Oct. 29, 1963 L. W. JOHNSON 3,108,839

HYDRAULIC DEVICE FOR REMOVING TIGHT BEARINGS

Filed Jan. 30, 1961 2 Sheets-Sheet 1

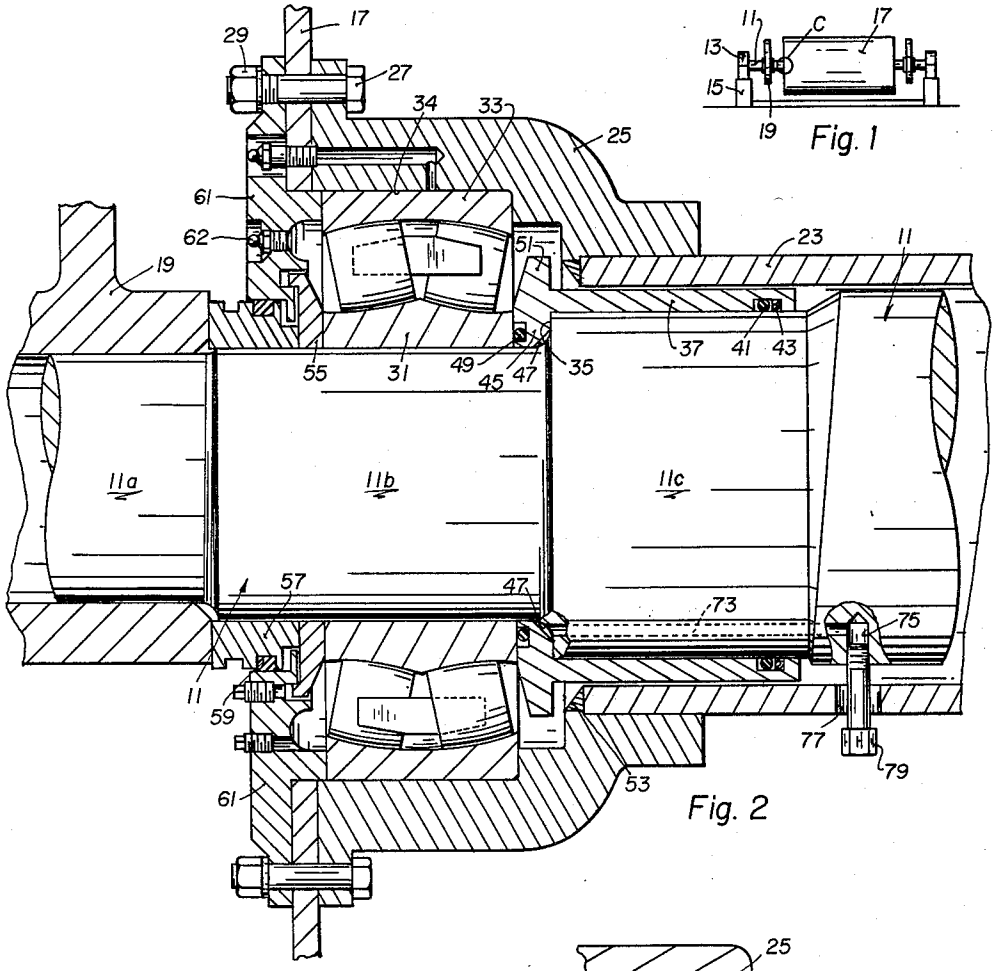


Fig. 2

Fig. 1

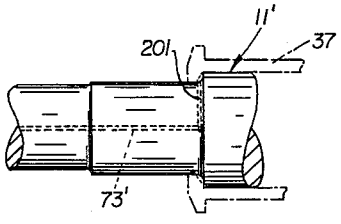


Fig. 3

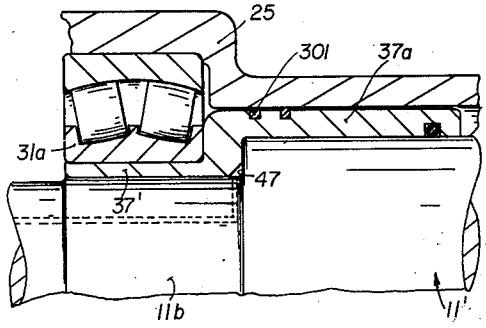


Fig. 4

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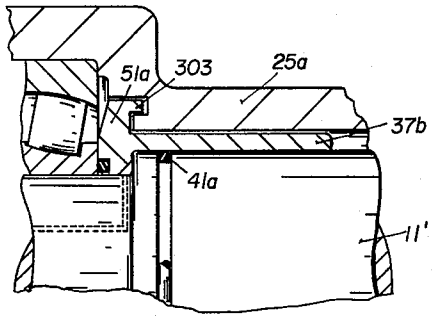


Fig. 5

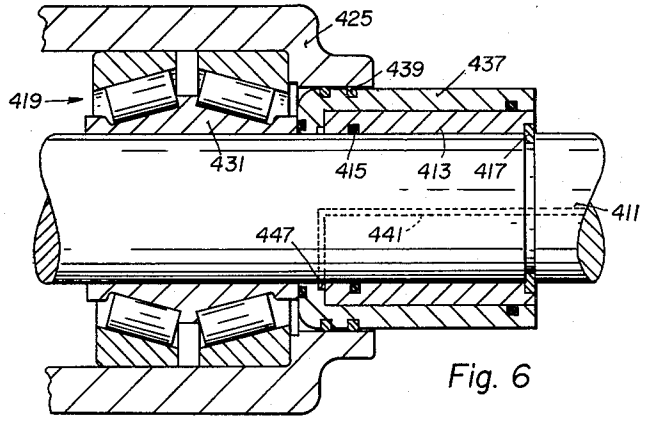


Fig. 6

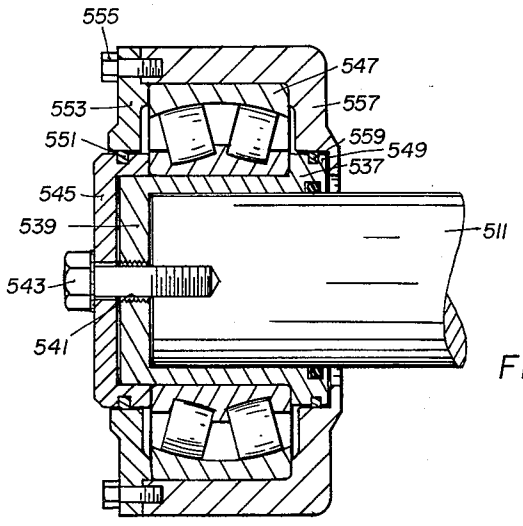


Fig. 7

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United States Patent Office 3,108,839 Patented Oct. 29, 1963

3,108,839
HYDRAULIC DEVICE FOR REMOVING TIGHT BEARINGS

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8 Claims. (Cl. 308—187)

This invention relates to a built-in arrangement for assisting in the removal of a bearing from a shaft.

In the past, when a bearing has resisted removal from a shaft, not infrequently it has been necessary to cut the bearing up in order to remove it. This is time consuming and sometimes results in damage to the shaft and the housing for the shaft.

It is a main object of the present invention to provide a built-in hydraulically operable arrangement associated with a shaft and its bearing to facilitate removal or assist in the removal of the bearing.

Another object is to provide such an arrangement in which the hydraulic medium employed is applied to the inner race of the bearing to lubricate it and expand it for ready axial movement relative to its shaft.

Various other objects of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a small diagrammatic end view of one type of apparatus in which the present invention is embodied;

FIG. 2 is a vertical mid-section through part of the shaft mounting structure, showing the present invention;

FIG. 3 is a view of a modified form of the invention; and

FIGS. 4 through 7 are views generally similar to FIG. 1 but showing modified forms of the invention.

My prior Patent 2,860,783 shows a vibrating apparatus, one form of which includes a cross shaft mounted by means of pillow blocks on a stationary frame and carrying eccentric weights. The shaft is driven to cause vibration of a screening box through which the shaft extends and to which the shaft is rotatably connected. For convenience in presentation, the present invention has been shown embodied in a cross shaft of an apparatus of the above general type.

Referring to FIG. 1, a cross shaft 11 is mounted at its ends in pillow blocks 13 supported by a frame 15. The shaft extends through a screening box 17 and carries eccentric weights 19 adjacent the box.

FIG. 2 shows on a much enlarged scale and in vertical section, approximately the portion surrounded by the circle C in FIG. 1. The structure of FIG. 2 is duplicated at the opposite side of the apparatus so that only the structure in FIG. 2 need be described.

FIG. 2 shows that the shaft 11 extends through a tubular housing 23 which includes an enlarged end piece 25. This end piece is secured by bolts 27 and nuts 29 to a side of the box 17, the side being also assigned the number 17 for convenience.

The shaft 11 has a portion 11*a* carrying an eccentric weight 19. Inwardly of portion 11*a*, the shaft has a larger diameter portion 11*b*, having the inner race 31 of an anti-friction bearing slidably fitting thereon. The outer race 33 of the bearing slidably fits in a recess 34 provided by the end piece 25.

The shaft 11 has a third portion 11*c* of larger diameter than portion 11*b*, and separated from portion 11*b* by a shoulder or step 35. Surrounding the shaft 11 in bridging relation to the shoulder 35 is an annular piston 37 which slidably fits on the shaft portions 11*c* and 11*b*. The piston is spaced from the interior surface of the housing 23.

The piston 37 extends a substantial distance to the right of the shoulder 35. In fact this distance is greater than the depth of the recess 34 for a purpose to appear presently.

The piston has an internal annular groove at its right-hand end receiving an O-ring 41 and a leather back-up washer 43.

The left-hand end of the annular piston has an inwardly extending flange 45 slidably fitting on the shaft portion 11*b*. The flange 45 abuts against the shoulder 35 and against the inner race 31 of the bearing. The flange 45 is relieved on its inner right edge to provide an annular recess 47 for a purpose to be described. The left end face of the flange 45 is formed with an annular groove receiving an O-ring 49 which sealingly engages the right end face of the inner race 31.

The piston 37 also has an outer flange 51 having an inclined left-hand face so as to constitute an oil flinger to tend to prevent oil from advancing to the right past the outer flange 51. A weld 53 connects the end piece 25 and the housing 23.

An outer flinger 55 is disposed between the inner race 31 and a sealing member 57 having a seal ring 59. The latter engages the inner surface of a cover plate 61 which retains the outer race 33 in place. The cover plate carries a fitting 62, shown in FIG. 2, by which a fluid lubricant, such as oil, may be injected or conducted into the chamber occupied by the bearing 31, 33.

The shaft 11 has a passage 73 formed therein with the left-hand end thereof communicating with the recess 47 and the right-hand end communicating with a radial passage extension 75. This passage is threaded and is located to register with a hole 77, when the shaft 11 is turned to the proper position. The hole is threaded to receive a pipe plug (not shown) which may be removed to enable a nozzle member 79 to be threaded into the passage 75.

Removal

To remove the bearing, the nuts 29 are removed and the nozzle member 79 threaded into place. Then, a source of hydraulic flowable material under pressure, such as oil or grease, is connected to the nozzle 79 to force flowable material into the passage 73 and the recess 47. This flowable material which may be considered as a fluid, acts between the flange 45 and the shoulder 35 to force the piston 37 to the left. At the same time, the fluid creeps along the interior of the shaft portion 11*b* and under the inner race 31 of the bearing to lubricate the inner surface of the inner race and also the outer surface of the shaft portion 11*b*. Also, this fluid will act to expand the inner race to make it slide more readily on the shaft portion 11*b*. Thus, the piston 37 and the bearing will be moved axially to the left to also move the outer flinger 55, cover plate 61, sealing member 57, and eccentric weight 19, in the event these parts have not previously been removed.

By the time the O-ring 41 closely approaches the shoulder 35, the outer race 33 of the bearing has been projected from the recess 34 and the inner race 31 has been partly moved off the shaft portion 11*b*. In fact, it is contemplated that the dimensions of the parts may be such that the inner bearing race 31 will be entirely moved off the shaft portion 11*b* before the piston reaches the end of its travel.

FIG. 3 shows a modified shaft 11' having a passage 73' extending from the left-hand end thereof to a radial passage 201 to conduct fluid under pressure to the interior of the piston 37.

In connection with seal 49, it is pointed out that the seal will be kept tightly against the inner race 31 by the piston 37, and that there is no danger of damaging the seal, as might occur if it were in engagement with and moved relative to the shaft portion 11*b*.

The FIG. 4 version differs from FIG. 2 in that in FIG. 4 the piston or ram 37*a* has an extension 37' having a

light press fit on the shaft portion 11*b*. This eliminates the necessity for a seal between the extension and the shaft. Fluid under pressure will expand the extension 37' for ready removal when fluid is supplied to the annular cavity 47. It is pointed out that the inner race 31*a* of the bearing could turn on the extension without damage to the shaft 11.

FIG. 4 also shows a modified form of outer seal instead of a flinger, and the piston 37*a* is grooved to receive annular seals 301 which may be felt or metal.

The FIG. 5 version differs from FIG. 2 in that in FIG. 5, the shaft 11' is grooved to receive an O-ring 41*a* which engages the interior of the piston or ram 37*b*. Also, the flinger 51*a* has an axial projection 303 extending into a groove formed in the housing 25*a* to provide a labyrinth seal.

In the FIG. 6 modification, the shoulder on the shaft 411 is provided by a sleeve 413. On its interior, at the left-hand end thereof, the sleeve has an O-ring seal 415. A split ring 417 fits in a groove in the shaft 411 to hold the sleeve against movement to the right relative to the shaft. Instead of the split ring, the shaft could be threaded and a lock nut threaded on the shaft to hold the sleeve in place.

A bearing 419 fits on the shaft 411 and in a tubular housing 425. The bearing has an inner race 431 engaging the left-hand end of the piston or ram 437. Ring seals 439 are provided between the piston 437 and the tubular member 425.

It is assumed that the right-hand end of the shaft is accessible so that fluid can be forced through a passage 441 into an annular cavity 447 to separate the shaft from the bearing. If the opposite end of the shaft were accessible and the shaft could not move, fluid could be forced through an appropriate passage to the cavity 447 to move the bearing 419 to the left relative to the shaft and housing.

If the right-hand ends of the piston and sleeve are accessible, an axial fluid passage could be provided in the sleeve 413, or a radial fluid passage could be provided in the piston to communicate with the space between the sleeve and piston at a place adjacent the right-hand end of the piston.

The FIG. 7 modification of the piston or ram 537 has a radially inwardly extending flange 539 providing a central threaded bore 541. A bolt 543 passes through a center cover plate 545 and through the threaded bore 541 and threads into a threaded hole formed in an end of the shaft 511. The bolt retains the center cover plate in place. The bearing 547 has its inner race fitting on the piston and against a flange 549 formed on the piston. The center cover plate 545 has a ring seal 551 bearing against an annular cover plate 553 secured by bolts 555 to a tubular housing 557. A ring seal 559 is disposed between the housing 557 and the flange 549.

Before removing the bearing 547, the annular cover plate 553 is removed. The bolt 543 is also removed and a hydraulic pressure fitting (not shown) is screwed into the threaded bore 541. Thereafter hydraulic fluid is forced into the piston to cause it to move to the left.

If the shaft 511 happens to be movable, it can be separated from the bearing assembly without removing the outer cover plate 553, by merely forcing the shaft to the right by means of the hydraulic pressure in the piston 537.

In general, the outer seals, such as the flingers and ring seals are meant to be interchangeable, so that while the FIG. 4 version has ring seals 301, it could have a flinger.

The term "shaft" in the claims is meant to include a shaft such as disclosed in FIG. 2, or a shaft such as disclosed in FIG. 6 wherein the collar 413 is meant to be a part of the shaft. In other words, the shaft can have an integral shoulder or a separable shoulder.

Having described the invention in what is considered

to be the preferred embodiment thereof, it is desired that it be understood that the invention is not to be limited other than by the provisions of the following claims.

I claim:

1. In combination;
a shaft;
a bearing having an outer race and having an inner race fitting on a first portion of said shaft;
a tubular member fitting on the outer race of said bearing, said shaft having a second portion of larger diameter than said first portion and located adjacent but spaced from said first portion;
there being a shoulder on said shaft between said shaft portions;
an annular piston surrounding said shaft and shoulder and bridging said shoulder;
a first sealing means between the inner race of said bearing and the adjacent end of said piston and disposed in spaced relation to the inner surface of said piston;
said first sealing means being of smaller internal diameter than that of said second shaft portion;
second sealing means between said piston and said second shaft portion, the latter sealing means being spaced from said shoulder;
and means for conducting flowable material under pressure to the interior surface of said piston at a place between said first and second sealing means to cause axial movement of said piston and thus said bearing relative to both said shaft and tubular member in a direction away from said shoulder.

2. In combination, a shaft having a first portion and a second larger portion separated by a shoulder;
a bearing having an inner race on said first portion;
an annular piston around said shaft and sealingly engaging said inner race and said second shaft portion;
and means for conducting flowable material under pressure to the inner surface of said piston to effect an axial shift of said piston and bearing.

3. In combination;
a shaft having a first portion and a second larger portion separated by a shoulder;
a fixed tubular housing around said shaft;
means for supporting said shaft in said housing including a bearing having an inner race slidably fitting on said first shaft portion and an outer race slidably fitting in said housing;
an annular piston around said shaft and sealingly engaging said inner race and said second shaft portion;
and means for conducting flowable material to the inner surface of said piston to effect axial movement of said piston and bearing relative to said shaft and housing.

4. In combination;
a shaft having a first portion and a second larger portion separated by a shoulder;
a fixed tubular housing around said shaft;
means for supporting said shaft in said housing including a bearing having an inner race slidably fitting on said first shaft portion and an outer race slidably fitting in said housing;
an annular piston around said shaft and sealingly engaging said inner race and said second shaft portion;
and means for conducting flowable material to the inner surface of said piston to effect axial movement of said piston and bearing relative to said shaft and housing;
said conducting means including a passage in said shaft having an inlet end;
and an opening in said housing to register with said inlet end in a predetermined position of rotation of said shaft with respect to said housing.

5. In combination;
a tubular housing;
a shaft having at least a portion in said housing;

a bearing between said portion and said housing;
means for conducting a fluid lubricant to said bearing;
means adjacent one side of said bearing for preventing escape of fluid one way from said bearing;
an annular flinger at the other side of said bearing surrounding said shaft and tending to confine the fluid lubricant from passage the other way from said bearing;
means on said shaft providing a shoulder facing toward said bearing;
said annular flinger bridging said shoulder;
and means for conducting flowable material to said shoulder to cause axial movement of said flinger to aid in removal of said bearing.

6. In combination
shaft means having a first portion of one diameter and a second portion of a larger diameter,
said second portion providing a shoulder defining one extremity of said first portion,
means for mounting said shaft means including a bearing slidably mounted on said first portion,
an annular piston surrounding said first shaft means portion adjacent said shoulder and having an end face in confronting relation to an end face of said bearing,
said piston extending beyond said shoulder and around at least part of said second shaft means portion,
first sealing means between said piston end face and said bearing end face,
second sealing means between said piston and said second shaft means portion, and
passageway means for conducting flowable material under pressure to the inner surface of said piston at said shoulder to effect axial movement of said piston and bearing relative to said shaft.

7. In combination, a shaft having a first portion and a second larger portion separated by a shoulder,

a housing surrounding said shaft at said shoulder,
an annular piston around said shaft and slidingly engaging said first shaft portion,
said piston sealingly engaging said second shaft portion in spaced relation to said shoulder,
said piston having a shoulder facing in the same direction as said shaft shoulder and located within the longitudinal confines of said first shaft portion,
a bearing having an inner race mounted on said piston in abutting relation to the piston shoulder and an outer race slidingly engaging said housing, and
means for conducting flowable material to the inner surface of said piston at said shaft shoulder to effect axial movement of said piston and bearing relative to said shaft and housing.

8. In combination,
a shaft,
a tubular member around an end portion of said shaft,
a cup-shaped piston fitting on said end portion with the bottom of said piston located opposite the end face of said portion,
a bearing mounted between said piston and tubular member,
sealing means between said piston and said shaft end portion, and
means for conducting flowable material to the interior of said piston at said end face to cause movement of said piston away from said end face,
said piston having means for carrying the bearing with said piston upon such movement.

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