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(54) **Winch with 2 coaxial drums for well logging applications**

(57) A winch system (10) is disclosed which includes a first drum (12) rotatably supported in a cradle (11), a second drum (14) rotatably supported in the cradle axially alongside the first drum and rotatable independently of the first drum, and a drive system selectively connectible to the first drum and the second drum. In one embodiment, the first drum is rotatably supported at one end by a first bearing (20) in one end of the cradle, the second drum is rotatably supported at one end by a second bearing (22) in another end of the cradle, and the second drum is rotatably supported at another end by at least one bearing in a support bore in the first drum (15).

The drive includes one or two power units (30) and the drums can be connected for rotation by an interlock, for example a pin (32). A thrust bearing (34) may be fitted between the flanges (12B, 14A) of the drums. The winch is suitable for well logging pressure control equipment cables.

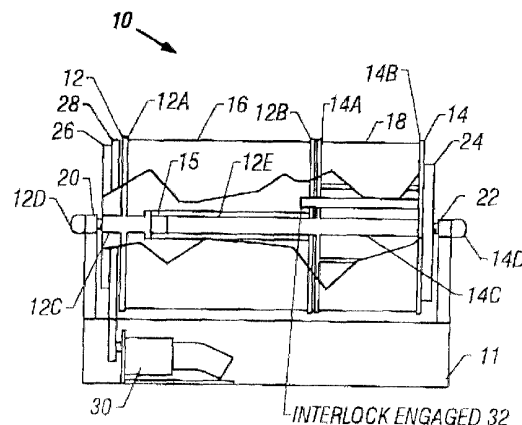


FIG. 1

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The invention is related generally to the field of winches and spooling devices. More specifically, the invention relates to spooling devices which have more than one independently driveable spool disposed in a mounting space typically used for a single spool.

Description of the Related Art

[0002] Well logging systems known in the art include a winch having a spool of armored electrical cable wound on the spool. Well logging instruments are lowered into and lifted out of wellbores for various purposes by rotating the spool (called a "cable drum") to extend and retract, respectively, the armored electrical cable.

[0003] Armored electrical cables for use in well logging operations have a number of electrical conductors therein, and an external diameter which are related to the type of logging instruments being used, the expected depth in the wellbore to which the instruments are to be lowered, and whether subsurface conditions in the wellbore may require the use of fluid pressure control devices at the earth's surface. Logging instruments which make specialized measurements of properties of the earth formations penetrated by the wellbore often require multiple insulated electrical conductors to carry electrical power to the instruments from the earth's surface, and to transmit signals back to the earth's surface for recording and interpretation. Typically, multi-conductor cable has a relatively large weight per unit length. As a result, multi-conductor cables typically have a relatively large external diameter because of the amount of armoring required to provide adequate tensile strength to the cable.

[0004] Conversely, simple instruments, particularly "perforating" and other mechanical wellbore servicing devices, may only require a single insulated electrical conductor to perform all required functions. Especially in the case of operating perforating devices, various types of pressure control devices are used at the earth's surface. Such pressure control devices require that the cable be "threaded through" cable-diameter openings in them. A mechanical/electrical coupling which connects the cable to the logging instruments, known as a cable head" must typically be coupled to the cable after threading the cable through the openings in the pressure control equipment. As is well known in the art, electrical cables used with pressure control equipment typically have as small as practical an external diameter (OD) to reduce the tendency of the cable to be expelled from the wellbore when fluid pressure builds up inside the pressure control equipment. Still other well logging cables include a single conductor, but have a large OD

and numerous armor wires for operations requiring high breaking strength on the cable, such as for setting mechanical devices in an unpressurized wellbore, or when lifting relatively heavy logging instruments or perforating guns.

[0005] Frequently, well logging operations require using both large OD-multi-conductor, or single conductor cables, and small OD single conductor cables in a single set of operations. Some well logging units have two separate, independently driven cable drums on them to accommodate these operations. Such well logging units, while quite effective, obviously have greater cost than single-drum well logging units because they have two completely independent winch systems. Other well logging units known in the art have a single winch drum which is "split". A split drum includes two exterior flanges on the axial outer ends of the drum, and a third flange in a selected axial position between the ends of the drum. Split drums have wound thereon both types of logging cables so that the foregoing multi-purpose well logging operations can be carried out. A limitation of split drum winch systems is that both cables rotate simultaneously. It is necessary to remove the cable head from the unused cable during operations which require use of the other cable. Even if the cable head need not be removed in some cases, it may be desirable to already have the smaller OD cable "threaded through" the pressure control equipment to save time during operations at the wellbore site. This is not possible on a split drum system while operating the winch drum to use the larger OD cable.

[0006] What is needed is a winch system which provides the space advantages of a split drum, while enabling separate rotation of two different logging cables.

SUMMARY OF THE INVENTION

[0007] The invention is a winch system which includes a first drum rotatably supported in a cradle, a second drum rotatably supported in the cradle axially alongside the first drum and rotatable independently of the first drum, and a drive system selectively connectible to the first drum and the second drum. In one embodiment, the first drum is rotatably supported at one end by a first bearing in one end of the cradle, the second drum is rotatably supported at one end by a second bearing in another end of the cradle, and the second drum is rotatably supported at another end by at least one bearing in a support bore in the first drum.

[0008] In one embodiment, the drive system is directly coupled to the first drum and comprises an interlock to rotatably couple the first drum to the second drum.

[0009] In another embodiment, the drive system comprises a drive member independently rotatable with respect to the first drum and the second drum, and a first and a second interlock each selectively operable to couple the first and second drums, respectively, to the drive member.

[0010] In another embodiment, the drive system comprises a first drive unit operably coupled to the first drum and a second drive unit operably coupled to the second drum.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Figure 1 shows a cross-sectional view of one embodiment of a dual-drive winch system.

Figure 2 shows the embodiment of Figure 1 where the two drums may rotate independently.

Figure 3 shows an alternative embodiment in which either the first drum or the second drum may be driven individually by a single drive unit.

Figure 4 shows another embodiment wherein the first drum and second drum each has its own drive unit.

Figure 5 shows an example of a dual drum winch having improved load carrying capacity.

DETAILED DESCRIPTION

[0012] Generally speaking, the invention is a winch system which includes two side-by side cable drums mounted in a cradle. The two cable drums are to rotate independently of each other, while being fit into a Space otherwise adapted for a single winch drum or a "split drum".

[0013] One embodiment of a dual-drum winch 10 according to the invention is shown in Figure 1. A cradle 11 as shown in Figure 1 can be the same or similar to those used to rotatably support a single cable drum or a split drum as are known in the prior art. The cradle 11 rotatably supports a cable drum on bearings 20, 22. In this embodiment, the cable drum is a "dual" drum consisting of a first drum 12 and a second drum 14. A first cable 16, and a second cable 18 are spooled, respectively, on first drum 12 and second drum 14. The first drum includes a first flange 12A and a second flange 12B to axially restrain a first cable 16 to be wound on the first drum 12. The second drum 14 includes similar flanges 14A, 14B to axially restrain a second logging cable 18 to be wound on the second drum 14.

[0014] The first drum 12 includes a bearing spindle 12C which at one end turns inside a support bearing 20 in the cradle 11. The bearing 20 can be a pillow block as is conventional for rotatable cable drum mounting. The second drum 14 also rotates about a spindle 14C which is supported in a bearing 22 in the other side of the cradle 11. The support bearing 22 can also be a pillow block or similar type of bearing. Second drum 14 is rotatably supported at the other end by at least one coaxial bearing 15. Coaxial bearing 15 is disposed inside a support bore 12E in the interior of the first drum 12. Practical embodiments of the invention may include more than one coaxial bearing 15 in the support bore

12E, preferably separated by as much axial distance between them as practical. In this way, the first drum 12 and the second drum 14 may rotate independently of each other while fitting in a conventional cradle 11, using bearings 20, 22, that are typically used for a single or split drum winch system.

[0015] It should be clearly understood that the particular configuration shown in Figure 1, which has spindle 14C extend from the second drum 14 into the corresponding support bore 12E in the first drum 12, so that the first drum 12 can rotate about the coaxial bearings 15 is only one possible configuration of this embodiment. Alternatively, the spindle 12C of the first drum 12 could extend into a corresponding support bore (not shown in Figure 1) in the interior of the second drum 14, wherein the coaxial bearings 15 would be located. This is the functional equivalent of the configuration shown in Figure 1 and has the same advantages of that configuration, which will be further explained below.

[0016] An advantage of the embodiment shown in Figure 1 (and its alternative as explained above) is that both the first drum 12 and second drum 14 can each have a cable passage (not shown in Figure 1). The cable passage is formed, and terminates at one end, substantially in the center of the respective spindles 12C, 14C. The cable passage terminates at its other end on the cylindrical surface that supports the cable 16, 18 wound on each drum 12, 14 and at the bearing end of the respective spindle 12C, 14C. Such cable passages are typical for cable drums known in the art, and the purpose of the cable passage (not shown), as is known in the art, is to provide a conduit from the interior cylindrical surface of the cable drum to the center of a slip ring assembly, or "collector" assembly. The collector is typically mounted on the bearing end of the cradle 11. As is conventional for a split drum winch, in the independently rotatable drum system of this embodiment, the first drum 12 includes at the bearing end thereof a first collector 12D. Correspondingly, the second drum 14 includes a second collector 14D at its bearing end. Both collectors 12D, 14D can be any suitable type known in the art to enable electrical coupling between a rotating member and a rotationally fixed member. In this embodiment, as is conventional in the art, the rotationally fixed member is the cradle 11.

[0017] Other embodiments may have the spindle 14C of the second drum 14 fully supported by both bearings 20, 22 on the cradle 11. In such embodiments, the first drum 12 would include only the support bore 12E therein, and coaxial bearings 15. It is also possible to have a spindle which extends between bearings 20 and 22, and is a separate element entirely from the first and second drums. The drums 12, 14 in such embodiments would rotate independently about the spindle on bearings in a support bore in each drum. Such embodiments would require each drum to have a different form of passage for the cable wound thereon to be conducted to the respective collector.

[0018] In the embodiment of Figure 1, the first drum 12 is rotated by a drive system including a chain 28 and power unit 30. The chain 28 and power unit 30 can be any type known in the art. In this embodiment, the chain 28 and power unit 30 are the same as would be used to drive a single drum or split drum. This embodiment has the advantage of being able to directly replace a single drum or split drum in a drive system and cradle already adapted to the single drum or split drum. The first drum 12 is stopped from rotating by a first brake band 26. The first brake band 26 can be any type known in the art for stopping a winch drum. Correspondingly, the second drum 14 is stopped by a second brake band 24. In this embodiment, the brake bands 24, 26 can be the same as used in a single drum or split drum winch, but the brake bands 24, 26 should be adapted to be separately controllable to enable separate rotation of the drums 12, 14.

[0019] In this embodiment, only the first drum 12 is driven by the chain 28 and power unit 30. To drive the second drum 14, in this embodiment, an interlock 32 is engaged to rotationally couple the first drum 12 to the second drum 14. The interlock 32 in this embodiment can be a pin or the like which engages corresponding holes in the flanges 14A, 14B, 12B of the drums 14, 12 respectively. In Figure 1, the interlock pin 32 is shown engaging the second flange 12B on the first drum to couple rotation of the first drum 12 to the second drum 14.

[0020] The same embodiment is shown in Figure 2 with the interlock 32 disengaged, so that the first drum 12 is driven by the drive unit (chain 28 and power unit 30), while the second drum 14 is not rotated. Typically the second brake band 24 will be set to stop rotation of the second drum 14 when the interlock 32 is disengaged as shown in Figure 2. However, as the second drum 14 is otherwise free to rotate, irrespective of rotation of the first drum 12, the system operator may in some cases manually pull some of the second cable 18 from the second drum 14 to perform any activities which may require extending the second cable 18.

[0021] It is contemplated that the embodiment shown in Figures 1 and 2 would be used where the first cable 16 is a large diameter multiple conductor cable not requiring uncoupling of a cable head (not shown) to "thread through" pressure control equipment. The second cable 18 is contemplated as being a small diameter cable which can be thread through pressure control equipment (not shown), and have coupled thereto a cable head (not shown). In this way, the pressure control equipment may be assembled to the second cable 18 prior to use of the winch system 10, while operations using the first drum 12 and first cable 16 may proceed uninterrupted.

[0022] An alternative embodiment of the winch system is shown in Figure 3. In the embodiment of Figure 3, the chain 28 and power unit 30 are positioned so that the chain is in between the first drum 12 and the second drum 14. A drive sprocket 28B is rotatably supported on

the spindle 14C by a bearing 28A. The drive sprocket 28B can be selectively coupled to either or both the first drum 12 by a first interlock 32A, which can be similar to the interlock (32 in Figure 1) of the previous embodiment, and by a second interlock 32B to the second drum 14. In the embodiment of Figure 3, either or both drums 12, 14 may be rotated.

[0023] Yet another embodiment, shown in Figure 4, includes a first drive chain 28A and first power unit 30A to operate the first drum 12, and a second drive chain 28C and power unit 30B to operate the second drum. In the embodiment of Figure 4, the drums 12, 14 may be operated completely separately, including in different directions. The embodiment shown in Figure 4 makes possible carrying out well logging operations on two wellbores simultaneously.

[0024] A particular embodiment shown in Figure 5 includes a thrust bearing 34 disposed between the adjacent flanges 12B, 14A of the first drum 12 and second drum 14, respectively, the embodiment shown in Figure 5 can have improved load carrying capacity. In some of the embodiments of the invention, such as shown in Figure 1, for example, some of the drum load is carried by the coaxial bearings (15 in Figure 1). Depending on the position and number of such bearings, there may still be some residual load applied as a torque which is applied in a direction to "twist" the axis of rotation of the drums 12, 14. Some of this load can be transferred between the drums by using the thrust bearing 34 between the adjacent drum flanges 12B, 14A. The thrust bearing 34 can be any type suitable for taking the thrust load between the flanges 12B, 14A, for example a roller bearing, ball bearing or torrrington (radial roller thrust) bearing. The embodiment shown in Figure 5 may also provide an additional benefit by reducing the load carrying capacity required on each drum in the spindle area (or support bore area) so that the adjacent flanges 12B, 14A may be positioned closer to the axial outermost extent of the corresponding drum 12, 14. This will provide each drum 12, 14 with some additional cable carrying capacity.

[0025] The invention provides a winch system which enables operating more than one winch drum separately from another winch drum, while maintaining the overall dimensions of single or split drum winch systems known in the art. The winch system of the invention may prove particularly useful in retrofitting single or split drum winch systems known in the art without extensive modification to the logging unit chassis or winch cradle.

[0026] While the foregoing invention has been described in terms of specific embodiments, it will be readily apparent to those skilled in the art that other embodiments of the invention can be devised which do not depart from the spirit of the invention as disclosed herein. Accordingly, the invention shall be limited in scope only by the attached claims.

Claims

1. A winch system, comprising:
- a first drum rotatably supported in a cradle; 5
 - a second drum rotatably supported in the cradle axially alongside, substantially coaxial with and rotatable independently of the first drum; and
 - a drive system selectively connectible to the first drum and the second drum. 10
2. The winch system as defined in claim 1 wherein the drive system is directly coupled to the first drum and comprises an interlock to rotationally couple the first drum to the second drum. 15
3. The winch system as defined in claim 2 wherein the second drum has wound thereon a cable adapted to be used with well logging pressure control equipment. 20
4. The winch system as defined in claim 1 wherein the drive system comprises a drive member independently rotatable with respect to the first drum and the second drum, and a first and a second interlock 25 each selectively operable to couple the first and second drums, respectively, to the drive member.
5. The winch system as defined in claim 1 further comprising a first brake adapted to selectively stop rotation of the first drum and a second brake adapted to selectively stop rotation of the second drum. 30
6. The winch system as defined in claim 1 wherein the first drum is rotatably supported at one end by a first bearing in one end of the cradle, the second drum is rotatably supported at one end by a second bearing in another end of the cradle, and the second drum is rotatably supported at another end by at least one coaxial bearing in a support bore in the first drum. 35 40
7. The winch system as defined in claim 1 wherein the second drum is rotatably supported by a spindle mounted in a bearing in each side of the cradle, and the first drum is rotatably supported by bearings disposed in a support bore therein coaxially disposed about the spindle. 45
8. The winch system as defined in claim 1 wherein the first drum comprises a first collector and the second drum comprises a second collector, the first and second collector each adapted to provide electrical contact between the respective rotating drum and a rotationally fixed member. 50 55
9. The winch system as defined in claim 1 wherein the drive system comprises a first drive unit operably coupled to the first drum and a second drive unit operably coupled to the second drum.
10. The winch system as defined in claim 1 further comprising a thrust bearing disposed between adjacent flanges of the first drum and the second drum.

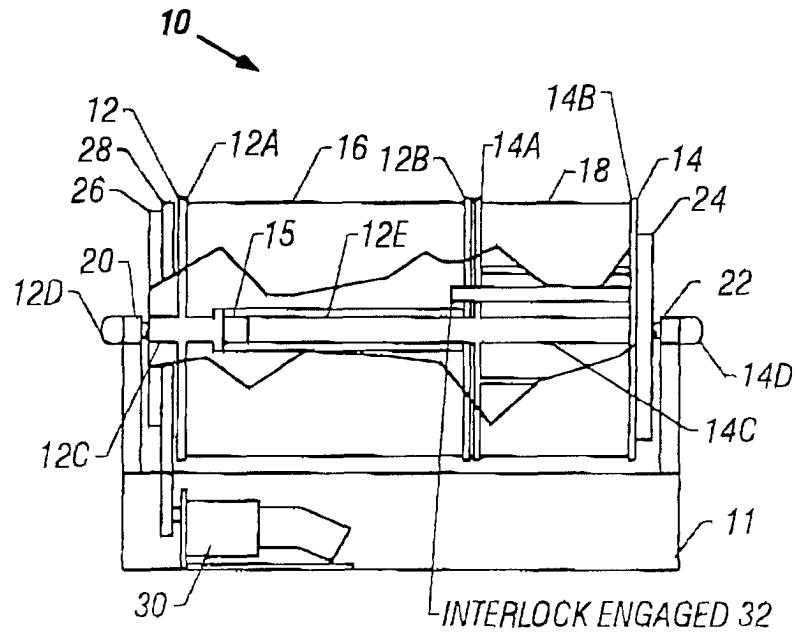


FIG. 1

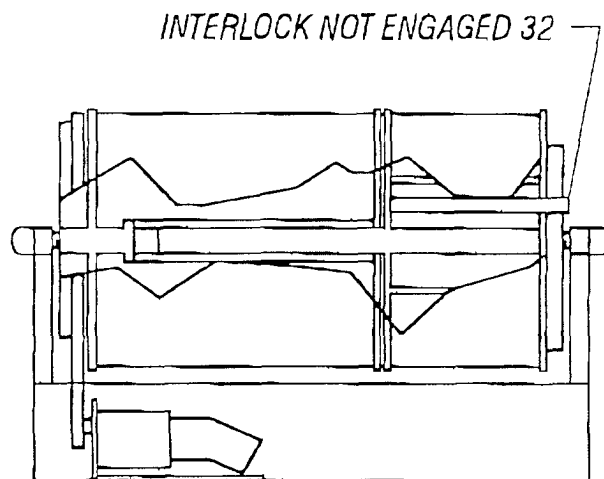


FIG. 2

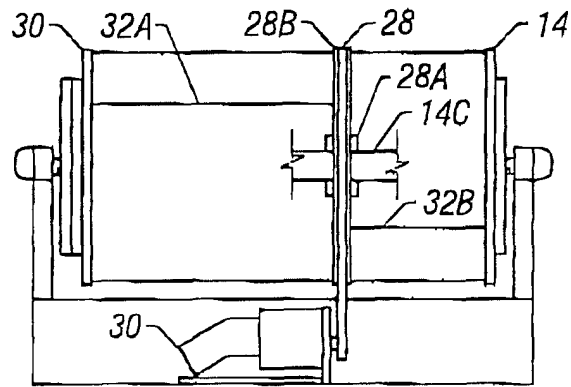


FIG. 3

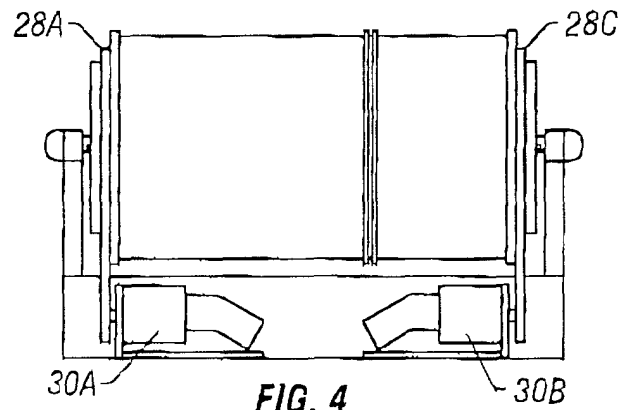


FIG. 4

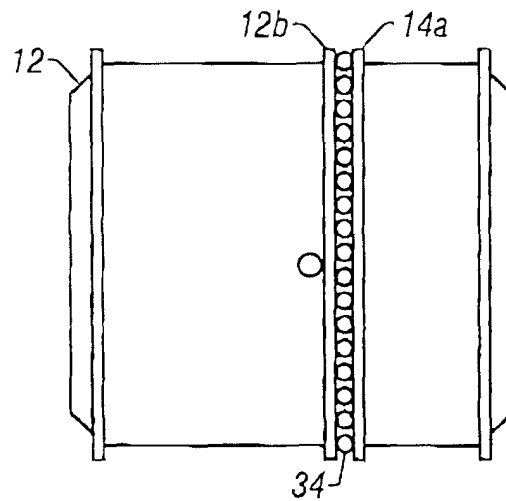


FIG. 5



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EUROPEAN SEARCH REPORT

Application Number
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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