

[54] BEARING UNIT FOR OPEN-END SPINNING
TURBINES

[75] Inventor: Fritz Stahlecker, Bad Uberkingen,
Germany

[73] Assignee: Wilhelm Stahlecker G.m.b.H.,
Reichenbach, Germany

[22] Filed: Dec. 7, 1971

[21] Appl. No.: 205,558

[30] Foreign Application Priority Data

Dec. 14, 1970 Germany..... 2061520
Dec. 14, 1970 Germany..... 2061462

[52] U.S. Cl..... 57/58.89, 57/133, 308/172
[51] Int. Cl..... D01h 1/20, F16c 1/24
[58] Field of Search..... 57/58.89, 58.95, 133;
308/163, 172

[56] References Cited

UNITED STATES PATENTS

135,295 1/1873 Taylor et al. 308/172 X

363,782 5/1887 Wyly..... 308/172 X
676,471 6/1901 Pessano 308/172
1,630,310 5/1927 Pitt 308/172 X

FOREIGN PATENTS OR APPLICATIONS

1,901,453 8/1970 Germany 57/58.89
1,933,930 1/1971 Germany 57/58.89
1,913,728 8/1970 Germany 57/58.89

Primary Examiner—John W. Huckert
Assistant Examiner—Charles Gorenstein
Attorney, Agent, or Firm—Craig & Antonelli

[57] ABSTRACT

A high-speed open-end spinning turbine with a horizontal shaft and a thrust bearing for the end of this shaft within a closed oil container and with means for insuring that during the operation of the turbine this end of the shaft and its point of engagement with the thrust bearing within the oil container will always be moistened with oil from the lower part of the container.

49 Claims, 17 Drawing Figures

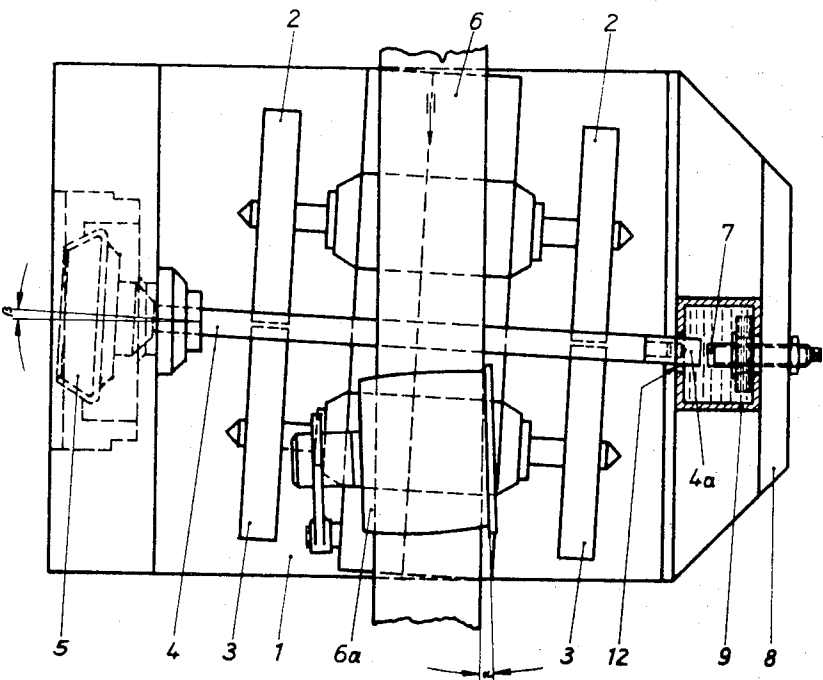


Fig. 1

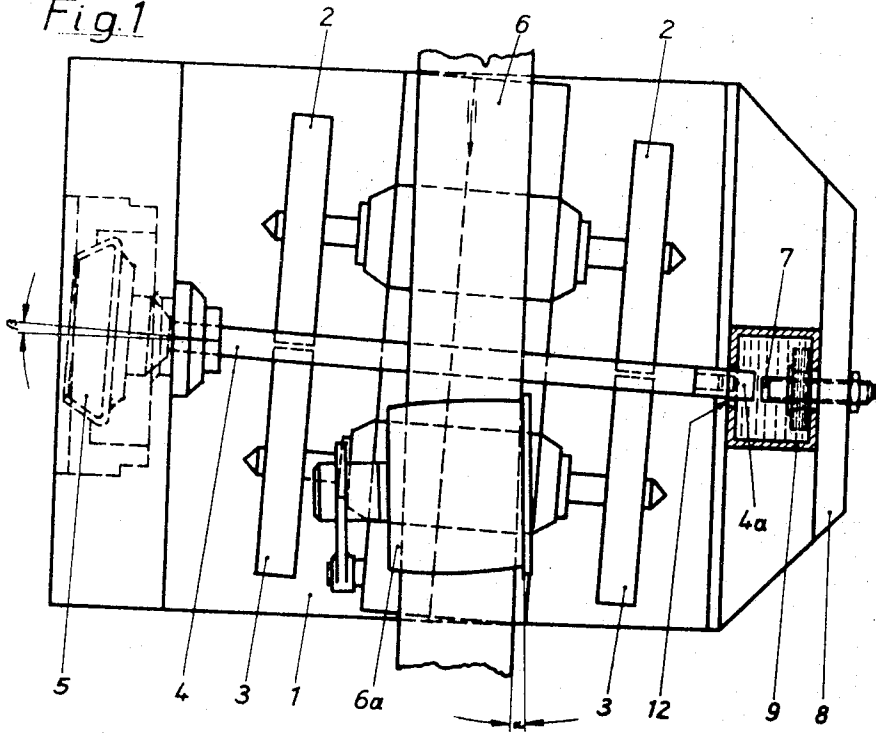
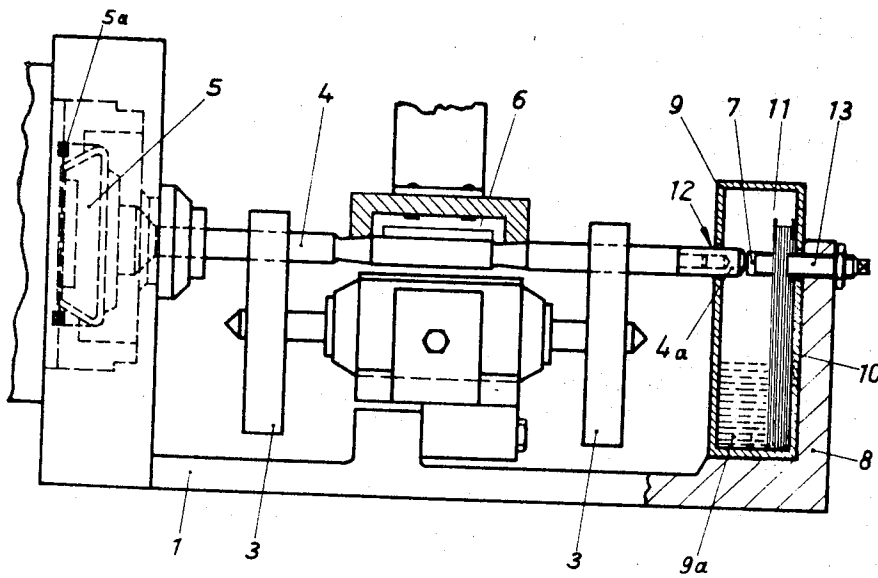


Fig. 2



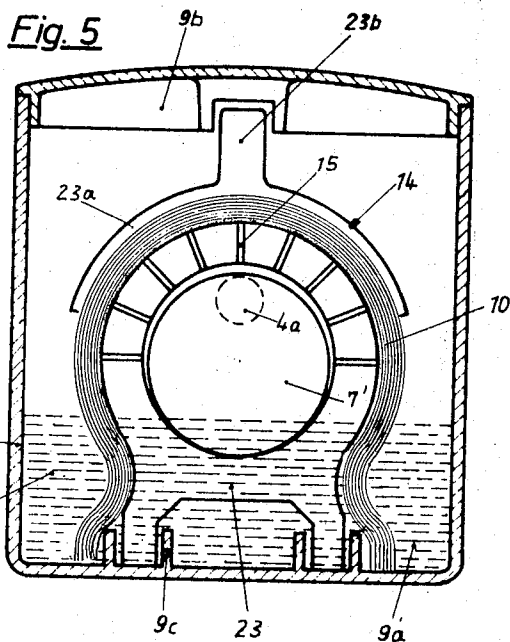
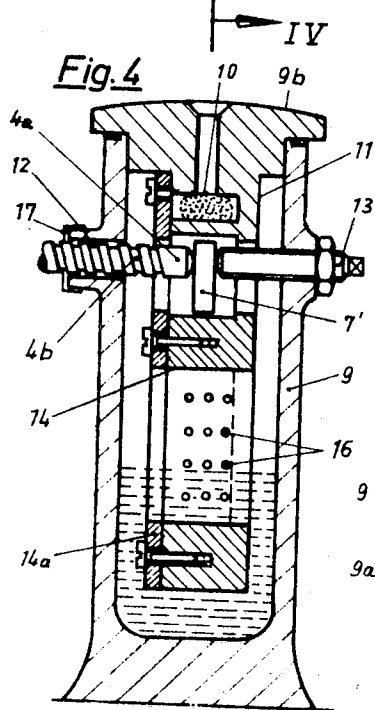
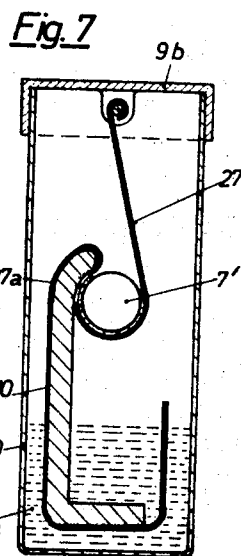
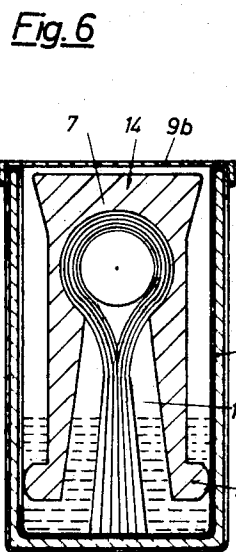
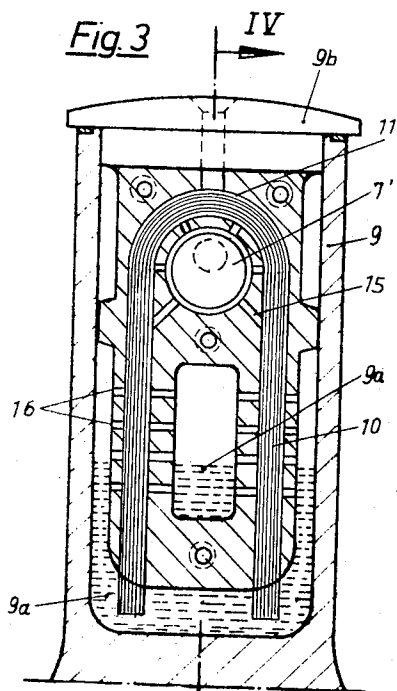


Fig. 8

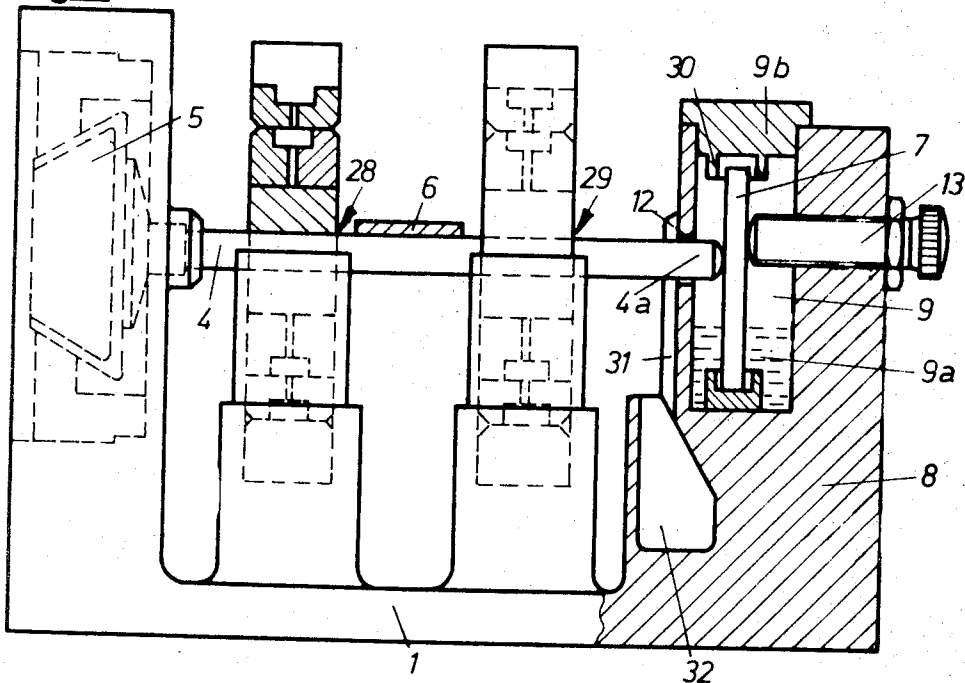


Fig. 9

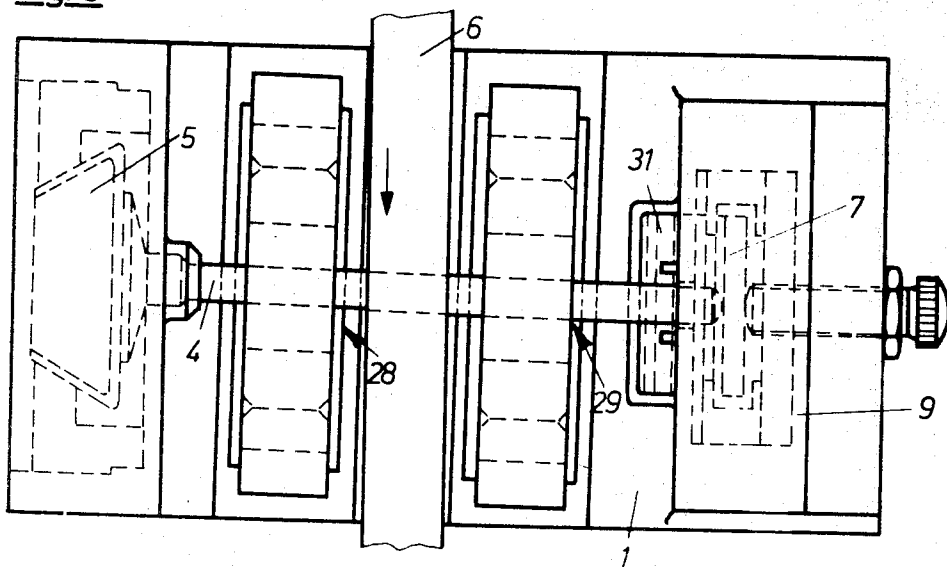


Fig. 10

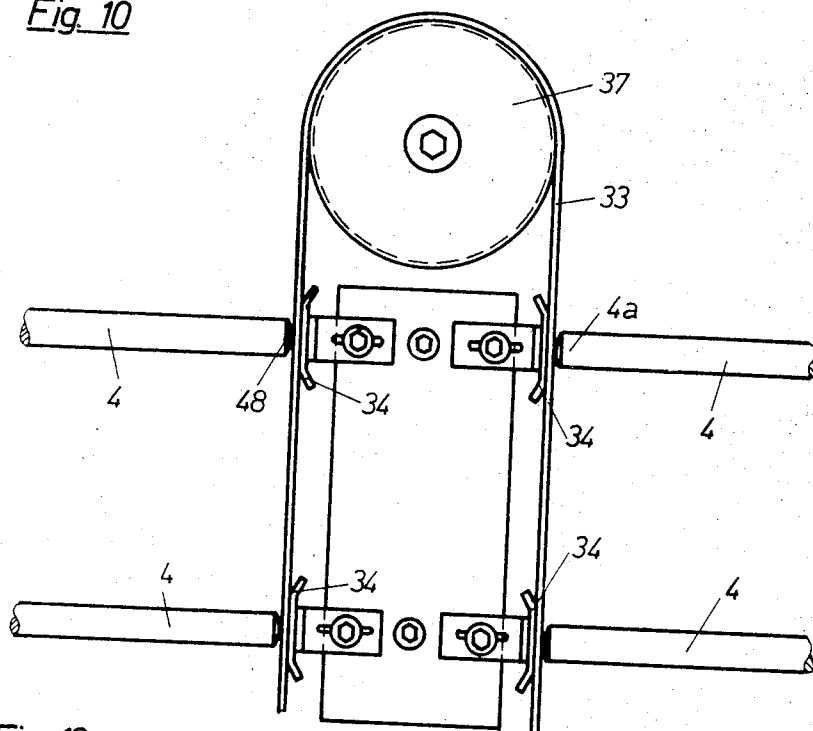


Fig. 10a

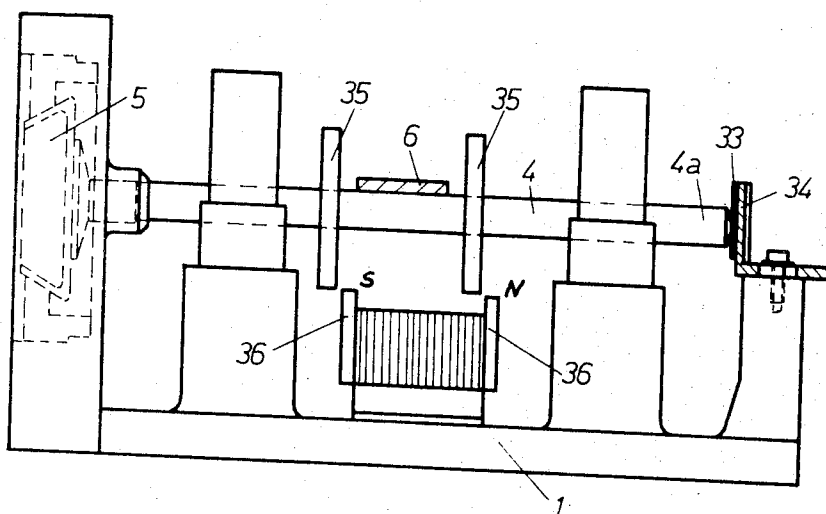


Fig. 11

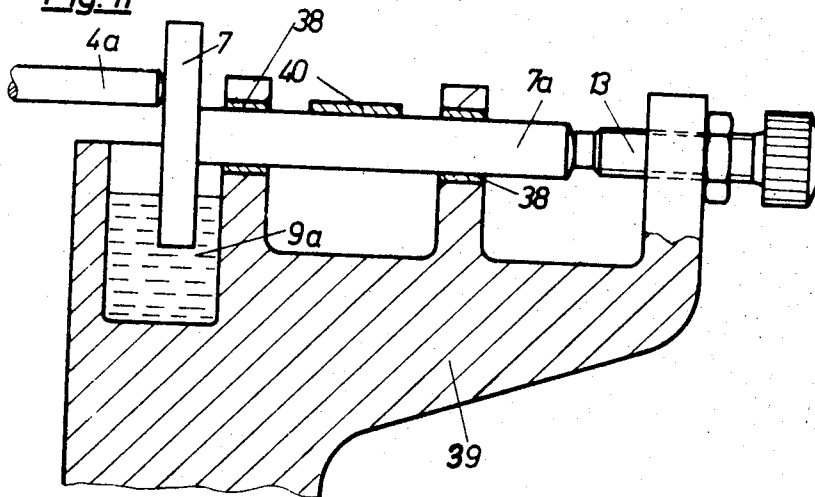


Fig. 12

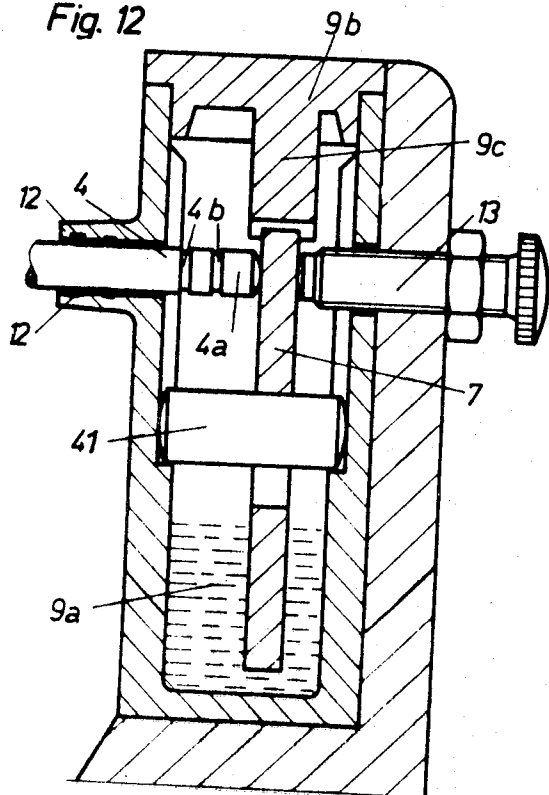
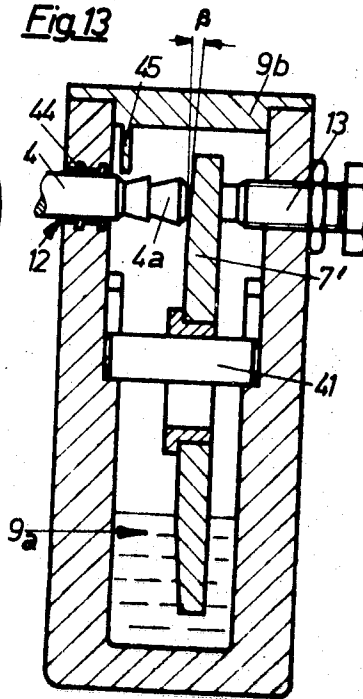
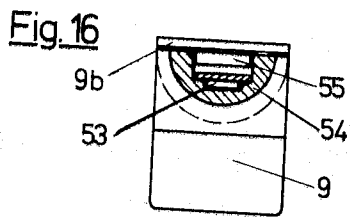
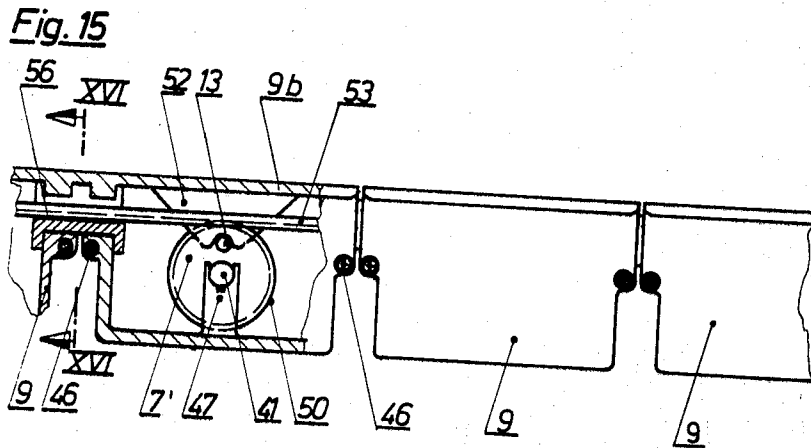
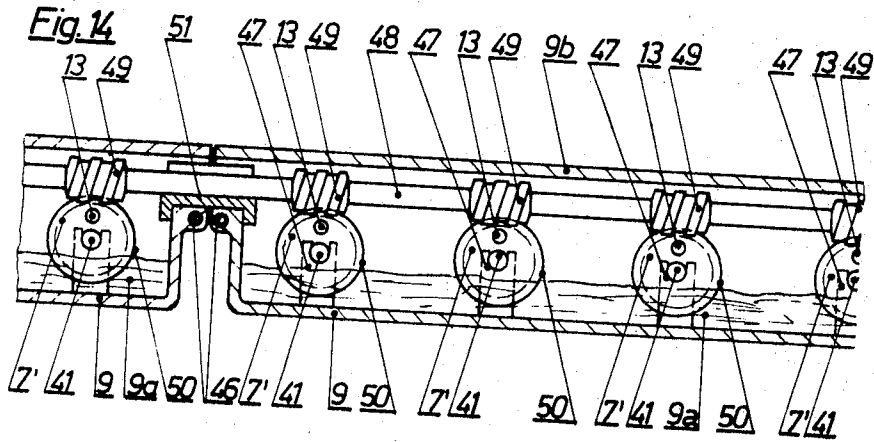


Fig. 13





BEARING UNIT FOR OPEN-END SPINNING TURBINES

The present invention relates to a bearing unit for one or more open-end spinning turbines each of which has a substantially horizontal shaft and a thrust bearing engaging upon one end of the shaft and acting in the axial direction upon the latter.

The manner of rotatably mounting the shafts of open-end spinning turbines involves a series of problems since such turbines have to be driven at speeds of 50,000 r.p.m. and more so that conventional bearings can generally no longer be employed. For mounting the shafts of such spinning turbines in radial directions, air suspension bearings are frequently used because they render the turbines easily accessible. It has also been proposed to support the shaft of such a turbine within the wedge-shaped gaps between two pairs of supporting rollers which because of their large diameters may rotate at lower speeds and therefore permit them to be mounted in conventional ball or roller bearings. For supporting and guiding the turbine shaft not only in radial directions but also in its axial direction, it has already been proposed to exert a thrust upon the shaft in the direction toward its end opposite to that carrying the turbine itself and to support this end of the shaft by a thrust bearing.

Since the shafts of spinning turbines generally extend horizontally, it is difficult to provide the thrust bearing of such a shaft with continuous lubrication. This difficulty is enhanced by the fact, that due to the high speeds at which spinning turbines are driven, the lubricant for their shafts will easily be atomized and thereby pass to points where it may seriously impair the quality of the material to be spun. For this reason it has already been proposed to make the end of the turbine shaft of a highly resistant material, for example, by providing it with a tip of a hard metal, and to make the bearing plate or bearing disk entirely of a hard metal or of a sapphire. Although these means permit the frictional wear upon the thrust bearing to be reduced to bearable limits, such bearing means of hard metal can be machined only with great difficulty and be produced only at a high expense. Furthermore, such thrust bearings will produce an almost unbearable noise, especially when they have been used for a greater length of time, and the power required for driving such spinning turbines is also very high, especially if they are of larger dimensions and produce a higher axial thrust.

It is an object of the present invention to provide a bearing structure for high-speed spinning turbines which overcomes the above-mentioned disadvantages, may be produced of conventional, more inexpensive materials, and is also devoid of any disagreeable operating noise.

For attaining this object, the invention relies upon the fact that in most cases the operation of spinning turbines absolutely requires the application of lubricants, and the invention therefore consists in providing the thrust bearing of the shaft of such a turbine within a closed bearing housing which contains a lubricant and into which the end of the turbine shaft projects while being sealed toward the outside. Such a bearing structure prevents the lubricant from escaping from the bearing housing and it therefore insures that the lubricant will not impair the spinning operation and the material to be spun. It further permits the end of the tur-

bine shaft and the thrust bearing to be made of conventional materials.

The bearing housing according to the invention preferably consists of a closed container the lower part of which is filled with oil and in which suitable means are provided for conveying the oil from this lower part of the container to the thrust bearing. These conveying means are preferably provided on a suitable support which is either loosely inserted into the bearing housing or easily removable therefrom. This permits the spinning turbine to be easily assembled and disassembled without requiring the machine itself or the oil container which is preferably connected to the machine to be provided with any complicated or expensive means to permit the turbine to be disassembled or removed from the machine frame.

A very simple device for conveying the oil from the lower part of its container to the thrust bearing consists according to the invention of a material which is partly immersed into the oil bath and capable of soaking up the oil, and is held by a supporting device which extends at least to the area adjacent to the thrust bearing. This material may, for example, consist of a wick which is held within a guide channel in a cage which may be loosely inserted into the bearing housing and may also serve as a support for a freely movable thrust-bearing disk which is interposed between and in engagement with the end of the turbine shaft and an abutment which is stationary but preferably adjustable in the axial direction of the turbine shaft. The oil conveying means may, however, also consist of a layer of felt or the like which is inserted between two plates which are pivotably suspended within the bearing housing. Also in this embodiment of the invention the oil will pass through the felt layer to the thrust bearing. In place of a wick or a felt layer it is also possible either to employ capillary tubes or to employ the vibration of these pivotably suspended plates for conveying the oil to the thrust bearing.

It would also be possible to hold such wicks or the like in pivotable arms which are supported on the bearing disk or to provide supporting means for the bearing disk which are made of a porous material and therefore gradually soak up the oil and then pass the same to the bearing plate or bearing disk to form a moist coating thereon. Other embodiments of the invention are also of great advantage, for example, in the form of an angular plate the rear side of which is provided with a layer of felt and which itself forms a bearing plate. It is also possible to provide a wick or the like on a float which engages upon the lower side of the turbine shaft or of the thrust bearing. In some cases, especially for an automatic lubrication, it is also of advantage to provide an oil conveying device in the form of a spraying device which is operated by compressed air.

Another advantageous embodiment of the invention consists in providing a common oil container for the thrust bearings of a plurality of spinning turbines which may, for example, form two rows at the opposite sides of the machine, in which the oil container is disposed centrally of the machine between the two rows and in which the lubricating elements may be loosely inserted as independent units at the required positions into this common oil container.

According to a preferred embodiment of the invention, the thrust bearing comprises a movable bearing plate, bearing disk or the like which permits the point

of engagement of the tip of the end of the turbine shaft upon this bearing disk to change continuously so that the wear by the end of the shaft upon the bearing disk is not confined to a particular point on the surface of this disk but is distributed over a very large surface area of the bearing disk during the operation of the spinning turbine. This movability of the bearing disk and of its point of engagement with the shaft end permits the bearing disk to be made of a conventional material which may be easily machined and be of a low cost.

This last-mentioned embodiment of the invention may be attained by providing means for positively driving the bearing plate or disk. This may be done, for example, by designing the bearing plate in the form of a bar which is movable back and forth in its longitudinal direction and the surfaces of which may be moistened during this movement by an oil-saturated strip of felt or the like. This construction has the advantage that the bearing plate will not be excessively worn during a long period of operation of the spinning turbine and that this operation will not cause any harmful noise. By the provision of means for positively moving the bearing plate or disk, it is also possible to make this plate of a suitable plastic which has good bearing or antifriction properties. Since the point of engagement on the bearing plate by the end of the turbine shaft constantly changes, the bearing plate will not be affected at any point by a concentration of heat and the good antifriction properties of some of the plastics which are now available may be fully utilized. A very advantageous embodiment of such a plastic bearing may be attained if the bearing plate consists of a traveling belt of plastic which is made, for example, of a material known under the trade mark "Teflon" and preferably serves as a thrust bearing for simultaneously supporting a plurality of turbine shafts. Such a common thrust bearing in the form of a traveling belt of plastic may be very easily produced and is of a low cost. For larger spinning turbines in which higher axial pressures occur, it is, however, more advisable to design the bearing plate in the form of a disk which is mounted on a driven shaft and may, if desired, be provided with a coating of plastic or be lubricated with oil or other lubricant during its rotation in a similar manner as the reciprocating bearing bar is lubricated which has been previously described.

Another very advantageous embodiment of the invention involving the use of a movable bearing plate consists in designing this plate in the form of a freely movable circular or annular disk which abuts eccentrically at one side upon the end of the turbine shaft and is supported at the other side by a stationary abutment which is preferably adjustable. This eccentric arrangement of the turbine shaft relative to the bearing disk has the advantage that this disk does not have to be driven by any separate driving means but will be rotated at a low speed solely by its frictional engagement with the end of the turbine shaft. This embodiment of the invention therefore also attains the advantage that the point of engagement between the end of the shaft and the surface of the bearing disk will be constantly shifted on this surface. For insuring that the bearing disk will always rotate in one particular direction, it is only necessary to mount the turbine shaft and the bearing disk in such a position relative to each other than the end of the shaft which engages upon the surface of the bearing disk does not extend vertically to this surface. This may be easily attained, for example, by mak-

ing the side of the bearing disk facing the end of the turbine shaft of a slightly conical shape or by mounting on this side of the bearing disk a slightly conical ring or disk. In place of a bearing disk, it is also possible to employ a bearing ring. When employing such a rotatable bearing disk or ring, it is advisable to pass the latter at least partly through a bath of lubricant, for example, oil. This oil bath preferably has a level lower than the axis of rotation of the bearing disk so that during its rotation only the lower part of this disk or ring will be immersed in the oil and the oil will be continuously taken along upwardly by the previously immersed part of the disk or ring and will then flow over the entire outer surfaces of the latter. By only rotating the bearing disk or ring only at a low speed and by immersing only its lower part in the oil bath, the danger will be avoided that the oil might be agitated to such an extent that it may be vaporized and that such an oil vapor might pass through some aperture out of the oil container to the outside where it might harm the operator of the machine and even eventually reach the material to be spun which might thereby be damaged.

These and additional features and advantages of the present invention will become more clearly apparent from the following detailed description thereof which is to be read with reference to the accompanying drawings, in which;

FIG. 1 shows a top view of a bearing unit according to the invention for an open-end spinning turbine the shaft of which is supported in its axial direction by a thrust bearing which is disposed within a closed oil container and in its radial directions by being rotatable within wedge-shaped gaps between two pairs of supporting rollers;

FIG. 2 shows a side view, partly in cross section, of the bearing unit according to FIG. 1;

FIG. 3 shows a cross section of a bearing and oil housing according to an embodiment of the invention which is similar to that as shown in FIGS. 1 and 2, but provided with a freely movable bearing disk and an oil wick which is held by a special wick support;

FIG. 4 shows a cross section which is taken along the line IV — IV of FIG. 3;

FIG. 5 shows a cross section of the bearing and oil housing of another embodiment of the invention which is provided with a cage-like device for carrying the oil wick and a bearing disk;

FIG. 6 shows a cross section of a modification of the invention, in which the oil wick is held by a rider-like or saddlelike element on the bearing disk;

FIG. 7 shows a cross section of another embodiment of the invention, in which a freely movable bearing disk is guided by a pivotably suspended supporting strip which curves around the bearing disk and carries a felt wick and holds the same immersed in the oil bath;

FIG. 8 shows a side view, partly in cross section, of a bearing unit in which the turbine shaft is mounted radially in air suspension bearings and axially on a rotating bearing disk which is partly immersed in an oil bath, and in which the turbine shaft is driven by a tangential driving belt;

FIG. 9 shows a top view of a bearing unit according to FIG. 8;

FIG. 10 shows a top view of an axial or thrust bearing mechanism for several turbine shafts which comprises a belt of plastic traveling around stationary supports;

FIG. 10a shows a side view of one of the turbine units which is provided with a thrust bearing as illustrated in FIG. 10;

FIG. 11 shows a cross section of another thrust bearing for the shaft of a spinning turbine, in which the bearing disk is secured to another shaft which is driven independently of the turbine shaft;

FIG. 12 shows a cross section of a further thrust bearing according to the invention;

FIG. 13 shows a cross section of a modification of the thrust bearing according to FIG. 12, in which the side of the bearing disk facing the end of the turbine shaft is made of a slightly conical shape;

FIG. 14 shows a longitudinal section of a common oil container for the bearing disks of a plurality of spinning turbines of a spinning machine and of the means for driving these disks;

FIG. 15 shows a side view of a plurality of adjacent oil containers one of which is partly shown in section and contains a driven bearing disk similar to one of those as shown in FIG. 14; while

FIG. 16 shows a cross section which is taken along the line XVI — XVI of FIG. 15.

In the drawings, FIGS. 1 and 2 illustrate an embodiment of the invention which comprises a frame 1 which supports two pairs of supporting rollers 2 and 3 which are separated by wedge-shaped gaps in which the shaft 4 of an open-end spinning turbine 5 is rotatably supported. The spinning turbine 5 is driven by a belt 6 which runs tangentially over the shaft 4 but at an angle which deviates from a right angle relative to the direction of shaft 4. Due to this angle of the tangential belt 6, an axial thrust is exerted upon shaft 4 carrying the spinning turbine 5 which draws the shaft toward the right. This axial thrust of shaft 4 is taken up at the right end 4a of the shaft by a thrust bearing 7 in the form of a screw which is screwed into the upper end of a vertical end wall 8 of frame 1 and is adjustable in its axial direction within this wall. For producing the required pressure of the tangential belt 6 upon the turbine shaft 4, a pressure roller 6a is provided the axis of which does likewise not extend at a right angle to the direction of travel of belt 6 but is turned in the direction opposite to that in which shaft 4 is turned relative to the belt and thereby insures that during its travel belt 6 will not shift axially along shaft 4.

For reducing the frictional wear upon the thrust bearing 7 and for permitting conventional materials to be used for making this thrust bearing 7 and the adjacent end of the turbine shaft, these parts are disposed within a bearing housing 9 the lower part 9a of which is filled with oil into which one end of a wick 10 is immersed which is held in a position adjacent to the thrust bearing 7 by a guide member 11 and from which the upwardly drawn oil may spread over the thrust bearing 7. The bearing housing 9 is completely closed so that the oil cannot pass in the form of a mist or film to areas in which it could impair the quality of the material to be spun. The end of the turbine shaft 4 passes into the bearing housing 9 through a bore 12 in its wall which is sealed toward the outside in a manner not particularly shown. Except for this bore 12, housing 9 has in effect no apertures since its wall opposite to that containing bore 12 is tightly connected to the end wall 8 of frame 1 and the coaxial bores in these walls for the adjusting screw 13 of thrust bearing 7 are sealed toward

the outside since this screw 13 is screwed tightly through the end wall 8.

While the manner of maintaining the wick 10 in its proper position is only illustrated diagrammatically in FIGS. 1 and 2, FIGS. 3 and 4 show an advantageous construction of the means for holding the wick which in this case extends like a horseshoe around the adjacent ends of the turbine shaft and the thrust bearing 7. According to FIGS. 3 and 4, thrust bearing 7 consists of a bearing disk 7' which is freely movable within a supporting element 14 which also contains a guide channel 11 for the wick 10. This supporting element 14 is rigidly secured to the housing cover 9b and provided adjacent to the bearing plate 7' with slotlike channels 15 which extend radially to the center of disk 7'. Further bores 16 in the lateral walls of the supporting element 14 permit the oil which has a level 9' to pass into the guide channel 11 for the wick 10 in which it can then rise within the wick and pass through the radial slots 15 to the bearing disk 7' which is thus constantly moistened by a coating of oil. The bearing structure as illustrated in FIGS. 3 and 4, in which after the wick 10 and the bearing disk 7' have been inserted into the supporting element 14 the latter may be closed by a cover plate 14a, has the important advantage that only a very small but sufficient quantity of oil will be passed upwardly so that there will be hardly any danger that any oil might pass out of the housing 9. Furthermore, the turbine shaft is provided with spirally shaped grooves 4b from which any oil film which might accumulate on the end 4a of the shaft will be thrown off the latter by centrifugal action and which will conduct any oil drops which might form on the housing wall adjacent to the bore 12 back toward the bearing disk 7'. In addition, a sealing cap 17 of plastic may be fitted over a flange projecting outwardly from this wall of housing 9. The opening of this cap 17 has at first a slightly smaller diameter than the turbine shaft 4 and it will expand to the diameter of the shaft when the latter is driven for a certain length of time. When this cap 17 no longer seals properly, it may be exchanged for a new cap. Since the bearing screw 13 may also be screwed tightly through the other wall of housing 9, the thrust bearing of the turbine shaft 4 will be properly oiled and the spinning turbine will therefore run without noise and no oil will pass out of the housing 9 to the outside where it might affect the spinning operation.

FIG. 5 illustrates an embodiment of the invention in which the supporting element 14 for the wick 10 is not connected to the cover 9b of the bearing housing but rests on the bottom of the latter. This supporting element 14 consists of a cage 23 for guiding a relatively large bearing disk 7' which is provided with a cover 23a for the wick 10 and with oil guide slots 15 which extend radially to the center of disk 7'. In this embodiment of the invention as well as in the embodiment as illustrated in FIGS. 3 and 4, the bearing disk 7' is rotated due to the fact that the tip 4a of the turbine shaft runs eccentrically on disk 7' and a part of the outer surface of this disk is directly immersed into the oil in housing 9 if the oil level 9a' in this housing is sufficiently high. In the event that the oil level should drop below bearing disk 7', the latter will be lubricated by the oil coming from the wick 10. For maintaining the cage 23 in its proper position on the bottom of housing 9, the latter is provided with projections 9c between which the feet of cage 23 are located, while the cover 23a of the cage

has a projection 23b which engages into a recess in the outer cover 9b.

FIG. 6 illustrates an embodiment of the invention in which the supporting element 14 for the wick 10 forms a rider which is placed from above over the end 4a of the turbine shaft or over a stationary thrust bearing 7. This supporting element 14 forms an insert the lower arms 24 of which engage upon the side walls of housing 9, while its upper part forms a cover for housing 9. This construction is very simple and may therefore be produced at a low cost.

FIG. 7, however, illustrates an embodiment of the invention which is designed for a freely movable bearing disk 7'. This bearing disk 7' is held within a bent supporting strip 27 of sheet metal or plastic which adjacent to disk 7' clamps the wick 10 and guides it downwardly into the oil bath 9a. The supporting strip 27 is pivotably suspended on the housing cover 9b and provided adjacent to the bearing disk 7' with an aperture 27a through which the oil can pass from the wick 10 to disk 7'. This embodiment of the invention has the advantage that the entire lubricating device may be lifted together with the cover 9b out of the housing 9 so that, after the end 4a of the turbine shaft has been withdrawn from the housing, the turbine may be easily disassembled, for example, if repairs have to be made.

FIGS. 8 and 9 illustrate a bearing unit for an openend spinning turbine 5 the shaft 4 of which is mounted horizontally in two air-suspension bearings 28 and 29 and is driven by a tangential belt 6 at a very high speed of about 50,000 r.p.m. or more. While the air-suspension bearings 28 and 29 serve for radially supporting the turbine shaft 4, the end 4a of the shaft is supported by an axial bearing. For this purpose an axial thrust is exerted upon the turbine shaft 4 in the direction toward its end 4a by the tangential belt 6 which is again attained by mounting the shaft 4 so as not to extend at a right angle to the direction of the tangential belt 6. This axial thrust is taken up by a bearing disk 7' which is freely movable within a bearing housing 9 the lower part of which is filled with oil. Bearing disk 7' is, in turn, supported by a bearing screw 13 which is screwed into a vertical end wall 8 of frame 1 and is adjustable in its axial direction. The bearing housing 9 is tightly closed by a removable cover 9b. If it becomes necessary, shaft 4 together with the turbine 5 may be withdrawn toward the left from the bearing housing 9 without requiring any parts of the bearing unit to be loosened or removed. For preventing the bearing disk 7' from then tilting over within the bearing housing, the cover 9b of the latter is provided with downwardly extending supporting projections 30. Since without special sealing means it is hardly possible to prevent entirely small quantities of oil to pass from the housing 9 through the bore 12 to the outside, an overflow channel 31 and an oil collecting chamber 32 are additionally provided. If desired, this collecting chamber 32 and also, for example, the oil chamber in housing 9 may form common chambers for several adjacent turbine bearing units or the individual chambers of each unit as shown in FIGS. 8 and 9 may communicate with each other through connecting pipes.

During the operation of the spinning turbine according to FIGS. 8 and 9, the bearing disk 7' will be slowly rotated due to the rotation of the end 4a of the turbine shaft on the surface of disk 7' and the eccentric position of this end relative to disk 7'. This rotation has the

advantage that the point of engagement of the end 4a of the shaft upon the bearing disk 7' changes continuously so that the wear upon the latter is distributed over a larger surface area. Furthermore, the rotation of bearing disk 7' causes all points of the periphery of the disk to pass successively into the oil bath so that the disk will be coated at all times by a film of oil which considerably reduces the friction and wear upon the disk and also the noise of operation of the spinning turbine.

FIGS. 10 and 10a illustrate an embodiment of the invention in which, instead of providing a freely movable bearing disk for each turbine shaft, the shafts of a whole group of spinning turbines are supported in their axial directions by a traveling belt of plastic 33 which is driven by a drive pulley 37 and runs at the end 4a of each turbine shaft 4 over a skid 34 which is adjustable to a small extent in the axial direction of the respective shaft 4 on a common stationary element. This bearing arrangement is especially suitable for smaller spinning turbines which require a smaller axial bearing pressure so that a liquid lubrication of the thrust bearings may be omitted which are formed by the belt 33 and the skids 34. In this particular embodiment of the invention, each individual turbine shaft 4 is provided with flanges 35 which are slightly offset in the axial direction relative to the poles 36 of an electromagnet or permanent magnet which draws the turbine shaft 4 in its axial direction toward the thrust bearing at its end 4a. If the bearing arrangement according to FIGS. 10 and 10a is to be employed for spinning units in which higher axial pressures by the turbine shafts 4 are to be expected, it is possible to provide between each pair of laterally adjacent shafts 4 an oiling element, for example, a wick as previously described, along which the belt 33 wipes during its travel so that this belt will be constantly moistened with oil. As shown in FIG. 10, this bearing arrangement may also be employed for machines which are equipped with spinning turbines on opposite sides.

FIG. 11 illustrates an embodiment of the invention in which the bearing disk 7' is rigidly secured to one end of a shaft 7a the other end of which is supported on an adjusting screw 13. Shaft 7a runs in two sleeve bearings 38 which are mounted on a frame 39. Shaft 7a and thus also the bearing disk 7' is driven by a belt 40 so that this bearing disk which is partly immersed in an oil bath 9a will always be coated with oil.

FIG. 12 only illustrates the parts of a turbine unit which are directly associated with a bearing housing and oil chamber 9 similar to that as already shown in FIGS. 8 and 9. In this case, however, the bearing disk 7' which is partly immersed in the oil bath 9a is provided with a transverse bore of a larger diameter than that of the shaft 41 on which it is mounted which is slidable in a vertical direction within the oil chamber. A projection 9c on the cover of the oil chamber limits the upward movement of bearing disk 7'. The end 4a of the turbine shaft is provided with two annular grooves 4b from which any oil which might pass from the bearing disk 7' to the end 4a of the turbine shaft 4 may be thrown off by centrifugal action. The passage of oil along shaft 4 through the bore 12 to the outside of the oil chamber may be additionally prevented by suitable sealing means.

In the description of FIG. 8 it has already been mentioned that the bearing disk 7' will be rotated by the ro-

tation of the end 4a of the turbine shaft 4 on the surface face of this disk. If, however, shaft 4 extends vertically to the surface of disk 7', it will not be certain - especially after a longer period of operation - that the point of engagement of the shaft end 4a on bearing disk 7' will change due to a rotation of this disk. In order to prevent the shaft end 4a from wearing a recess into the surface of bearing disk 7' which would even prevent this disk from rotating, the invention further provides according to FIG. 13 that the side of disk 7' facing the shaft end 4a is slightly inclined toward its peripheral edge. This insures that the shaft end 4a will at all times engage eccentrically, that is in FIG. 13 at a point below its axis, with the bearing disk 7' and will thus effect a positive rotation of this disk in one direction. For preventing any oil from passing along the turbine shaft 4 through the bore 12 in the wall of the oil chamber 9 to the outside of this chamber, the wall of this bore 12 is provided with a spirally shaped groove 44 which is wound so that during the rotation of shaft 4 any oil will flow back toward the inside of the oil chamber 9. In addition, the end part of the turbine shaft at the inside of the oil chamber 9 is provided with two conical surfaces from which the oil which might pass from the bearing disk 7' upon the shaft end 4a will be thrown off by centrifugal action. Furthermore, the cover 9b of the oil chamber is provided with an oil shield 45 which is intended to prevent any oil from passing from the lower side of the cover directly to the bore 12.

A thrust bearing in the form of a freely movable or positively driven bearing disk may also be employed for supporting a vertical turbine shaft in its axial direction. The bearing disk would then be disposed within a substantially horizontal plane and would support the turbine shaft with its upper surface. The bearing disk may then run partly or entirely within an oil bath or be provided with an oil coating in any other suitable manner. In smaller turbine units, the turbine shafts may also run without being lubricated.

FIG. 14 illustrates a bearing and oil housing 9 for a plurality of turbine units of a spinning machine. This oil housing 9 is made of metal or plastic and adapted to be secured by screws 46 to the rear walls of the individual spinning units or the common rear wall of these units so that the ends of the turbine shafts project into the oil housing 9. For each spinning unit, the oil housing 9 contains a bearing disk 7' the shaft 41 of which is mounted in a bearing bracket 47. Each of the axially adjustable bearing disks 7' is supported in its axial direction by a bearing screw 13 and is thus acted upon at one side by the end of the turbine shaft and at the other side by the bearing screw 13. The oil housing 9 is filled with oil to such a level that all of the bearing disks 7' are partly immersed in an oil bath 9a. All of the bearing disks 7' are positively driven by a common drive which insures that all bearing disks will rotate at a uniform but adjustable speed which facilitates the supervision and adjustment of the thrust bearings. This common drive consists of a longitudinal shaft 48 which is provided at each spinning unit with a worm 49 which engages with wormgear teeth 50 on the peripheral surface of the respective bearing disk 7'.

The longitudinal shaft 48 is preferably divided into sections each of which has a length substantially equal to the length of one oil housing 9. The longitudinal shaft 48 or the shaft sections are rotatably mounted in bearing rings 51 which are mounted on the ends of the

oil housings 9. The individual sections of shaft 48 may be connected to each other by connecting elements (not shown) which preferably consist of parts of plastic which are inserted, for example, into longitudinal grooves in the adjacent ends of the shaft sections and are held in position thereon by spring clamps which surround the connecting elements. If the individual turbines are spaced at short distances from each other, the connecting element between the adjacent sections of shaft 48 is preferably located in or adjacent to a bearing ring 51, while for turbines which are spaced at larger distances from each other, it is possible also to space the adjacent oil housings 9 from each other and to provide the connecting elements of the shaft sections within the areas between the oil housings.

In order to prevent the oil from passing out of the ends of each oil housing 9 through the bores which are provided for the longitudinal shaft 48 or the sections thereof, oil shields (not shown) are provided which may be provided on a common metal strip which extends along the entire length of the oil housing 9 and is secured to either the latter or to its cover 9b.

FIGS. 15 and 16 finally illustrate a positive drive for the bearing disks 7 of all turbine units of a spinning machine. For each turbine unit a separate oil housing 9 is provided in which a bearing disk 7 is located the shaft 41 of which is rotatably mounted in a bearing bracket 47. Each bearing disk 7 is braced in its axial direction by an adjustable bearing screw 13.

The individual oil housings 9 are secured by screws 46 to the frames of the respective turbine units or to a common frame. This individual mounting permits each thrust bearing to be centered within small limits relative to the respective turbine shaft. The cover 9b has integrally connected thereto an oil shield 52 which projects downwardly to the bore in the wall of the oil housing 9 through which the turbine shaft 41 extends. If desired, these oil housings 9 may be made of a transparent plastic through which the operation of the thrust bearing of each turbine unit may be easily inspected from the outside.

The bearing disks 7 of all turbine units are provided with outer gear teeth 50 with which a toothed belt 53 engages which runs longitudinally through the spinning machine. This toothed belt 53 which is made of plastic is guided between each adjacent pair of oil housings 9 within an insert 54 of plastic which has a semicylindrical outer shape and is inserted into a semicylindrical aperture between two adjacent oil housings. Each of these inserts 54 has at the inside a channel of a cross-sectional shape substantially equal to that of the toothed belt 53. The covers 9b of the individual oil housings 9 maintain the inserts 54 of the adjacent spinning units in their proper position. These covers 9b are further provided with inwardly directed projections 55 which are located at a small distance above the toothed belt 53 so that the latter cannot disengage from the outer gear teeth 50 of the bearing disks 7.

In order to require for each spinning machine only one toothed belt 53 which has a length equal to that of the machine, suitable means may be provided for moving the toothed belt back and forth. This may be done, for example, in such a manner that at one end of the spinning machine the toothed belt 53 is mounted on spring means, while the other end of the belt is connected to a reciprocating drive member so that when the direction of travel of the toothed belt 53 is re-

versed, the direction of rotation of the bearing disks 7 will likewise be reversed.

When the bearing disks 7 of the embodiment of the invention as last described are rotated, their outer teeth 50 will take along the oil upwardly from its level within the oil housings 9 so that the oil will then flow over the lateral surfaces of the disks and thus insure additionally that these surfaces will be coated with oil. In this as well as in the other embodiments of the invention it is additionally possible to provide the bearing disks 7 with bucketlike projections which have the advantage that an increased flow of oil over these disks 7 will be attained and that the speed of rotation of bearing disks which are freely rotatable and not positively driven will be reduced by these bucketlike projections.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. A bearing unit for an open-end spinning turbine having a shaft, disposed in a frame, one end of which is operatively connected to the spinning turbine and the other end of which axially abuts against a thrust bearing provided with a bearing surface, said thrust bearing being disposed within a closed bearing housing containing a liquid lubricant, said end of said shaft extending to the inside of said housing through a wall thereof, said shaft being sealed toward the outside of said housing, and means for movably mounting said thrust bearing within said housing to continuously change the point of engagement of said other end of said shaft with said bearing surface.

2. A bearing unit as defined in claim 1, wherein the lower part of said bearing housing forms an oil bath and means are provided for conveying the oil from the oil bath to the thrust bearing.

3. A bearing unit as defined in claim 2, wherein said means for conveying the oil are mounted on a supporting element, said supporting element being loosely inserted into said bearing housing to be easily removable therefrom.

4. A bearing unit as defined in claim 3, wherein said oil conveying means comprise a material partly immersed in said oil bath and a supporting means is provided for supporting said material, said supporting means extending at least to an area adjacent said thrust bearing.

5. A bearing unit as defined in claim 3, wherein said supporting element is substantially U-shaped, said supporting element and said wick being disposed as a rider directly on said thrust bearing.

6. A bearing unit as defined in claim 3, wherein said housing is provided with a cover and wherein said supporting element is made of a flat material bent to a suitable shape secured to said cover.

7. A bearing unit as defined in claim 6, wherein said flat material forms a bent strip pivotably suspended at one end on said cover, said strip adjacent to said thrust bearing including means for clamping said wick.

8. A bearing unit as defined in claim 7, wherein said strip is also bent to form said means for movably mounting said thrust bearing.

9. A bearing unit as defined in claim 2, wherein said means for conveying the oil includes a U-shaped wick extending around the upper side of said thrust bearing with the two arms of said U-shaped wick being at least partly immersed into said oil bath.

10. A bearing unit as defined in claim 9, wherein said wick is held within a guide channel extending around the upper side of said thrust bearing, said guide channel being provided with a wall having openings through which the oil may pass from said wick to said thrust bearing.

11. A bearing unit as defined in claim 10, wherein said openings in said wall form slots extending radially toward said thrust bearing.

12. A bearing unit as defined in claim 2, wherein said means for conveying the oil includes a wick and means are provided for supporting said wick including a cage for holding said wick.

13. A bearing unit as defined in claim 12, wherein a cover is provided for said bearing housing and said cage is mounted on said cover.

14. A bearing unit as defined in claim 12, wherein said cage rests loosely on the bottom of said bearing housing and means are provided for maintaining said cage in a fixed position.

15. A bearing unit as defined in claim 2, wherein said oil conveying means comprise a felt-like layer and wherein at least one mounting plate is provided for serving as the supporting element of said felt-like layer.

16. A bearing unit as defined in claim 15, wherein said mounting plate consists of two plates and said felt layer is mounted between said two plates and wherein snap means are provided for connecting said two plates.

17. A bearing unit as defined in claim 2, wherein a plurality of spinning turbines are provided including thrust bearings, and wherein said oil bath is a common oil bath for the thrust bearings of said plurality of spinning turbines.

18. A bearing unit as defined in claim 17, wherein said common oil bath is disposed centrally of a machine which is provided with said plurality of spinning turbines on both sides.

19. A bearing unit according to claim 1, wherein said shaft is substantially horizontally disposed in said frame.

20. A bearing unit according to claim 19, wherein additional bearing means are provided for radially supporting said turbine shaft.

21. A bearing unit according to claim 20, wherein said additional bearing means includes air suspension bearings disposed along said shaft.

22. A bearing unit as defined in claim 1, wherein said thrust bearing comprises a bearing plate movably mounted in said housing.

23. A bearing unit as defined in claim 22, wherein said bearing plate consists of a slidably mounted bar, and wherein separate drive means are provided for reciprocating said bar relative to the axis to the end of said shaft.

24. A bearing unit according to claim 23, wherein at least said bearing surface consists of a plastic having antifriction properties.

25. A bearing unit as defined in claim 22, wherein at least the surface of the bearing plate engaging with the

end of the shaft consists of a plastic having antifriction properties.

26. A bearing unit as defined in claim 22, wherein said bearing plate consists of an endless belt of plastic having antifriction properties and wherein a separate driving means is provided for driving said endless belt during the rotation of said shaft, said endless belt being disposed at a right angle to said shaft while bearing upon the end thereof and also upon the end of a shaft of at least one other additional spinning turbine extending parallel thereto.

27. A bearing unit as defined in claim 22, including an additional shaft wherein said bearing plate consists of a circular disk coaxially secured to one end of said additional shaft, the axes of said additional shaft and said shaft of said spinning turbine being disposed in substantially parallel spaced relationship to each other, and wherein a separate drive means is provided, said separate drive means being operatively connected with said additional shaft to drive said additional shaft and said circular disk secured thereto.

28. A bearing unit as defined in claim 22, wherein the end of said turbine shaft abuts said bearing surface at an angle differing slightly from a right angle.

29. A bearing unit as defined in claim 22, wherein said bearing surface is slightly conical.

30. A bearing unit as defined in claim 22, wherein said bearing plate consists of at least two parts, one of said parts consisting of a disk of plastic engaging upon the end of the turbine shaft and the other part consisting of a metal disk.

31. A bearing unit as defined in claim 30, wherein said disk of plastic consists of a sheet of plastic which is secured to the metal disk.

32. A bearing unit as defined in claim 22, wherein said bearing plate is provided with paddlelike projections for at least one of retarding the rotary movement of the disk and for taking along oil from said oil bath.

33. A bearing unit according to claim 22, wherein said housing is provided with a removable cover portion provided with means for limiting the lateral movement of said thrust bearing.

34. A bearing unit according to claim 33, wherein said frame includes an overflow channel and a collecting chamber communicating with said oil bath.

35. A bearing unit according to claim 22, wherein a plurality of spinning turbines are provided each having an oil bath and means are provided for communicating with each of the oil baths.

36. A bearing unit as defined in claim 22, wherein said bearing plate is rotatably mounted with the axes of said shaft and said bearing plate being substantially parallel but spaced from each other, said shaft eccentrically engaging said bearing surface, and wherein separate drive means are provided for rotating said bearing plate independently from the rotation of said shaft.

37. A bearing unit according to claim 36, wherein at least said bearing surface consists of a plastic having antifriction properties.

38. A bearing unit as defined in claim 36, wherein a plurality of adjacent spinning turbines are provided, each of said turbines being provided with a turbine shaft and an additional shaft, each of said additional shafts having secured thereto a substantially disk-shaped bearing plate, and wherein said drive means are

common means for driving simultaneously said plurality of adjacent spinning turbines.

39. A bearing unit as defined in claim 38, wherein each of said bearing disks is provided with outer peripheral teeth, and wherein said common drive means includes an elongated element having teeth engaging with the teeth of said bearing disks, said elongated element being movably mounted to drive all of said bearing disks.

40. A bearing unit as defined in claim 34, wherein said outer teeth on said bearing disks form worm teeth and said common drive element consists of a shaft having associated worm teeth engaging with the worm teeth of said bearing disks so as to rotate the latter when said last mentioned shaft is rotated.

41. A bearing unit as defined in claim 40, wherein said lastmentioned shaft is divided into a plurality of sections, and wherein connecting means are provided for connecting said plurality of sections.

42. A bearing unit as defined in claim 38, wherein said common drive element consists of a flexible toothed belt the teeth of which engage with said outer teeth on said bearing disks for rotating said disks when said belt is driven in a longitudinal direction.

43. A bearing unit as defined in claim 42, wherein a reciprocating drive means is provided operatively interconnected with one end of said toothed belt for positively moving said additional shaft in one longitudinal direction, the other end of said toothed belt being connected to a resilient means for positively moving said belt in the opposite longitudinal direction.

44. A bearing unit as defined in claim 42, wherein said additional shafts of said plurality of adjacent spinning turbines are mounted in separate bearing housing, each of said separate housings forming oil baths, and wherein guide means are provided between adjacent housings for guiding said toothed belt.

45. A bearing unit for an open-end spinning turbine having a shaft, disposed in a frame, one end of which is operatively connected to the spinning turbine and the other end of which axially abuts against a thrust bearing, said thrust bearing being disposed within a closed bearing housing containing a liquid lubricant, said end of shaft extending to the inside of said housing through a wall thereof, said shaft being sealed toward the outside of said housing, said thrust bearing comprises a bearing plate rotatably mounted in said housing is movable during the rotation of said shaft, the point of engagement of the end of said shaft with the surface of said bearing plate changing continuously on this surface, the axes of said shaft and said bearing plate being substantially parallel but spaced from each other, said bearing plate being driven by the engagement of the end of said shaft with said surface of the bearing plate facing said end in an off-center position of said surface.

46. A bearing unit as defined in claim 45, wherein said bearing plate forms a disk freely rotatable in said housing and wherein the space between the axes of said shaft and said disk varies during the rotation of said disk with said axes always spaced at a predetermined minimum distance.

47. A bearing unit according to claim 46, wherein at least said bearing surface consists of a plastic having antifriction properties.

48. A bearing unit for an open-end spinning turbine having a shaft, disposed in a frame, one end of which

15

is operatively connected to the spinning turbine and the other end of which axially abuts against a thrust bearing, said thrust bearing being disposed within a closed bearing housing containing a liquid lubricant, said end of said shaft extending to the inside of said housing 5 through a wall thereof, said shaft being sealed toward the outside of said housing said thrust bearing comprising a bearing plate movably mounted in said housing, said bearing plate being movable during the rotation of said shaft with the point of engagement of the end of 10

16

the shaft with the surface of the bearing plate changing continuously on this surface, and an abutment, wherein the end of said shaft abutting against said surface of said bearing plate thereby presses the opposite surface of said bearing plate in the axial direction against said abutment.

49. A bearing unit according to claim 48, wherein said abutment includes an axially adjustable bearing screw disposed in said frame.

* * * * *

15

20

25

30

35

40

45

50

55

60

65