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(54) **A tool for, and a method of, removal of a bearing from a bearing housing**

(57) A bearing 2 is removed from a bearing housing 4 of a laundry appliance drum 1 by driving axially an annular thrust region e.g. sleeve 17, against an end face of the bearing. This is effected by rotation of an internally threaded member, such as member 18, relative to an externally threaded member e.g. bolt 16. One of the threaded members, in this case member 18, has anti-

rotation means 19 to prevent rotation of member 18 relative to the bearing housing so that the bearing can be removed by rotary force being applied only to the bolt 16 by means of say a T-bar 27. The invention permits bearings to be removed by applying rotary force only to one of the members. Previously, rotary force had to be applied to both members, in opposite directions.

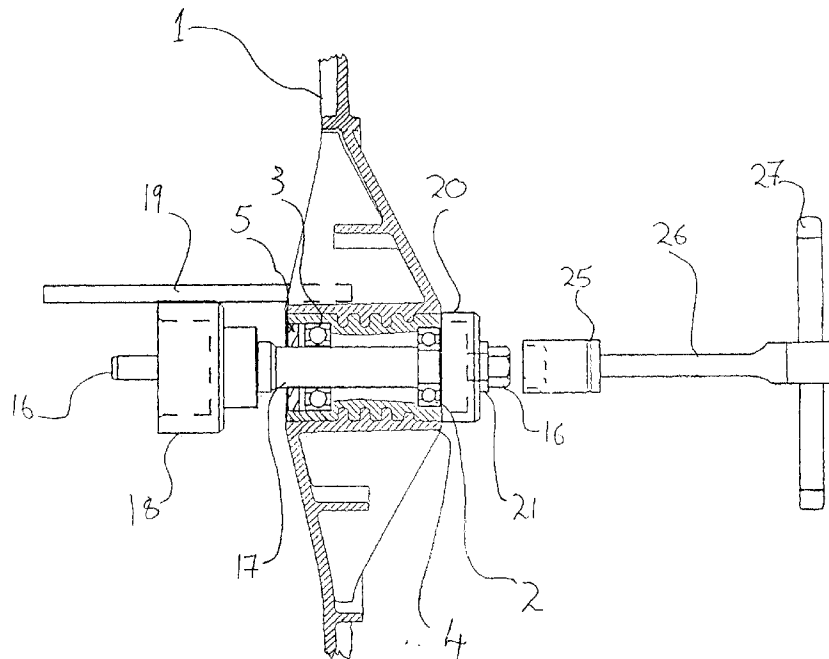


FIG. 5

Description

This invention relates to a tool for, and a method of, removing of a bearing from a bearing housing of a laundry appliance drum.

Laundry appliances typically have a drum, into which laundry can be placed, and which can rotate within an outer drum which remains stationary in the appliance. A shaft on the laundry drum, which provides the axis of rotation, extends through the outer drum. Bearings are provided for the shaft, which bearings are located in a housing in the outer drum. Typically, two bearings are provided to distribute the load on the shaft.

In time, the bearings wear down and need to be replaced. Conventionally, a service engineer removes panels of the cabinet of the laundry appliance to gain access to the laundry drum and shaft, which the engineer takes out of the appliance. The engineer subsequently removes the bearings individually by inserting a bolt through the bore of a bearing and rotating a nut on the bolt, which pushes a collar axially along the bolt. The head of the bolt or, alternatively, a collar on the head of the bolt provides the thrust needed to pull out the bearing, whilst a tube around the bolt provides a reaction force.

In order to carry out this procedure, the engineer uses a spanner to turn the nut whilst applying an opposite torque to the bolt by means of, for example, a T-bar put through a hole in the bolt, in order to prevent rotation of the bolt.

A problem which may be encountered with this tool and this method of removing bearings is that the application of two opposite turning moments is an unwieldy operation. The housing for the bearings is shaped such that both bearings have to be pulled out of the housing, i.e. removed in opposite directions. Therefore, to remove the bearing nearest the interior of the outer drum, the engineer has to utilise the tools within the confined space of the outer drum. As a result, strain injuries to the wrists of engineers have been reported.

The invention provides a tool for the removal of a bearing from a bearing housing of a laundry appliance drum, the tool comprising an annular thrust region for engaging an end face of the bearing, the annular thrust region being drivable axially by rotation of an internally threaded member relative to an externally threaded member, characterised by one of the threaded members having anti-rotation means to prevent rotation of that threaded member relative to the bearing housing so that the bearing can be removed by rotary force being applied only to the other threaded member.

The provision of anti-rotation means permits an engineer to remove bearings by applying rotary force only to one of the members. This facilitates the removal of the bearings and reduces the likelihood of injury.

Preferably, the anti-rotation means comprises a bar which can engage in a recess in the laundry appliance drum. Such recesses are a feature of conventional

moulded polypropylene outer drums, and cast alloy drum backplates.

Advantageously, the tool is arranged so that the rotary force can be applied from the back of the appliance, a pulling force being applied to one bearing and a pushing force to the other. This further facilitates the removal of bearings by the engineer, and further reduces the likelihood of injury.

The annular thrust region can comprise a sleeve on the externally threaded member. The sleeve can have a different diameter at each end portion, so that only one sleeve is required to remove both bearings.

The externally threaded member can comprise a bolt which can extend through a bore of the bearing.

The tool can also comprise a receptacle for a removed bearing, such as a cup. The receptacle can be arranged to fit co-axially on the bolt.

The invention further provides a method of removing a bearing from a bearing housing of a laundry appliance drum, the method comprising driving an annular thrust region against an end face of the bearing by applying a rotary force such that an internally threaded member rotates relative to an externally threaded member, one of the threaded members having anti-rotation means to prevent rotation of that threaded member relative to the bearing housing so that the bearing is removed by applying a rotary force only to the other threaded member.

Preferably, the rotary force is applied from the back of the appliance.

The rotary force is advantageously applied to the externally threaded member by employing a T-bar. This reduces the likelihood of injury to the engineer, as it is easier to provide a rotary force by means of a T-bar than by means of a spanner, which was commonly used in the prior art.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a sectional side view of a prior art tool being employed in the removal of a rear bearing of an outer drum;

Figure 2 is a sectional side view of the prior art tool of Figure 1 being employed in the removal of an inner bearing and a water seal of the outer drum;

Figure 3 is a perspective drawing showing components of a tool constructed according to the invention;

Figure 4 is an exploded perspective view of an outer drum of a laundry appliance, partly cut away, and parts of the tool of Figure 3 employed to remove a rear bearing;

Figure 5 is a cut-away section showing the tool of

Figure 6 being employed to remove the rear bearing;

Figure 6 is an exploded perspective view of the outer drum of Figure 4 and parts of the tool of Figure 3 employed to remove an inner bearing and water seal;

Figure 7 is a cut-away section showing the tool of Figure 6 being employed to remove the inner bearing and water seal;

Figure 8 is an exploded perspective view of the outer drum of Figure 4 and parts of the tool of Figure 3 employed to refit an inner bearing and a rear bearing;

Figure 9 is a cut-away section showing the tool of Figure 8 being employed to refit the bearings;

Figure 10 is an exploded perspective view of the outer drum of Figure 4 and parts of the tool of Figure 3 employed to reposition a water seal for the drum; and

Figure 11 is a cut-away section showing the tool of Figure 10 being employed to reposition the water seal.

Like reference numerals have been given to like parts throughout the drawings.

Referring to Figure 1, an outer drum 1 of a laundry appliance is shown, the rest of the appliance being omitted throughout the drawings for clarity. The outer drum 1 has two bearings, a rear bearing 2 and an inner bearing 3, which are located co-axially in a housing 4, and through which a shaft of a laundry drum can extend. The bearings 2 and 3 are fixed in the housing by adhesive. A water seal 5 is also provided for the shaft and this is located at one end of the housing, adjacent to the inner bearing 3. In order to gain access to the bearings, the engineer removes panels of the cabinet of the appliance, and pulls out the laundry drum and shaft. A prior art tool, indicated generally by the reference numeral 6, is shown in a first configuration for removing the rear bearing 2.

In this configuration, the tool 6 comprises a bolt 7 having a head 8, a tube 9, the bore of which is larger than the outer diameter of the larger bearing, collars 10 and 11, washers 12 and 13 and a nut 14. The bolt 7 has been inserted through the bores of the bearings 2 and 3 from the interior of the outer drum 1, the diameter of the head 8 of the bolt being larger than the bore of the rear bearing 2, so that the head engages an end face of this bearing. Collar 10 is slid onto the bolt, to centralise it, from the back of the appliance. Tube 9 is put in position over the collar 10, co-axially with the bolt 7. Washer 12, which has a larger outer diameter than the tube 9,

is slid along the bolt 7 to meet the tube, as is collar 11 and washer 13. Lastly, the internally threaded nut 14 is put on the threaded region of the bolt 7.

The service engineer takes a tool, such as a T-bar (not shown), and fits this onto the end of the bolt nearest the nut. Then, the engineer turns the nut 14 until it is fingertight, whilst applying an opposite turning moment to the T-bar to prevent the bolt 7 from rotating.

In order to remove the rear washer 2, the engineer employs another tool, such as a spanner (also not shown), to turn the nut 14 whilst maintaining an opposite torque to the T-bar to prevent rotation of the bolt 7. As the nut 14 progresses along the bolt 7, it pushes washer 13 against collar 11 which, in turn, is pushed against the washer 12. Washer 12 engages an end face of the tube 9, the other end face being pressed against an end of the housing 4. Further rotation of the nut 14 causes the bolt 7 to move axially relative to the nut, the head 8 of the bolt providing the thrust needed to pull out the rear bearing 2 from the housing 4.

Figure 2 shows a second configuration of the prior art tool, this configuration being used to remove the inner bearing 3 and water seal 5. In this configuration, the tool 6 comprises bolt 7 having head 8, tube 9, collars 11 and 15, washers 12 and 13 and nut 14. In this instance, the bolt 7, onto which collar 15 is placed, is inserted through the housing 4 from the back of the appliance, so that the major portion of the bolt is within the outer drum 1. The collar 15 is smaller than the narrowest part of the housing 4, but has an end face of larger diameter than the bore of the inner washer 3, so that the collar can engage an end face of the inner washer. The tube 9, washer 12, collar 11 and washer 13 are put on the bolt 7 as in the Figure 1 arrangement. The engineer employs the spanner to tighten the nut 14 whilst applying an opposite torque to the bolt 7 to prevent rotation of the bolt, in the manner described above with reference to Figure 1. The thrust required to pull the bearing 3 and seal 5 out of the housing 4 is, in this instance, provided by the collar 15.

The manipulation of the spanner and T-bar by the engineer can be cumbersome, as well as time-consuming. This is particularly so during removal of the inner bearing, as the operation has to be carried out within the confined region of the outer drum.

The constituent parts of a tool constructed according to the invention are shown in Figure 3. The main features of the tool are an externally threaded bolt 16, a sleeve 17, which has a different outer diameter at each end, and an internally threaded member 18 having an anti-rotation bar 19. A cup 20, washers 21 and 22 and a resiliently biased split collar 23 are also provided to facilitate removal of the bearings.

Figure 4 shows an outer drum 1, part of which has been cut away to show the interior of the drum. The drum 1 is made of polypropylene, and the closed end of the drum comprises a plurality of spaced segments 24a, 24b, 24c, 24d and 24e, which structure makes this drum

stronger, and easier to manufacture, than a polypropylene drum having a smooth interior. In order to remove the rear bearing 2 from the drum, the engineer firstly takes the bolt 16 and lubricates it with, for instance, silicone grease. He then slides washer 21 and cup 20 onto the bolt 16, and inserts the bolt through the bores of the bearings 2 and 3 from the back of the laundry appliance. The engineer fits the sleeve 17 onto the bolt, pushing it through the bore of the water seal 5 and the inner bearing 3 from the interior of the drum 1. Finally, the internally threaded member 18 having the anti-rotation bar 19 is pushed onto the bolt 16 until the threads on the member meet the threads on the bolt. The anti-rotation bar 19 is placed in the gap between segments 24a and 24e although, of course, the bar can be put into any of the gaps between the segments.

The engineer then pushes socket 25, extension 26 and T-bar 27 onto the head of the bolt 16, and rotates the T-bar clockwise, working from the back of the appliance.

As the bolt 16 is turned, the internally threaded member 18 tries to turn with it. However, the bar 19 attached to member 18 engages in an edge of segment 24e, thereby preventing further rotation of this member. The threads on the bolt 16 engage in the internal threads of the member 18, and axial movement of the bolt takes place as the bolt is turned.

Figure 5 is a cut-away section, showing removal of the rear bearing 2 in progress. In this drawing, the bolt 16 has undergone axial motion towards the interior of the drum, to a point at which the open end of the cup 20 abuts an end of the housing 4. The cup 20 prevents further axial motion of the bolt 16 into the interior of the drum 1. Further rotation of the bolt 16 causes axial motion of the member 18 towards the housing 4. This motion drives the sleeve 17 against an end face of the rear bearing 2 with sufficient thrust to pull the bearing out of the housing 4 and into the cup 20. Removal of the rear bearing 2 and the tool 6 is effected by the engineer rotating the T-bar 27 anti-clockwise.

Figures 6 and 7 illustrate removal of the inner bearing 3 and washer 5. Referring to Figure 6, the service engineer firstly puts washer 21 and sleeve 17 onto the bolt 16 to meet the head of the bolt, and then inserts the bolt through the housing and the bore of bearing 3 from the back of the appliance, as before. The end portion of sleeve 17 arranged to contact an end face of bearing 3 has a larger diameter than the diameter of the bore of the bearing. One end portion of the internally threaded member 18 has a cup 28, the member being pushed onto the bolt, from within the drum 1, such that the open end of the cup faces the housing 4.

The engineer fits the socket 25, extension 26 and T-bar 27 onto the end of the bolt 16, as before. Then, working from the back of the appliance, the engineer rotates T-bar 27, to turn bolt 16. The anti-rotation bar 19 on the member 18 engages against an edge of segment 24e, and thereby prevents rotation of the member.

Therefore, rotation of the bolt 16 causes it to move axially towards the interior of the drum 1, as before. In this instance, the axial motion of the bolt 16 causes the sleeve 17 to be pushed against the inner bearing, as shown in Figure 7.

As the engineer continues to turn the T-bar 27, the sleeve is thrust against an end face of the inner bearing 3 with sufficient force to displace the bearing 3 and seal 5 from housing 4, into the cup 28. The engineer subsequently rotates the T-bar anti-clockwise in order to permit removal of the tool and bearing from the appliance.

Occasionally, after carrying out the above operation to remove inner bearing 3, the engineer may find that the outer race of the bearing remains in the housing 4. In this situation, split collar 23 is employed. The tool is set up as in Figure 6, the split collar 23 being pushed onto the wider end of the sleeve 17. The springs in collar 23 push it outwardly, so as to grip the inner surface of the outer race of bearing 3. The tool is then used as for the removal of inner bearing 3.

The bearings 2 and 3 can be put back into the housing 4 at the same time, which procedure is illustrated by Figures 8 and 9. The engineer firstly cleans the bearings 2 and 3 and coats their outer surfaces with a sealant. The bearings are then tapped lightly into the housing 4 so that their end faces are located by the housing. The engineer slides washer 21 onto the bolt 16, followed by the cup 20. In this arrangement of the tool, the cup is turned around so that its open end faces the head of the bolt. The bolt is introduced through the bores of the bearings, and through the housing 4, from the back of the appliance. The internally threaded member 18 is pushed onto the bolt 16, the cup 28 facing outermost. The engineer then fits socket 25, extension 26 and T-bar 27 onto the end of the bolt 16, and rotates the T-bar clockwise from the back of the appliance. The anti-rotation bar 19 engages and effects axial motion of bolt 16 towards the interior of the drum 1 as before, so that the closed end of the cup 20 pushes against an end face of the rear bearing 2. Consequently, the rear bearing 2 is driven into the housing 4. Continued rotation of the T-bar 27 causes the member 18 to move axially along the bolt 16, which motion drives inner bearing 3 into position in the housing 4. Anti-clockwise rotation of the T-bar 27 permits removal of the tool.

The water seal 5 for the shaft of the laundry drum can be refitted in a similar fashion, as illustrated by Figures 10 and 11. The engineer fits the washer 21 and cup 20 to the bolt 16 in the same manner as for refitting of the bearings. The engineer inserts the bolt 16 through the bores of the bearings 2 and 3, and slides the water seal 5, washer 22 and member 18 onto the bolt, the cup 28 on the member 18 facing outwards as before. The socket 25, extension member 26 and T-bar 27 are then fitted onto the bolt 16. Rotation of the T-bar 27 causes the cup 20 to be pressed against the housing, with subsequent axial motion of the member 18, so that washer 21 drives the water seal 5 into position in the housing 4.

The engineer now pushes the shaft of the laundry drum back into position, and refits the casing of the laundry appliance.

By employing the tool and the method of the invention, the likelihood of injury to a service engineer during removal and refitting of bearings is diminished. The time savings gained through use of the tool and the method permit the cost of servicing laundry appliances to be reduced.

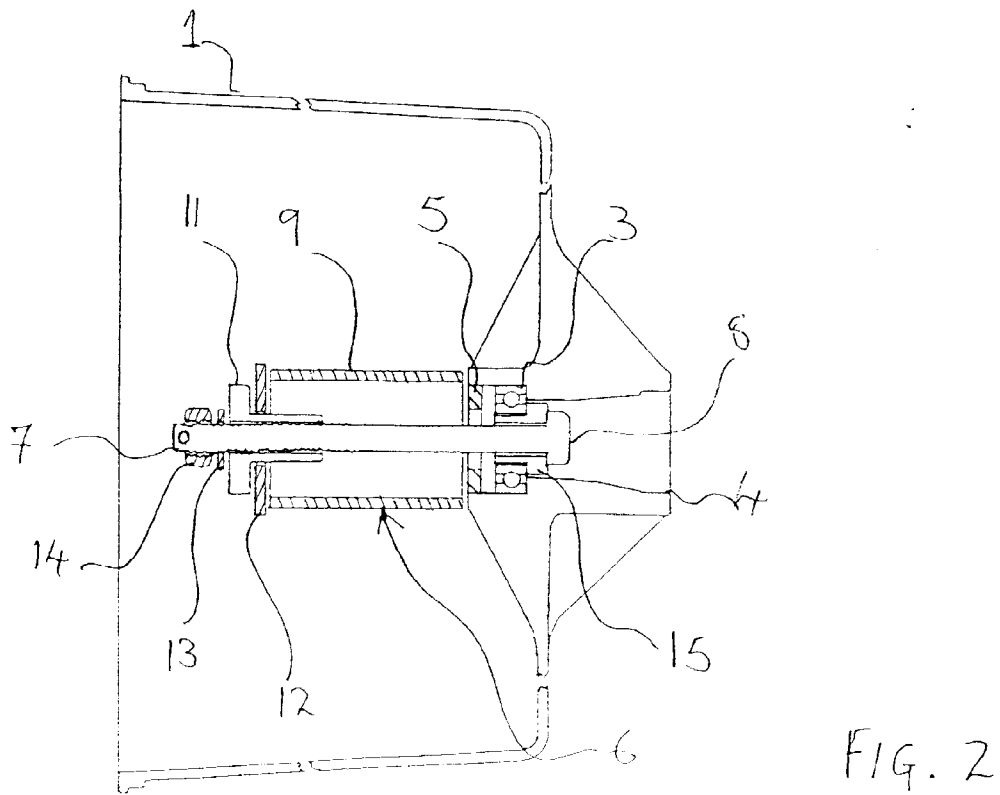
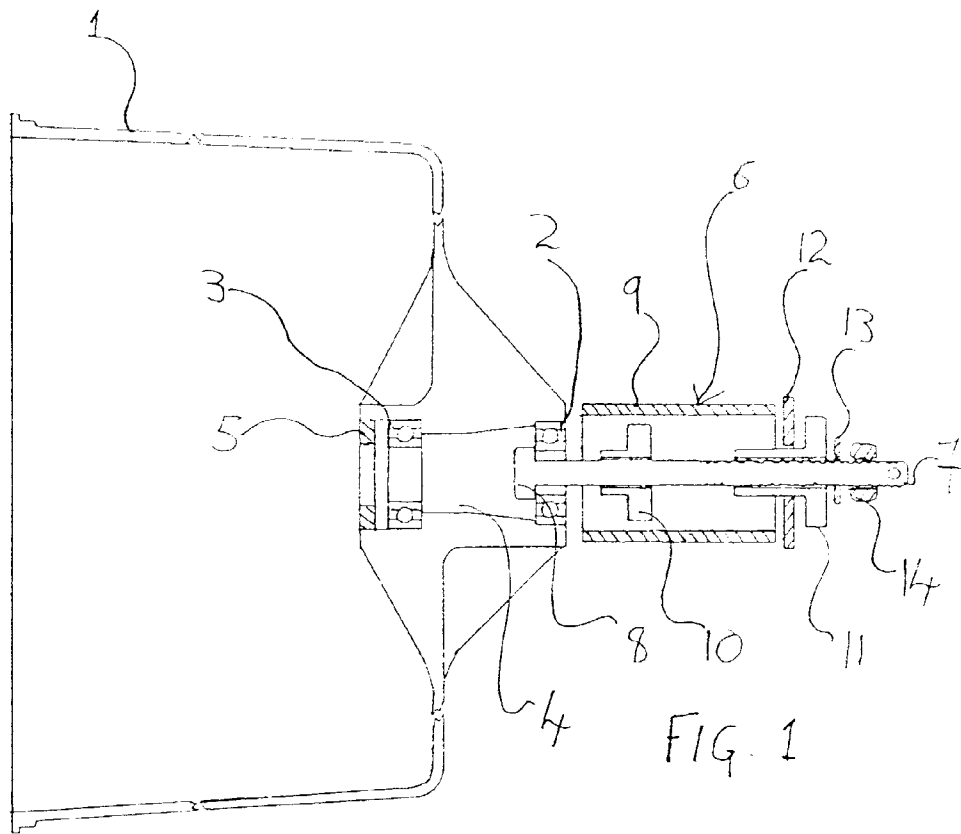
The bolt 16 is manufactured preferably from high tensile steel, although other materials can be used. The anti-rotation bar 19 is shown welded to the internally threaded member 18 in these drawings, although other methods of attachment may be employed.

In addition, the invention is not limited to the anti-rotation means being fixed to the internally threaded member; means may be provided to prevent rotation of the externally threaded member i.e. the bolt.

The bolt may be rotated by means other than a T-bar, for instance a power tool with an appropriate attachment.

Claims

1. A tool for the removal of a bearing (2, 3) from a bearing housing (4) of a laundry appliance drum (1), the tool comprising an annular thrust region (17) for engaging an end face of the bearing, the annular thrust region being drivable axially by rotation of an internally threaded member (18) relative to an externally threaded member (16), characterised by one of the threaded members having anti-rotation means (19) to prevent rotation of that threaded member relative to the bearing housing so that the bearing can be removed by rotary force being applied only to the other threaded member.
2. A tool as claimed in claim 1, characterised in that the anti-rotation means comprises a bar (19) which can engage in a recess in the drum.
3. A tool as claimed in claim 1 or 2, arranged so that the rotary force can be applied from the back of the appliance.
4. A tool as claimed in claim 1, 2 or 3, characterised in that the annular thrust region comprises a sleeve (17) on the externally threaded member (16).
5. A tool as claimed in any one of claims 1 to 4, characterised in that the externally threaded member comprises a bolt (16) which can extend through a bore of the bearing.
6. A tool as claimed in any one of claims 1 to 5, characterised by a receptacle (20, 28) for a removed bearing.
7. A tool as claimed in claim 6, characterised in that the receptacle comprises a cup (20, 28), through which the externally threaded member (16) extends.
8. A method of removing a bearing (2, 3) from a bearing housing (4) of a laundry appliance drum (1), the method comprising driving an annular thrust region (17) against an end face of the bearing by applying a rotary force such that an internally threaded member (18) rotates relative to an externally threaded member (16), characterised by one of the threaded members having anti-rotation means (19) to prevent rotation of that threaded member relative to the bearing housing so that the bearing is removed by applying a rotary force only to the other threaded member.
9. A method as claimed in claim 8, characterised in that the rotary force is applied from the back of the appliance.
10. A method as claimed in claim 8 or 9, characterised in that the rotary force is applied to the externally threaded member (16).
11. A method as claimed in claim 10, characterised in that the rotary force is applied by means of a T-bar (27).



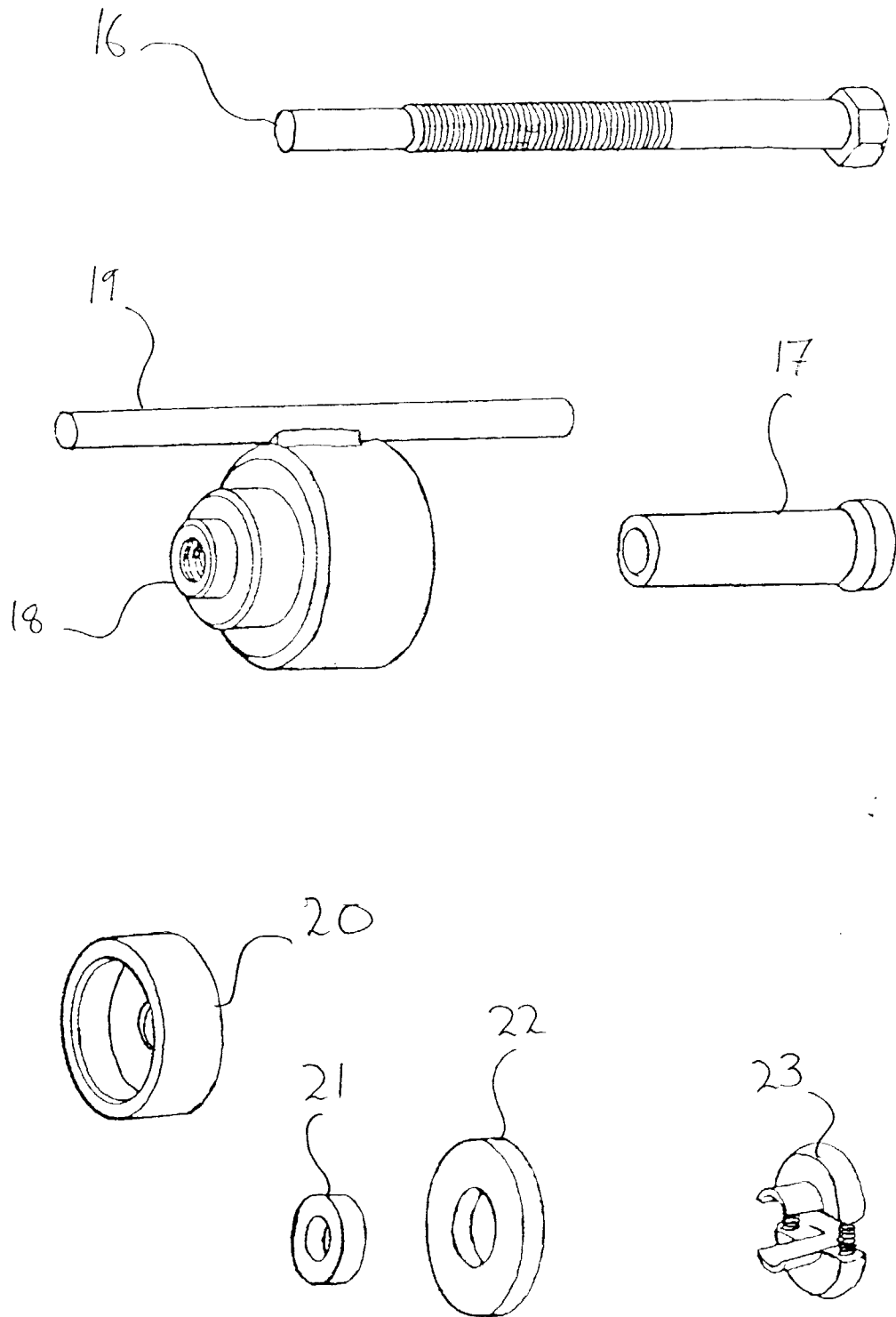


FIG. 3

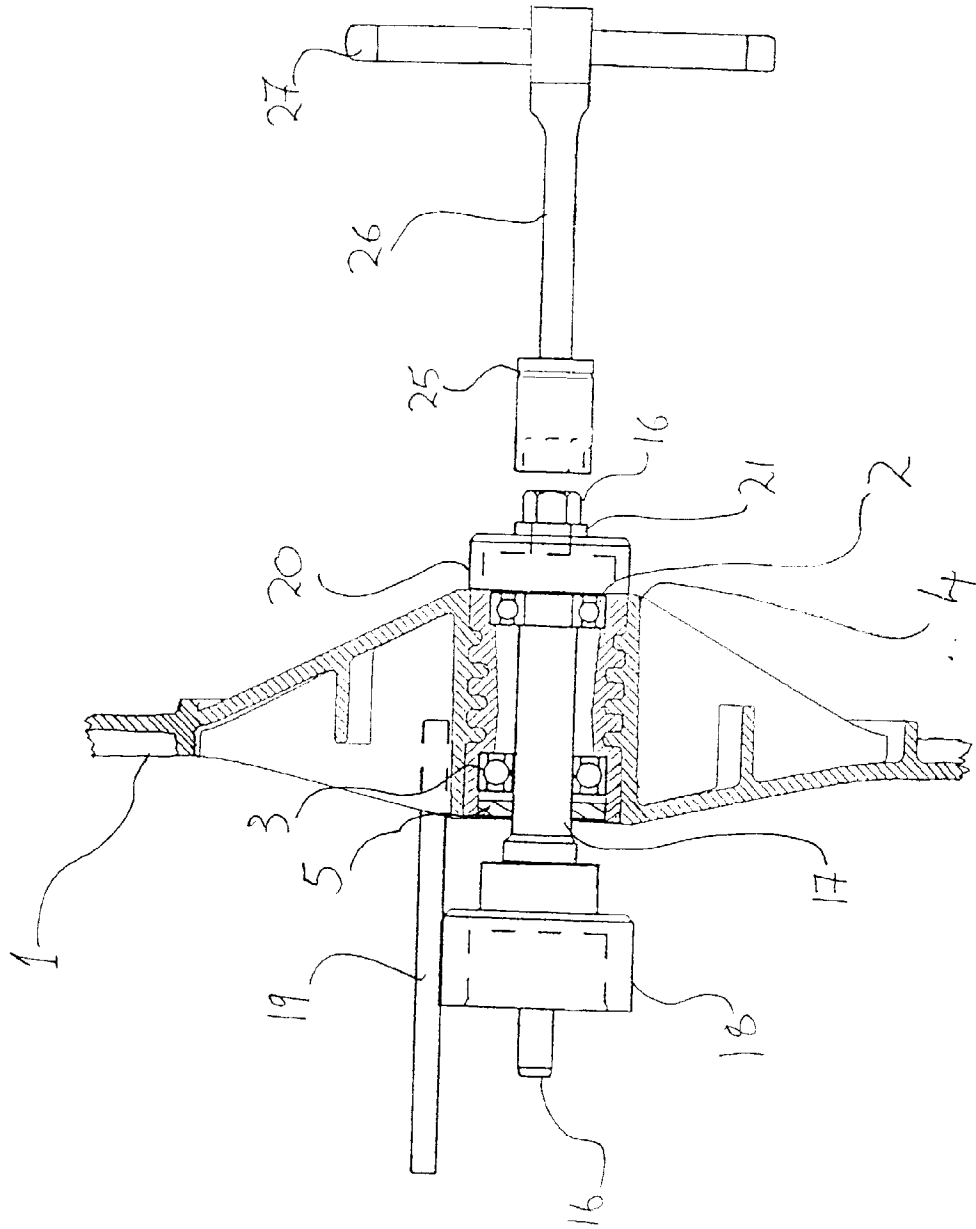


FIG. 5

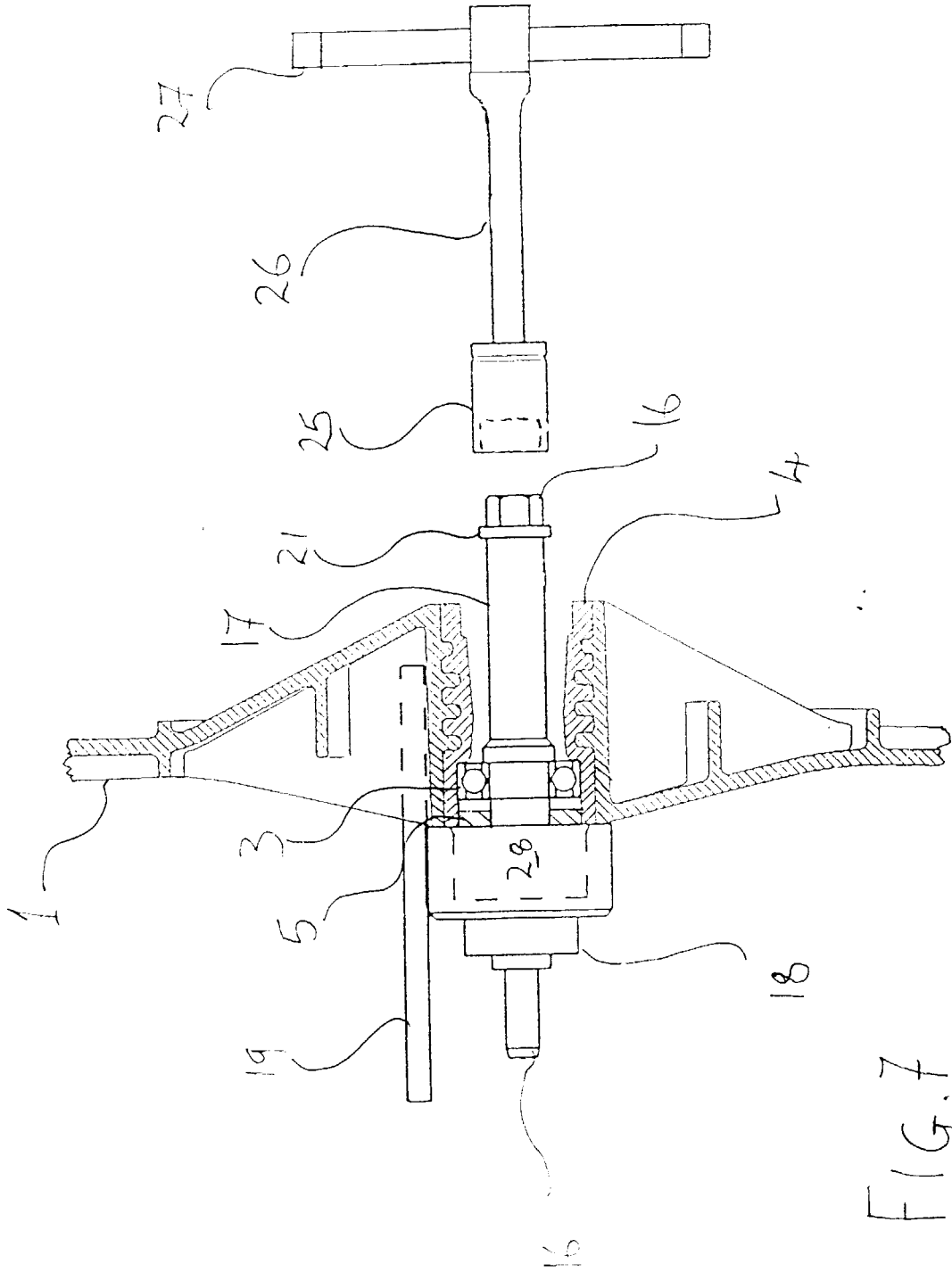


FIG. 7

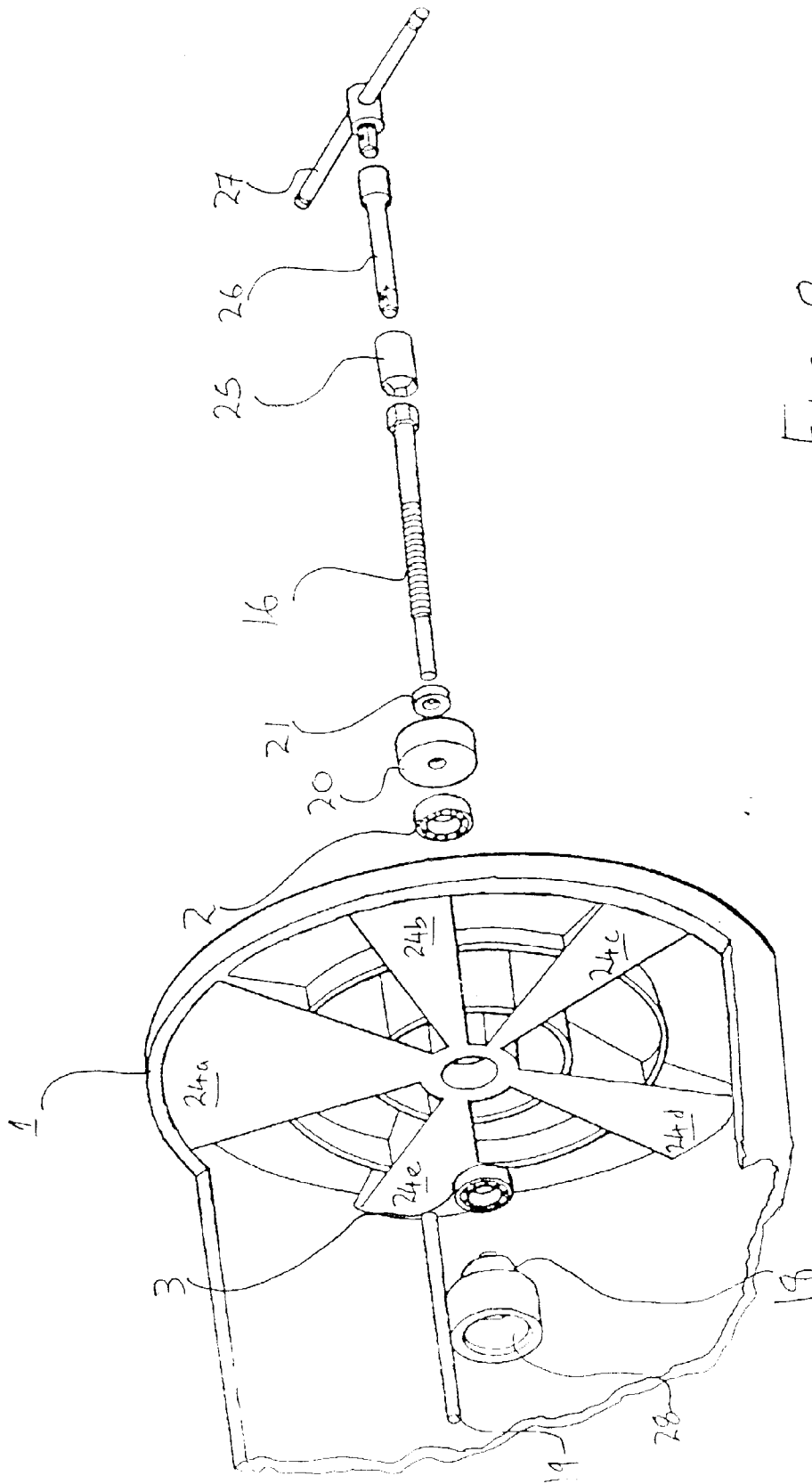


FIG. 8

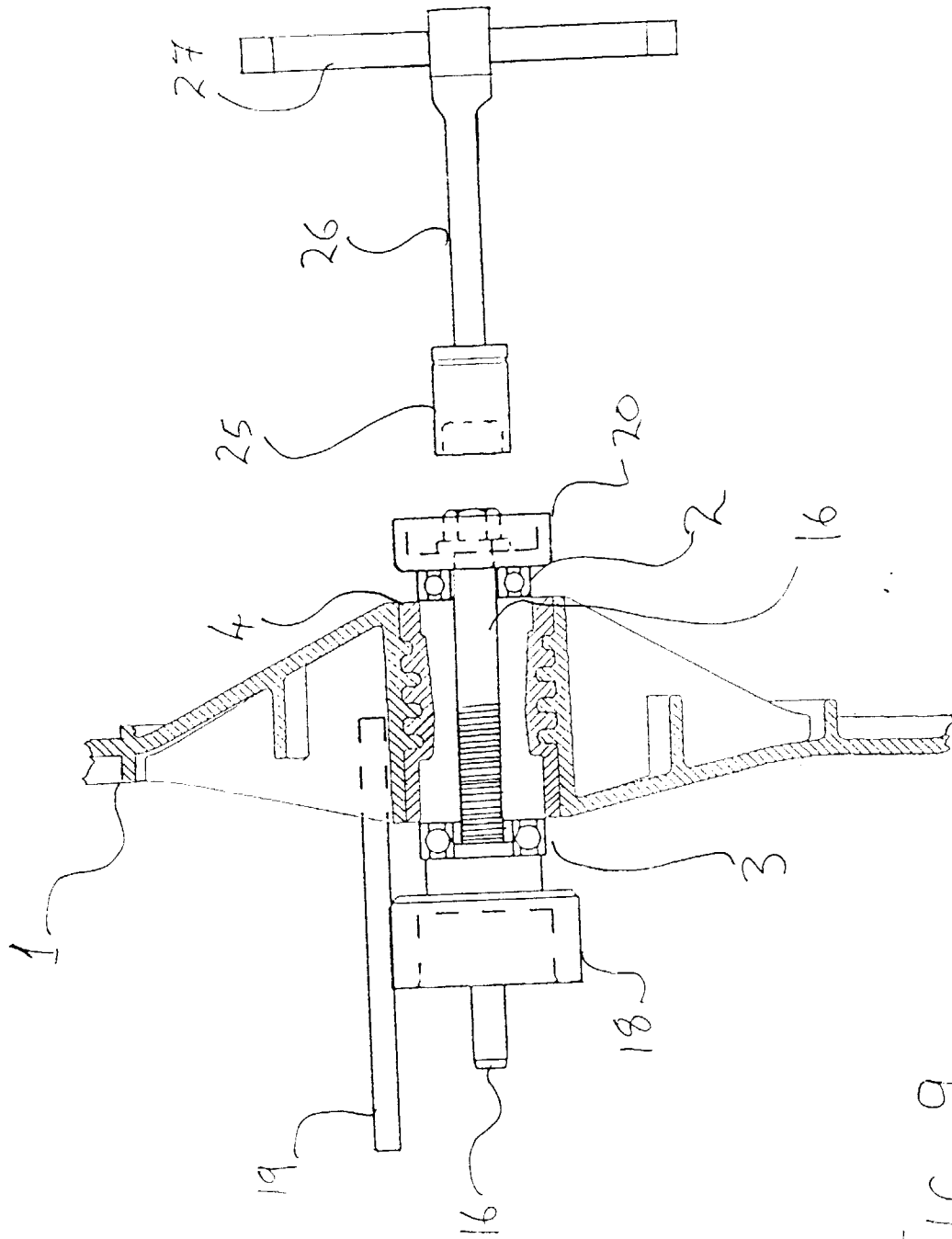


FIG. 9

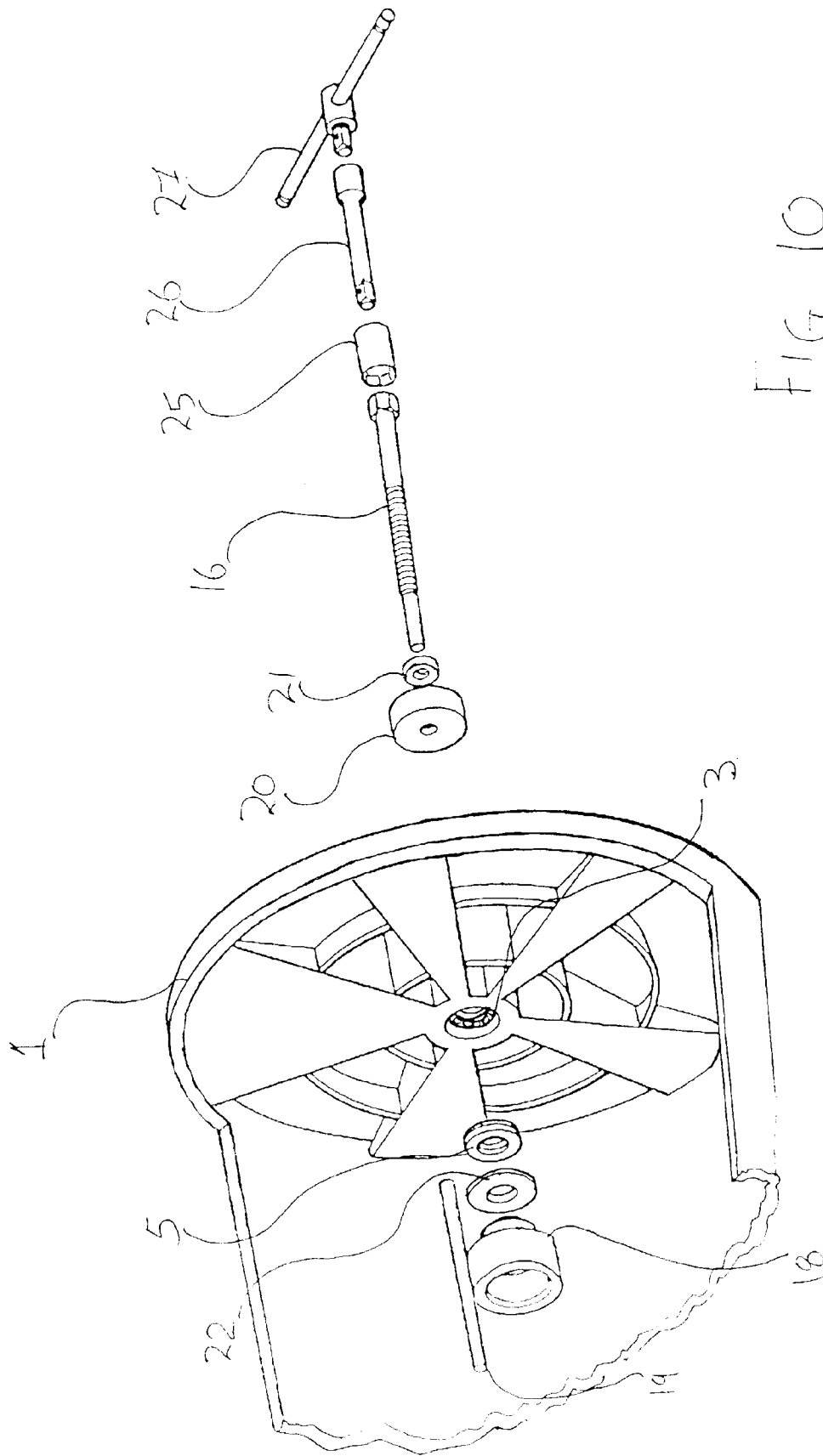


FIG 10

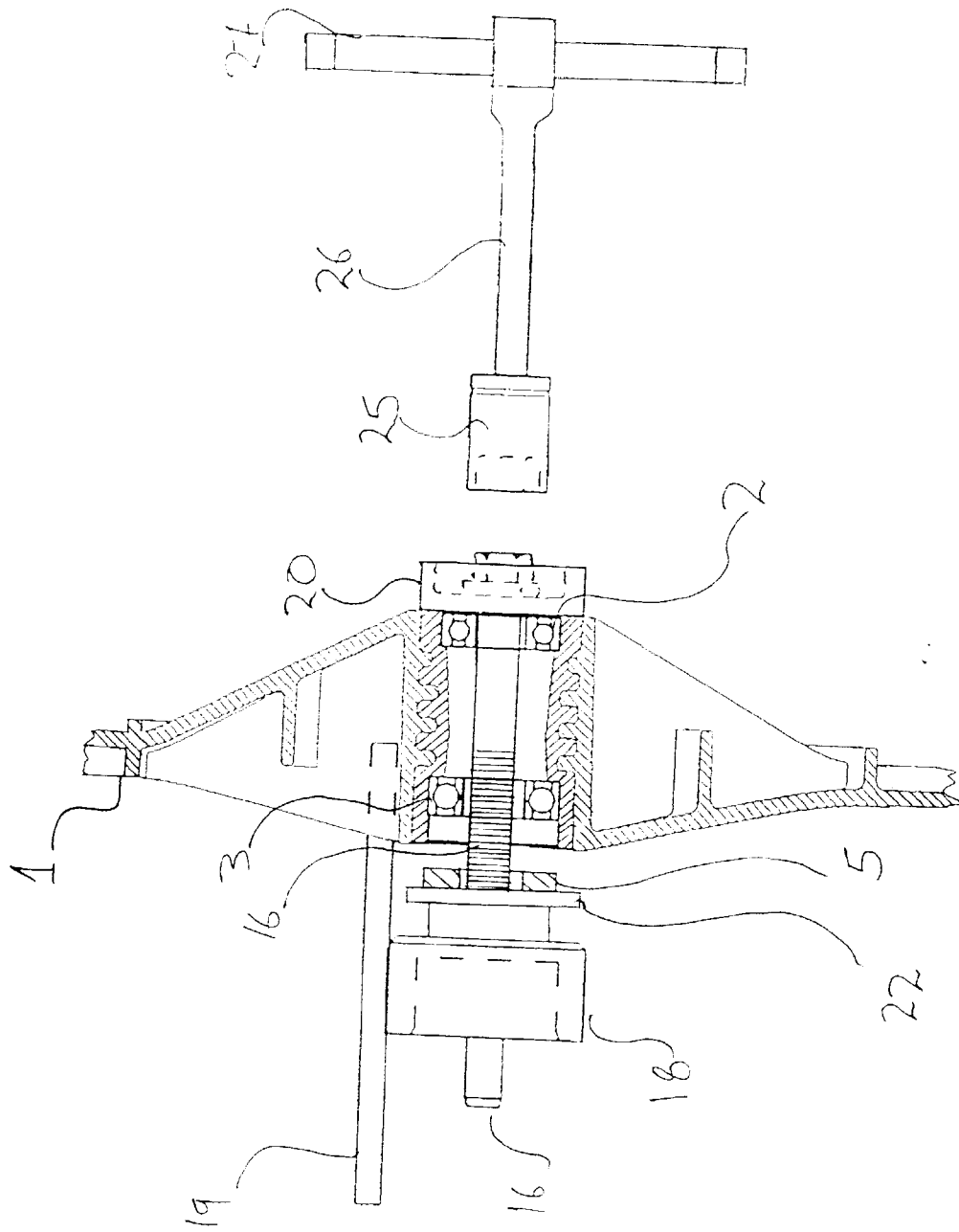


FIG. 11