May 9, 1950 C. J. KEIM 2,507,256

WELL DRILLING APPARATUS

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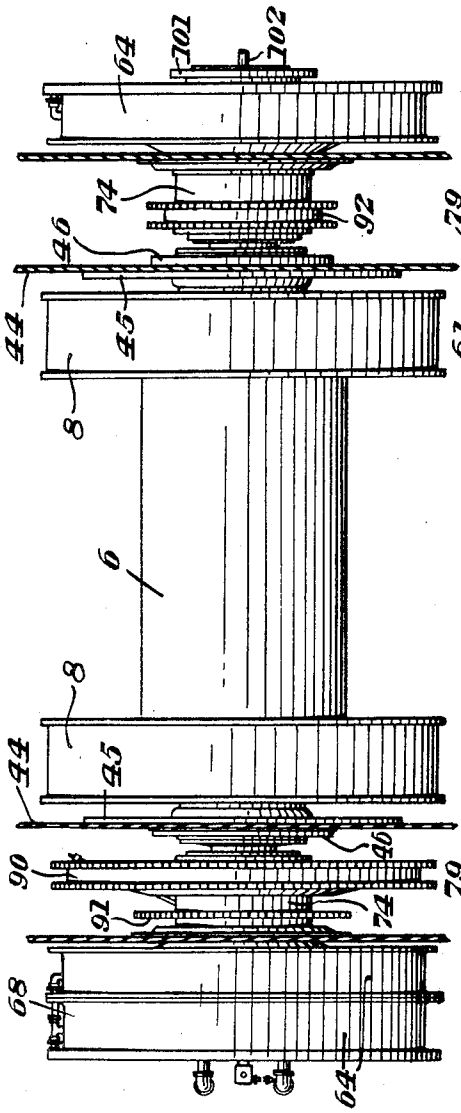


Fig. 1.

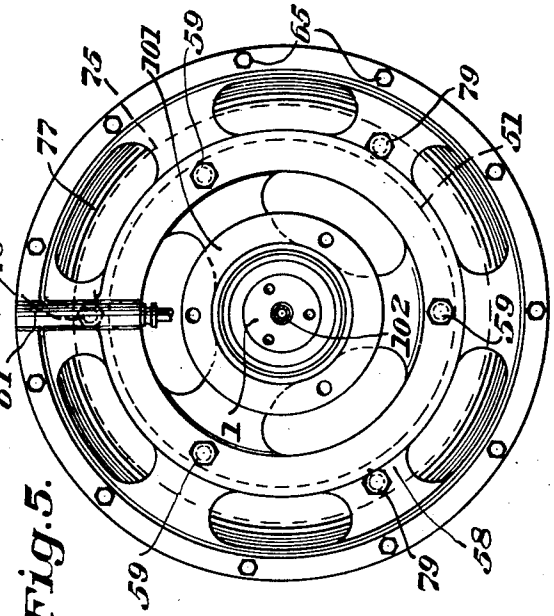


Fig. 5.

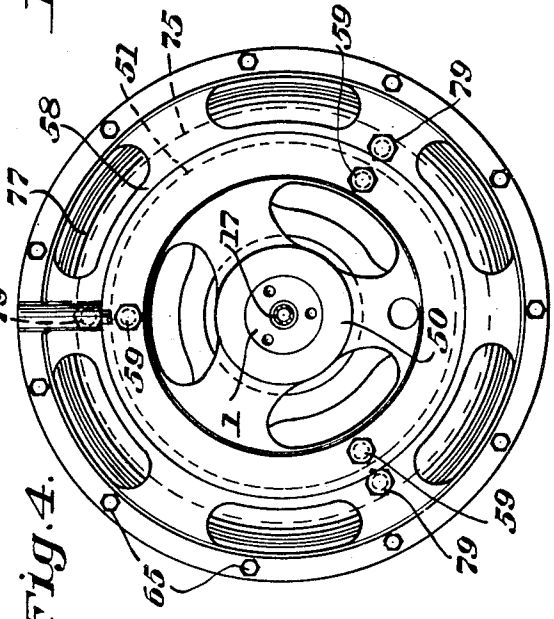


Fig. 4.

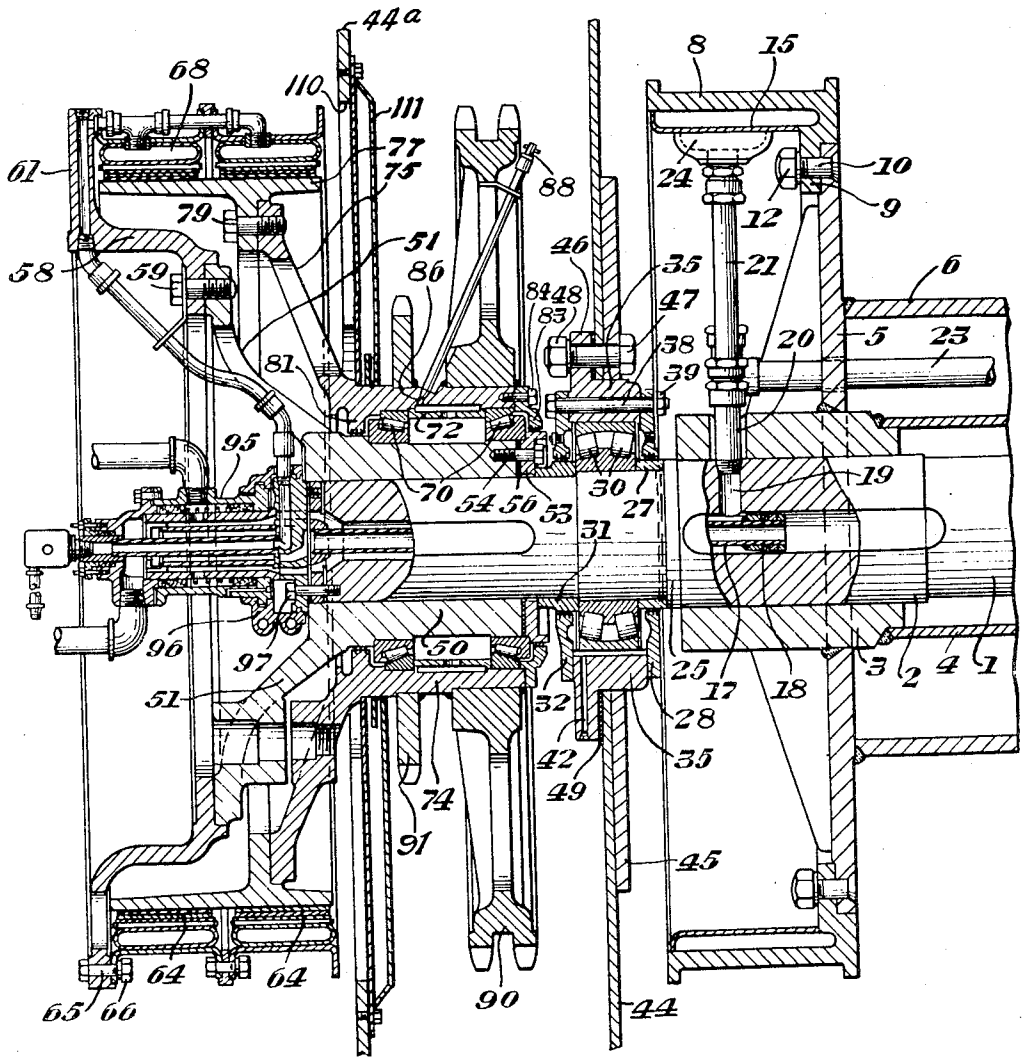
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Fig. 2.



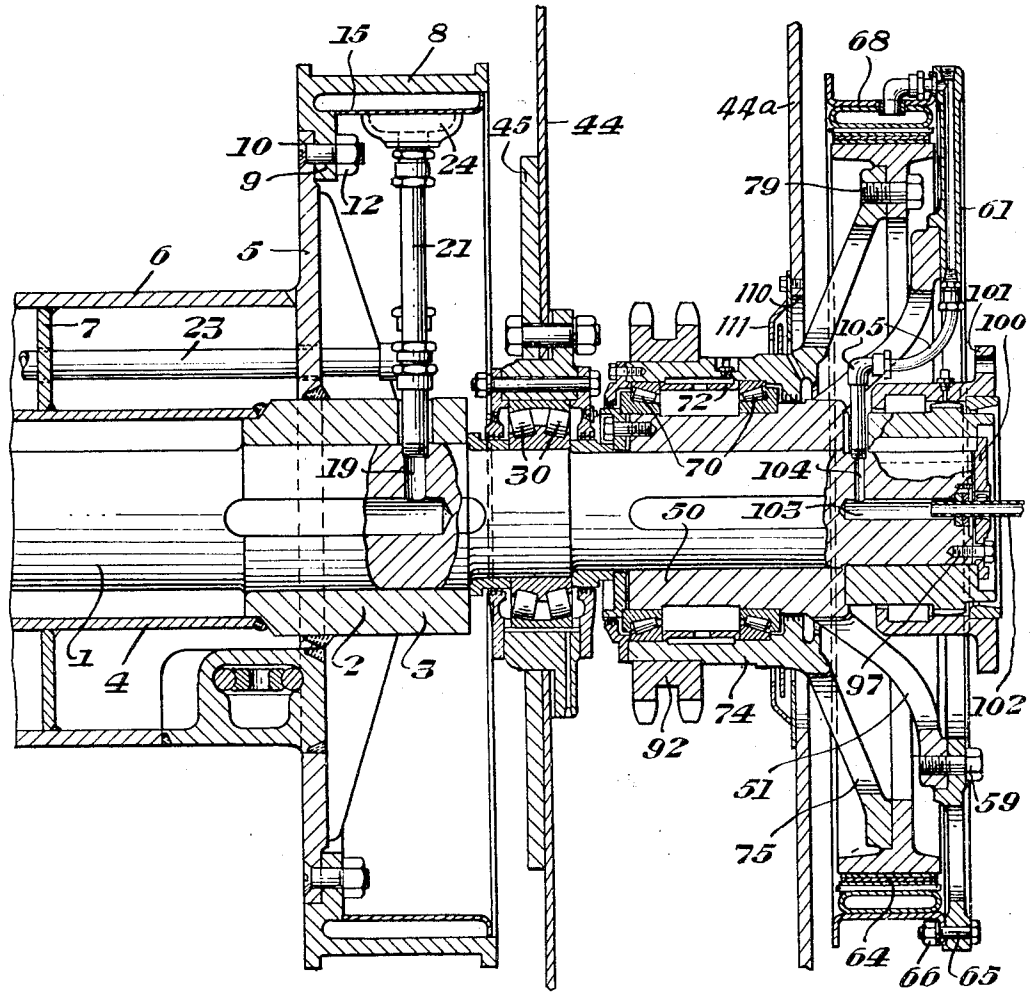
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Fig. 3.



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WELL DRILLING APPARATUS

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Application June 10, 1946, Serial No. 675,631

2 Claims. (Cl. 254—187)

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This invention relates to well drilling apparatus, such as are used in the drilling of oil wells, and more particularly to a drum shaft assembly for a hoist or drawworks.

In the drilling of oil wells numerous problems are encountered as the depth of the hole progresses, and particularly when extreme depths are encountered. For this reason there have recently been numerous developments in heavy duty oil drilling equipment. Of course, prime considerations are rapidity of drilling with lowered maintenance costs while substantially increasing safty factors. This necessitates massive and costly equipment which must be repaired from time to time. It is of great importance that such repairs be made as quickly and as safely as possible.

One of the biggest problems in the design of modern oil field hoist or drawworks is to provide shaft assemblies which can be serviced readily without requiring the removal of too many parts from the complete hoist assembly. The advent of antifriction bearings, air operated clutches, water cooled brakes and mutiple chain drives operating in oil bath enclosures has further complicated this problem.

It is among the objects of the present invention to provide a drum shaft assembly for a hoist or drawworks of heavy duty well drilling apparatus which is highly efficient in operation and at the same time is very easy to dismantle for necessary repairs.

The foregoing and other objects will become more apparent as this description proceeds and is read in conjunction with the accompanying drawings in which:

Figure 1 is a plan of the drum shaft assembly of the present invention;

Figure 2 is an enlarged fragmentary elevation, partly in section, of the left-hand end of the drum shaft as viewed in Figure 1, and illustrating the stuffing box assembly for introducing compressed air to the low-speed drum shaft clutch, and water to cool the brake drums;

Figure 3 is an enlarged fragmentary elevation, partly in section, of the right-hand end of the drum shaft as viewed in Figure 1;

Figure 4 is a right-hand end view of the drum shaft with the stuffing box removed; and

Figure 5 is a left-hand end view of the drum shaft with its cap plate removed.

Referring more particularly to the drawings, the novel drum shaft assembly of the present invention is shown as comprising a shaft 1 provided with a pair of short cylindrical sections 2 of increased diameter which are substantially

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spaced from each other and from the respectively adjacent ends of the said shaft. Each of these short cylindrical sections 2 carries a press-fitted thick sleeve 3, and between this pair of sleeves there extends and is supported a tube 4 which surrounds, and is concentric with, the underlying central portion of the shaft 1.

Each of the thick sleeves 3 carries a radial disk 5 of substantial diameter, between which there extends a cylindrical drum 6 of lesser diameter. Annular reinforcing rings 7 extend between the cylindrical drum 6 and the tube 4. The numeral 8 designates a pair of brake drums, each having an integral inwardly extending flange 9 which is detachably secured to the periphery of one of the radial disks 5 by means of bolts 10 and nuts 12. To the inner surfaces of the brake drums 8 there are attached continuous metallic pans 15 which form chambers for the circulation of water, whereby the brake drums 8 are cooled.

From its left-hand extremity the shaft 1 is provided with a central bore which extends to a position adjacent the outer extremity of the right-hand thick sleeve 3. Disposed to extend within the central bore of the shaft 1 from the left-hand end thereof is a water inlet tube 17 of substantially lesser diameter which extends to a position substantially opposite the inner end of the left-hand thick sleeve 3. The space between the exterior of the inner end of the water inlet tube 17 and the adjacent portion of the central bore of the shaft 1 is sealed, as by means of the packing 18. Each of the cylindrical sections 2 of the shaft 1 is provided with a radial port 19 adjacent its outer end. The radial port in the left-hand cylindrical section 2 communicates with a pipe 20 which connects with the adjacent pan 15; while the radial port 19 in the right-hand cylindrical section communicates with a pipe 21 which connects with its adjacent pan 15. Immediately adjacent each of the pipes 20 and 21 there is a parallel pipe (not shown) which extends from the respectively adjacent pan 15 and communicates with a return-flow pipe 23 which passes through the radial disks 5 and extends between the tube 4 and the cylindrical drum 6, passing through the reinforcing rings 7.

Water is circulated through the brake drum cooling chamber provided by the continuous metallic pans 15 in the following manner: from the water inlet tube 17 through the central bore of the shaft 1, from which it flows through the right-hand radially extending pipe 21 to the cooling chamber at the outer end thereof. After passing around the cooling chamber for the right-hand brake drum 8, the water is discharged

through the discharge pipe (not shown) which parallels the pipe 21, and into the return-flow pipe 23 which leads to the inlet pipe (not shown) for the left-hand brake drum 8 which parallels the radially extending pipe 20. After passing from the said inlet tube (not shown) of the left-hand brake drum 8, the water flows through the pipe 20 and is discharged through the space between the water inlet tube 17 and the wall of the bore of the shaft 1. By circulating the cooling water in the foregoing manner, the centrifugal force by the spindle rotation tends to assist circulation and reduces the pressure drop through the system.

Preferably, but not necessarily, the tube 4, radial disks 5, cylindrical drum 6 and reinforcing rings 7 are welded at their respective points of contact to form a unitary construction. And preferably too, the pans 15 are welded to the inner surfaces of the brake drums 8 in such manner as to form water-tight joints. In addition, the radially extending pipes 20 and 21 may be connected with the pans 15 through the medium of headers 24 which are screw-threadedly secured thereto and welded to the inner surfaces of the brake drums, as shown.

Immediately adjacent the outer end of thick sleeve 3 on the left, the shaft 1 is provided with an integral collar 25 which is abutted by a press-fitted ring 27 having a cylindrical exterior. An annular plate 28 closely fits over each of the cylindrical rings 27 and provides an oil seal between these assembled elements. Abutting each of the press-fitted rings 27, the shaft 1 carries a spherical self-aligning, roller bearing 30 at the outer end of which there is disposed a press-fitted ring 31 having a cylindrical exterior. Fitted over each of the rings 31 is an annular plate 32 (the same being identical in size and shape with the annular plates 28) which provides an oil seal between it and its inwardly disposed ring 31. On the periphery of the outer race of the spherical self-aligning, roller bearing 30 there is disposed a hub 35, the outer ends of which overlie the said bearing and are adapted to seat in fillets in the adjacent surfaces of the annular plates 28 and 32. The hub 35 and annular plates 28 and 32 are rigidly secured together by a series of bolts and nuts, shown at 38 and 39 respectively.

As shown most clearly in Figure 3, the inner surfaces of the annular plates 28 and 32 are recessed at points immediately opposite the sides of the double-taper roller bearing 30 to provide lubricant pockets; and lubricant is supplied thereto through a radial passageway 42 in the hub 35.

Peripherally disposed on each of the hubs 35 is a pair of plates 44 and 45, the same being secured to a radial flange 46 on the said hub through the medium of bolts and nuts 47 and 48 respectively which extend through each of them, shims 49 being provided between the said flange 46 and the most adjacent plate (i. e. 44). Plates 45 are part of the standards by means of which the novel drum shaft is supported for rotation. Plates 44 together with plates 44a are a part of the housings which form guards over the sprockets. Plates 44a have apertures 110 of such size that the various parts within the housing can be removed endwise from the shaft through these apertures. The apertures are closed by oil slinger guards 111 which are formed in two sections to enable them to be removed from the housing.

On each end of the shaft 1 (and outwardly of the brake drums 8 and their supporting instrumentalities) there is keyed a hub 50 having an integrally formed outward flared spider 51. At the inner end of each of the hubs 50 there is disposed a ring 53 which is secured thereto by means of a series of cap screws 54, intermediately disposed shims 56 being provided for maintaining a proper space relationship with respect to the immediately adjacent press-fitted ring 31. An annular rim 58 is disposed at the outer end of the spider 51 of each of the hubs 50, and connected thereto through the medium of cap screws 59. Each of the annular rims 58 is provided with a radially extending flange 61. The radially extending flange 61 of the annular rim 58 at the left-hand end of the drum shaft assembly supports a sectionally assembled unitary clutch band 64, the latter being secured in position by means of bolts and nuts 65 and 66. This sectionally assembled unitary clutch band 64 carries the operating elements of an external contracting air-operated low-speed clutch of conventional design, the latter being generally indicated at 68. The radially extending flange 61 of the annular rim 58 at the right-hand end of the drum shaft assembly (see Figure 3) supports a single element clutch band 64 which carries the operating elements of an external contracting air-operated high-speed clutch of conventional design.

Disposed on the periphery of each of the hubs 50 is a pair of spaced single-taper roller bearings, as shown at 70, the spaced relationship being preserved by an intermediately disposed spacer ring 72. The outer race of each of the bearings 70 supports a hub 74 having an integrally formed outwardly flared spider 75. The outer end of each of the spiders 75 is connected to a cylindrical clutch drum 77 through the medium of cap screws 79. The clutch drums 77 underlie their respectively adjacent clutch bands 64 and cooperate with the intermediate operating elements 68 of the air-operated clutches (i. e. low-speed clutch at the left-hand end of the drum shaft assembly and high-speed clutch at the opposite end thereof). Each of the hubs 74 is provided with an inwardly extending flange 81 which terminates at the periphery of the immediately adjacent hub 50 and provides an oil seal therebetween. A retainer ring 83 is secured to the inner end of each of the hubs 74 by means of cap screws 84; and these retainer rings 83 are shaped to provide closures for the inner ends of the spaced pairs of single-taper roller bearings 70 and also to form oil seals with the peripheries of the rings 53 which are attached to the inner ends of the hubs 50.

The construction and arrangement of each of the hubs 50, and its surrounding hub 74, is such as to provide a lubricant chamber for the intermediately disposed pair of single-taper roller bearings 70; and in order to introduce lubricant to this chamber there is provided in each of the hubs 74 a lubricant port 86 communicating either directly with a tube or indirectly with a lubrication fitting 88.

Secured to the hub 74 at the left-hand end of the drum shaft assembly is a low-speed drum shaft sprocket 90 which is connected to a suitable prime mover. Also secured to the hub 74 is a drive sprocket 91 for driving the line shaft of the hoist (not shown).

The hub 74 at the right-hand end of the drum shaft assembly has secured to it a high-speed drum shaft sprocket 92.

As shown most clearly in Figure 2, a stuffing box 95 is provided at the left-hand end of the

drum shaft assembly for introducing water for cooling both of the brake drums 8 and for operating the clutching elements 68 of the adjacent air-operated low-speed clutch. It is to be understood, however, that as such this stuffing box 95 and its associated elements forms no part of the present invention and therefore is neither claimed nor described in detail herein. However, it will be perceived that the stuffing box assembly may be very easily removed from the end of the drum shaft by removing the split clamping yoke 96 and the cap screws 97.

In lieu of a stuffing box 95 and its cooperating elements, the right-hand end of the drum shaft assembly utilizes a clamping plate 100 and a flexible coupling hub 101. The flexible coupling 101 is used to connect with a hydraulic brake (not shown) or some other optional device which is coupled to the drum shaft. Compressed air is supplied to the right-hand (i. e. high-speed) clutch through a tube 102 which extends through a central aperture in the clamping plate 100 and communicates with ports 103 and 104 and a conduit 105. The hub 50 on the right-hand end of the drum shaft assembly may be removed after the removal of the clamping plate 100 and the flexible coupling hub 101.

From the foregoing it will be noted that the same cap screws 97 which clamp the stuffing box assembly 95 in place on the right-hand end of the drum shaft assembly also hold in place the hub 50 which is keyed to the end of the drum shaft and supports the air-operated low-speed clutch. Also, this hub 50 rotatably supports the hub 74 which carries the low-speed clutch drum 77 and the two sprockets 90 and 91.

The entire clutch and sprocket assembly can be removed from the shaft 1 after the hub 50 and oil slinger guard 111 are removed, which is a very simple operation. On the other hand, if it is necessary to service only the operating elements 68 of the clutch or the clutch drum 77, these parts can be removed without even disturbing the stuffing box assembly 95 or the hub 50, since the clutch (with its operating elements 68) and the clutch drum 77 are fastened in such a manner that they can be removed from the end of the shaft merely by removing the cap screws 59 and 79 which hold them to their respective hubs.

In like manner the corresponding elements at the right-hand end of the drum shaft assembly may be removed after the removal of the clamping plate 100, oil slinger guard 111, connection 105, and the flexible coupling hub 101.

As previously stated, it is very desirable in a drum shaft assembly of this type to be able to replace the brake drums on the hoisting drum without much difficulty. In the drum shaft assembly of the present invention this can be done very conveniently since it is merely necessary to lift the drum shaft assembly out of the hoist frame, remove the two clutch and sprocket hub assemblies on both ends, and then remove the brake drums 8. An important feature of this construction is the fact that in stripping either of the clutch and sprocket assemblies from the ends of the shaft it is not necessary to disturb any of the anti-friction bearing assemblies and there is no danger of the bearings getting out of adjustment or being contaminated with dirt.

A further advantage in being able to easily remove these clutch and sprocket assemblies as a unit is that in some instances it may be desirable to replace the clutches shown with jaw-type clutches (not shown) on the high-speed or low-speed drum shaft drives, or both (for example, as where there is utilized in lieu of the more usual internal combustion engines, a steam engine or electric motor having high starting torque.

While I have shown and described certain specific embodiments of the present invention, it will be readily understood by those skilled in the art that I do not wish to be limited exactly thereto, since various modifications may be made without departing from the scope of the invention as defined in the appended claims.

I claim:

1. A drum shaft assembly for hoists comprising a shaft, a pair of standards rotatably supporting said shaft, a cable drum secured to said shaft between said standards, inner hubs press fitted on said shaft outside said standards, pneumatic clutch elements fixed to said inner hubs, outer hubs, anti-friction bearings mounting said outer hubs on said inner hubs, a high speed drive sprocket carried by one of said outer hubs, a low speed drive sprocket carried by the other of said outer hubs, pneumatic clutch elements carried by said outer hubs selectively cooperable with said first named clutch elements to effect driving connections to said shaft and drum, and housings covering said sprockets, said inner hubs, said antifriction bearings, said outer hubs and said sprockets being removable as units endwise of said shaft through said housings without disturbing the bearing alignment.

2. A drum shaft assembly for hoists comprising a shaft, a pair of standards rotatably supporting said shaft, a cable drum secured to said shaft between said standards, brake drums secured to said shaft at the ends of said cable drum, means for liquid cooling said brake drums, an axial bore in said shaft for circulating liquid through said cooling means, inner hubs press fitted on said shaft outside said standards, pneumatic clutch elements fixed to said inner hubs, outer hubs, antifriction bearings mounting said outer hubs on said inner hubs, a high speed drive sprocket carried by one of said outer hubs, a low speed drive sprocket carried by the other of said outer hubs, pneumatic clutch elements carried by said outer hubs selectively cooperable with said first named clutch elements to effect driving connections to said shaft and cable drum, housings covering said sprockets, a stuffing box removably secured to an end of said shaft for introducing and discharging liquid from said bore, and a clamping plate removably secured to the other end of said shaft, said inner hubs, said antifriction bearings, said outer hubs and said sprockets being removable as units endwise of said shaft through said housings after removal of said stuffing box and clamping plate without disturbing the bearing alignment.

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