being mounted on a first frame part in the form of a sheave bracket 36 which is itself mounted on a second frame part in the form of a swivel bracket 38. A collar 40 forming part of the swivel bracket 38 engages a stuffing box 42 adapted to be mounted to an upper end of a lubricator assembly (not shown in Figure 3) via a releasable union 44.

The sheave 32 is configured to guide the slickline 34 from a bottom hay pulley into the top of the lubricator and into a well. The sheave contact angle with the wireline is maintained substantially constant at 180 degrees by tension retainer rollers 46. The sheave 32 also includes spring-mounted wire retainer rollers 52, to ensure that the slickline 34 is maintained in contact with the sheave 32.

As will be described in greater detail below, the apparatus 30 includes various sensors which gather information for transmission to a wireline control unit, which records and displays the gathered information. In particular, the apparatus 30 includes provision for measuring wireline length or depth, wireline tension and wireline speed. The apparatus 30 also links to pressure sensors in the lubricator assembly to gather and transmit well pressure and stuffing box hydraulic pressure information.

The sheave 32 serves as a wireline length measuring wheel and has a calibrated outer diameter. The sheave wheel has a wear resistant rim 48 and a lightweight material hub 50 to reduce weight and inertia.

A mechanical counter and depth encoder 54 is mounted on the sheave bracket 36 adjacent the sheave axis and by measuring the number of sheave rotations provides an indication of the length of slickline 34 that has passed over the sheave 32, indicative of the length or depth of slickline 34 in the well.

The sheave bracket 36 also provides mounting for a dual channel Hall effect speed and direction sensor 56.

The sheave bracket 36 is mounted to the swivel bracket 38 via a pivot pin 58 which is laterally offset from the sheave axis. The orientation of the sheave bracket 3634 is maintained by a load pin 60 which incorporates dual independent strain gauges, to measure slickline tension.

An electronics module 62 is also mounted on the sheave bracket 3634, the module 62 housing sensor amplifiers, batteries, transmitters and providing mounting for an RF antenna 64. The module 62 is also illustrated in block diagram form in Figure 4 of the drawings, the figure also illustrating how signals representative of slickline speed, depth and tension, and of stuffing box and well pressure are transmitted from the module 62 to a receiver 66 in the wireline unit. The signals are processed for storage and display on an electronic display 68 in the wireline unit. The information

CLAIMS:

1. A wireline sheave apparatus comprising:

a sheave for accommodating a wireline;

a sheave mounting configured for coupling to a wireline stuffing box, the sheave being mounted on the sheave mounting; ~~and~~

a sensor for measuring wireline tension at the sheave; ~~,~~ and

a load pin,

wherein the sensor comprises a strain gauge which is arranged to measure strain on the load pin,

wherein the sheave mounting comprises a frame which includes a first ~~is in at least two~~ frame parts and a second frame part, the first and second frame parts being arranged such that tension on the wireline tends to cause the first and second frame parts to pivot relative to one another, and

wherein the load pin is arranged to prevent the first and second frame parts from pivoting relative to one another so that the strain ~~sensor is provided between the frame parts so as to~~ measured by the strain gauge on the load pin is ~~parameters~~ indicative of ~~forces acting on the~~ wireline tension.

2. The apparatus of claim 1, comprising a sensor for measuring deployed wireline length at the sheave.

3. The apparatus of claim 1 or 2, including a transmitter for relaying information gathered by the sensor for measuring wireline tension and/or by the sensor for measuring deployed wireline length, and a wireline control unit configured to receive and process said information.

4. The apparatus of claim 3, wherein the wireline control unit is configured to record or display said information.

5. The apparatus of claim~~s~~ 3 or 4, wherein the transmitter is configured to wirelessly relay the information.

6. The apparatus of any preceding claim, configured for measuring wireline speed.

7. The apparatus of any preceding claim, including one or more sensors configured to measure one or more of sheave rotation and sheave rotation direction.

8. The apparatus of claim 7, wherein said one or more sensors include at least one of a mechanical counter, encoder and electromagnetic speed sensor.

9. The apparatus of any preceding claim, wherein the apparatus is configured to communicate with pressure sensors and the apparatus is further configured for transmitting signals received from the pressure sensors to a receiver.

10. The apparatus of claim 9, wherein the pressure sensors are provided in a lubricator assembly.

11. The apparatus of any preceding claim, comprising one or more pressure sensors configured for measuring at least one of stuffing box pressure and well pressure.

12. The apparatus of any preceding claim, including a swivel for coupling to a stuffing box.

13. The apparatus of any preceding claim, configured such that wireline used in combination with the apparatus experiences less than eleven bending cycles between a wireline reel and a lubricator.

14. The apparatus of any preceding claim, wherein the sheave is configured to guide wireline from a bottom hay pulley into the top of a lubricator and into a well.

15. The apparatus of any preceding claim, configured such that the sheave contact angle with the wireline is maintained substantially constant.

16. The apparatus of any preceding claim, wherein the sheave contact angle is maintained at or around 180 degrees.

17. The apparatus of any preceding claim, wherein the apparatus includes wireline guides for maintaining a desired sheave contact angle.

18. The apparatus of claim 17, wherein the guides comprise rollers.

19. The apparatus of any preceding claim, wherein the sheave serves as a wireline length measuring wheel and has a calibrated outer diameter.

20. The apparatus of any preceding claim, wherein the sheave includes a wire retaining arrangement to ensure that the wireline is maintained in contact with the sheave.

21. The apparatus of claim 20, wherein the wire retaining arrangement comprises spring-mounted rollers.

~~22. The apparatus of any preceding claim, including a strain gauge which is mounted on the frame and which is configurable to measure tension in the wireline.~~

~~23. The apparatus of claim 22, wherein tension on the wireline tends to cause the parts of the frame to pivot and wherein the apparatus includes a load~~

~~pin which prevents the parts of the frame from pivoting and the strain gauge measures strain on the load pin so as to indicate tension in the wireline.~~

2224. The apparatus of any preceding claim, including dual independent strain gauges.

2325. The apparatus of any ~~of~~ preceding claim, comprising a hydraulic load cell mounted on the frame.

2426. The apparatus of any preceding claim, including a power source configured to be recharged through rotation of the sheave.

2527. The apparatus of claim 2426, wherein the power source comprises a battery arranged to be charged by a generator in an encoder and an energy harvesting module.

2628. A wireline work method comprising:

mounting a sheave on a sheave mounting ~~comprising a frame which is in at least two frame parts, the frame parts being arranged to pivot relative to one another~~;

coupling the sheave mounting to a wireline stuffing box; and

passing wireline around the sheave~~,~~;

wherein the sheave mounting comprises a frame which includes a first frame part and a second frame part, the first and second frame parts being arranged such that wireline tension tends to cause the first and second frame parts to pivot relative to one another, a load pin is arranged to prevent the first and second frame parts from pivoting relative to one another, and a strain gauge is arranged to measure strain on the load pin so as to indicate wireline tension~~providing a sensor between the frame parts; and~~

~~using the sensor to measure wireline tension at the sheave by measuring parameters indicative of forces acting on the wireline~~.

2729. A wireline work method as claimed in claim 2628, comprising measuring deployed wireline length at the sheave.