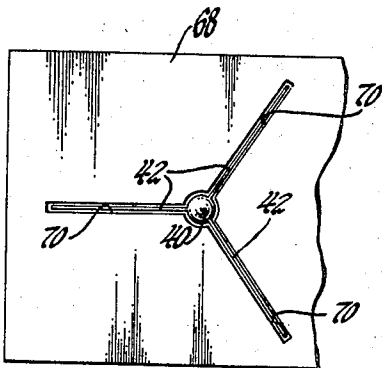


Fig. 3

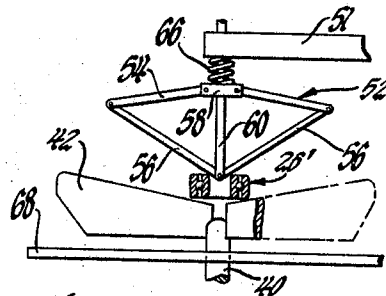


Fig. 4

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APPARATUS FOR CLEANING BALL BEARINGS
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Filed Aug. 23, 1967, Ser. No. 662,809

Int. Cl. B08b 3/04, 3/10

U.S. Cl. 134—116

5 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for cleaning a ball bearing assembly that provides for placing the assembly in a bath of cleaning liquid subjected to ultrasonic vibrations and moving the bearing assembly as a unit to different positions in the bath while rotating one of the races.

This invention relates to cleaning ball bearing assemblies and more particularly to an apparatus that provides for supporting the assemblies in a cleaning liquid during an ultrasonic cleaning operation.

One form of ultrasonic equipment presently available for cleaning ball bearings requires the bearing assemblies to be placed stationary in a basket and lowered into a bath of cleaning liquid subjected to vibratory energy. One difficulty with this method of cleaning is that it does not provide adequate exposure of all portions of the bearing to be cleaned. Another drawback is that the vibrations generated in the bath tend to be dampened due to the bulk in the basket. As a result, many of the bearings must undergo secondary cleaning operations prior to meeting critical performance specifications.

Accordingly, the objects of the present invention are to provide an apparatus for supporting ball bearing assemblies in a bath of cleaning liquid subjected to ultrasonic vibrations; to provide an apparatus for cleaning ball bearing assemblies that assure maximum exposure of all parts of the bearing assembly; to provide an apparatus that supports and handles ball bearings during an ultrasonic cleaning operation and serves to rotate one of the races relative to the other so as to give complete exposure of the assembly to the agitated cleaning liquid; to provide a device for supporting bearings of different sizes in an ultrasonic cleaning bath, and to provide a carrier for a ball bearing assembly that will reciprocate the latter as a unit in a bath of ultrasonically vibrated cleaning liquid while rotating one race relative to the other.

Other objects and advantages of the present invention will be more apparent from the following detailed description of the invention when taken with the drawings in which:

FIGURE 1 is an elevation view showing a ball bearing support device made in accordance with the invention and located adjacent a bath of cleaning liquid;

FIGURE 2 shows the ball bearing support device of FIGURE 1 located in the bath of cleaning liquid;

FIGURE 3 is a view taken on line 3—3 of FIGURE 1, and

FIGURE 4 is a fragmentary view of the support device handling a ball bearing of a smaller size than that incorporated with the device of FIGURE 1.

Referring to the drawings and more particularly FIGURE 1 thereof, a ball bearing support device 10 made in accordance with the invention is shown positioned adjacent to a tub 12 within which a cleaning liquid 14 is located. A vibrator 16 is located beneath the tub 12 and is adapted to generate ultrasonic vibrations within the cleaning liquid 14 in a manner well known to those skilled in the art.

The support device 10 includes a stanchion 18, the lower end of which is fixedly attached to the floor 19 adjacent the tub 12. The upper end of the stanchion 18 is provided with an air cylinder 20, the piston rod 22 of which is connected to a primary carriage 24 which serves to support a ball bearing assembly 26 having the usual outer race 28 and inner race 30 with a plurality of rotatable balls 32 therebetween.

More specifically, the carriage 24 comprises a frame 34 depending from an arm 36 that is mounted on the stanchion 18 for vertical movement therealong under the control of the cylinder 20. The lower end of the frame 34 is joined to a laterally extending foot 38 which is connected with a vertically oriented rod 40 supporting three identical blades 42 which radially extend from the upper end of the rod. The blades 42 are circumferentially equally spaced from each other by angles of approximately 120° and each is shaped so as to have an inclined upper surface 44 which extends downwardly toward the rod 40 with all surfaces 44 of the blades lying in a common cone, the apex of which is coincidental with the longitudinal axis of the rod. Although not shown, the blades 42 are made of relatively thin sheet metal for reasons which will be more apparent as the description of the invention proceeds.

A secondary carriage 46 is mounted within the primary carriage 24 and is supported for movement by frame 34 between the positions shown in FIGURE 1 and that of FIGURE 2 by an air cylinder 48 mounted on an extension 50 of the arm 36. The secondary carriage 46 has an arm 51 which serves to support an inner race driver 52 consisting of two pairs of links 54 and 56 pivotally connected to each other at their outer ends, while the inner end of each link 54 is pivotally connected to a collar 58 slidably supported on a drive shaft 60 which in turn is adapted to be rotated by an electric motor 62 through a flexible drive shaft 64. The inner ends of the links 56 are pivotally attached to the lower end of the drive shaft 60 at a common point, and a coil spring 66 biases the collar 58 downwardly so the links of the driver 52 assume the position of FIGURE 1 in the normal position. It will be noted that the driver 52 can be utilized with bearings of various sizes while providing a firm wedge type engagement with the inner race due to the link arrangement described above. A thin plate 68 is attached to the lower end of the secondary carriage 46 and has slots 70 formed therein which correspond in relative position and register with the blades 42. The plate 68 functions as an initial support for the bearing to be cleaned after which it is removed in a manner to be described below.

The operation of the above-described bearing support device 10 is as follows:

With the various portions of the support device 10 being positioned as shown in FIGURE 1, the ball bearing assembly 26 is initially placed on the plate 68 and centrally located relative to the slots 70. Thereafter, the air cylinder 48 is expanded causing the secondary carriage 46 and, accordingly, the plate 68 to move downwardly so that the plate 68 assumes the position shown in FIGURE 2 at which time the outer race 28 is supported by the blades 42. At the same time, the links 56 of the driver 52 make frictional contact with the inner race 30 of the ball bearing assembly 26. This is followed by expansion of the air cylinder 20 causing the primary carriage 24 to be lowered into the bath 12 of cleaning liquid. At this time, all the parts of the bearing support device 10 assume the position shown in FIGURE 2. It will be understood that by the time the carriage 24 enters the cleaning liquid 14, the vibrator 16 has been activated causing ultrasonic vibrations to be generated in the cleaning liquid. For best cleaning results it has been found the

vibrator should be operated in a range between 20,000 and 100,000 cycles per second with optimum operating frequency being approximately 40,000 cycles per second.

Once the bearing is washed, the primary carriage 24 is raised by contracting the air cylinder 20 and similarly the secondary carriage 46 is moved upwardly relative to the primary carriage 24. Thereafter, the ball bearing assembly 26 is removed from the plate 68 and can be replaced by a new bearing to be cleaned.

Inasmuch as the support blades 42 are tapered as afore-described, only the outer race 28 of the ball bearing assembly 26 remains stationary while resting on the legs. Accordingly, the frictional engagement of the rotating driver 52 with the inner race 30 causes the latter to be rotated while the assembly 26 is in the bath. During such rotation, the primary carriage 24 is continuously reciprocated thereby exposing the bearing assembly 26 to various locations in the cleaning liquid 14 while the inner race 30 is being rotated. The purpose for reciprocating the bearing assembly 26 is to expose the latter to most effective and intense vibrations occurring within the cleaning liquid 14. As is well known, any medium exposed to vibratory energy tends to have antinode and nodal points with the latter constituting points of least vibration. Thus, in order to obtain the most effective cleaning, the bearings should be located in the cleaning liquid at the antinode point or points of maximum vibration to ensure that dirt and all other foreign matter will be dislodged from the bearing surfaces. It should be apparent that the reciprocal movement of the primary carriage 24 will assure this form of effective cleaning and, when augmented by the rotating inner race 30 during the washing cycle, the possibility of foot prints occurring between stationary parts of the bearing is precluded.

As mentioned above, the blades 42 are made from relatively thin sheet metal and similarly it should be noted that both the primary and secondary carriages are formed from metal stock having a minimal cross section while having the required strength for supporting the bearing as described. By so doing, the usual bulk encountered in cleaning equipment of this type is eliminated so that when submerged within the cleaning liquid 14, any damping effect on the vibrated liquid is negligible.

FIGURE 4 shows the blades 42 supporting a ball bearing assembly 26' of much smaller diameter than that incorporated with the device shown in FIGURES 1 and 2. From this view, it should be apparent that by tapering the upper surfaces of the blades 42 inwardly toward the rod 40 it is possible to support various sizes of bearings with the same equipment. Similarly, the tapered form of

the driver 52 allows the central portion thereof to be inserted within the opening of the ball bearing assembly and contact the inner race for rotating same during the cleaning operation. As should be apparent, the air cylinder 48 provides sufficient downward force so when the driver 52 contacts the ball bearing, the outer race is frictionally restrained from movement relative to the blades 42.

I claim:

1. An apparatus for supporting a ball bearing assembly in a bath of cleaning liquid during an ultrasonic cleaning operation, said ball bearing assembly having an inner race and an outer race, said apparatus comprising a plurality of relatively thin upstanding blades which co-operatively establish a seat for said outer race, means engaging the inner race and rotating the latter relative to the supported outer race, and a primary carriage supporting said blades for reciprocation whereby said bearing assembly is moved as a unit in said bath while the inner race is being rotated.

2. The apparatus of claim 1 wherein said blades extend radially from a support rod and the edge of each blade supporting the bearing assembly is tapered toward the center of the rod.

3. The apparatus of claim 1 wherein a secondary carriage supports the means for rotating the inner race, and said secondary carriage is carried by the primary carriage for movement between a first position wherein said means engages the inner race and a second position wherein said means is out of engagement with the inner race and spaced therefrom a distance sufficient to permit removal of the bearing assembly from said blades.

4. The apparatus of claim 1 wherein said means for rotating the inner race has the bearing engaging surface thereof located in an imaginary cone.

5. The apparatus of claim 4 wherein said means comprises a plurality of links pivotally connected to a drive shaft.

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U.S. Cl. X.R.

134—141, 147, 149