Dec. 23, 1969 W. A. HAHS 3,485,181

SUPPORT FOR A SUBTERRANEAN PUMP INSTALLATION

Filed April 29, 1968

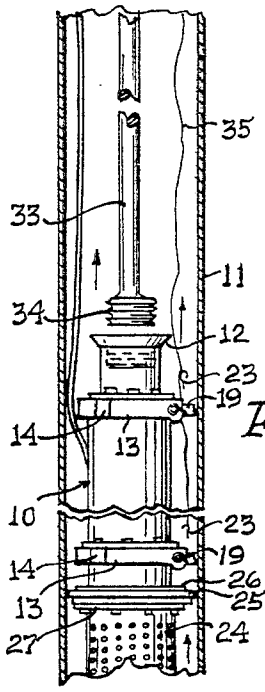

Fig. 1.

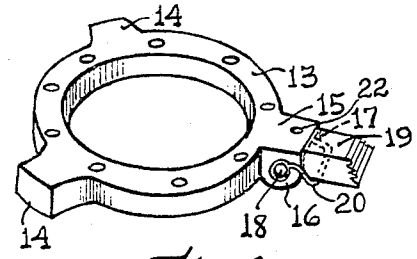

Fig. 3.

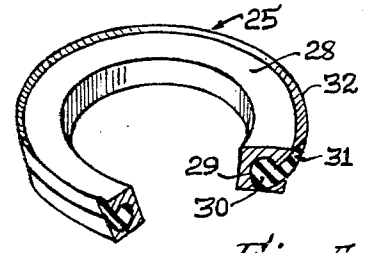

Fig. 5.

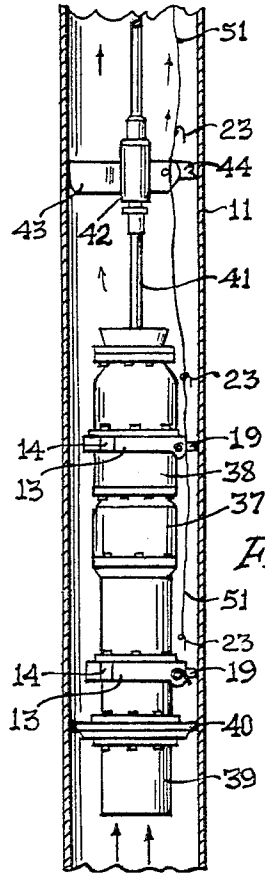

Fig. 2.

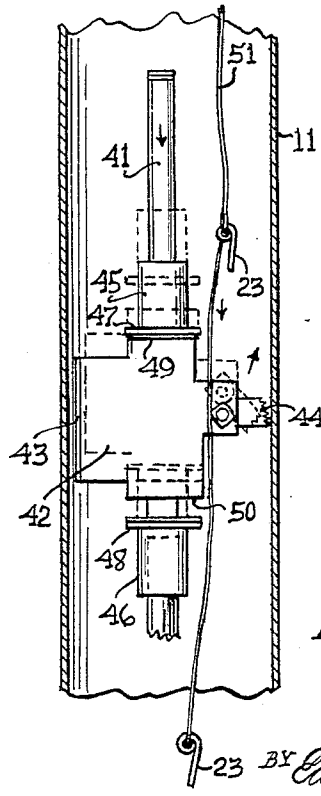

Fig. 6.

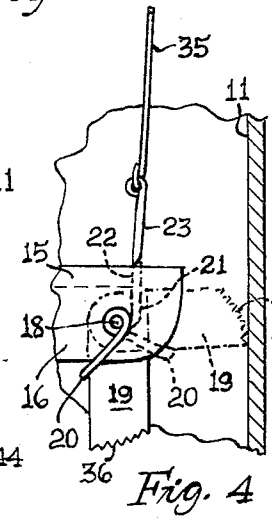

Fig. 4

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SUPPORT FOR A SUBTERRANEAN PUMP INSTALLATION

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ABSTRACT OF THE DISCLOSURE

A subsurface pump installation in a well casing through which subterranean liquids can be transported for surface discharge, including a pump structure within the casing, the housing of which provides a plurality of locking members for removably supporting the pump concentrically within the casing, and for sealing the casing to prevent circumventing circulation of the liquid in the well about the pump structure.

SUMMARY OF THE INVENTION

A pump structure for subsurface installation in an unlined well casing, including a plurality of adaptor rings having releasable locking cams for concentrically positioning the pump structure within the well casing. A surface actuated releasing cable connected to the locking cams for holding the same in an inoperative position within the well casing as the pump structure is lowered therein. Seals are projected between the pump structure and the well casing and effective under back pressure created by the liquid within the casing above the pump structure to seal the casing so as to prevent circumventing circulation of the liquid back into the well. This invention constitutes an improvement over the structure shown and disclosed in my U.S. Letters Patent No. 3,033,615 dated May 18, 1962.

The invention will be best understood by reference to the accompanying drawing in which there is shown the preferred form of construction.

FIG. 1 is a fragmentary detailed side elevational view of a submersible type pump positioned and sealed within a well casing,

FIG. 2 is a fragmentary detailed side elevational view of a turbine type pump positioned and sealed within a well casing,

FIG. 3 is a perspective view of one adaptor ring as used in my invention,

FIG. 4 is a fragmentary side elevational view of the locking cam in its inoperative position on the adaptor ring,

FIG. 5 is a perspective view of a part broken away of the sealing ring as used in my invention, and

FIG. 6 is a fragmentary detailed side elevational view of a shaft bearing housing within the well casing.

In the present day turbine type or submersible pump installations, the pump unit is connected to and supported within a well casing by a separate water pipe or column, which is of a reduced diameter when compared to the well casing. As an example of the present day installation a turbine type pump having 8-inch bowls would include a 6-inch water column or pipe, installed within a 10-inch well casing. The output of this pump is through the 6-inch water column rather than utilizing the full 10-inch diameter of the well casing. This practice results in a greater degree of friction loss which must be overcome by an increase in operation of the pump itself to produce a determined volume of liquid at the discharge portion of the well. To overcome the friction and to increase the liquid output in ratio to the effective operation of the pump I have by my present invention omitted the necessity of a water pipe or column for supporting the pump unit within the well casing.

Referring to FIG. 1 there is shown a submersible pump unit **10** positioned within a subterranean well casing **11** wherein the discharge port **12** of the pump unit **10** has open communication with the entire interior of the well casing **11**. To mount the pump unit **10** within the well casing **11** there is provided a pair of adaptor rings **13** bolted to annular flanges provided by the pump unit **10**. These adaptor rings **13** are so formed as to provide a pair of equally spaced, radially extending positioning lugs **14** as well as a three-sided hollow bracket **15**, such as is shown in FIGS. 3 and 4.

With respect to the mounting bracket **15** there is journaled between the arms **16** and **17** thereof a shaft **18** which has pivotally mounted thereon a locking cam **19**. Coiled about the shaft **18** and embracing a portion of the locking cam **19** is a spring **20** which functions to pivot the locking cam **19** about the shaft **16** into a radially extending plane with respect to the adaptor ring **13** as shown in full lines in FIG. 3.

As shown in dotted lines in FIG. 4, the inner end wall of the cam **19** is provided with an aperture **21** which when the cam **19** is pivoted about the shaft **18** against the spring **20** so that it extends tangentially with respect to the ring **13**, will be in alignment with a corresponding opening **22** formed in the top wall of the bracket **15**. When a locking pin **23**, such as that shown in FIG. 4 is inserted in the openings **22** and **21** the cam **19** will be releasably locked in its retracted position.

To concentrically position the pump unit **10** within the well casing **11** it is necessary to include at least two adaptor rings **13**, as shown in FIG. 1.

Immediately adjacent to the intake sleeve **24** of the pump unit **10** is positioned a sealing ring **25**. This ring **25** is carried between annular flanges **26** and **27** provided by the pump structure **10**, and consists of a circular body member **28** having an inner recess **29** formed therein which receives the bulb end **30** of a gasket **31**. The gasket **31** has an upwardly tapered outwardly extending tail section **32** normally disposed to one side and above the outer wall of the ring **25**, as shown in FIG. 5.

In the installation of the pump unit **10**, as shown in FIG. 1, a carrying rod **33** having an enlarged end **34** is threaded into the discharge port **12** of the pump unit **10**. The pump unit **10**, carried by the rod **33**, is then lowered within the well casing **11** until it is well below the static water level.

When the pump unit **10** is correctly located within the well casing **11** it is locked into place through the releasing of locking cams **19** on each of the adaptor rings **13**. To accomplish this a release cable **35**, which is attached to each of the locking pins **23**, is withdrawn from the well casing **11**, permitting the locking cams **19** to be pivoted under the tension of the springs **20** into a horizontal plane with their free serrated ends **36** in contact with the inner wall surface of the well casing **11**. It should be noted that the locking cams **19** together with their mounting brackets **15** have a composite length equal to that of the positioning lugs **14** also carried by the adaptor rings **13** so that all of these elements engage the inner wall surface of the well casing **11** to concentrically position the pump unit **10** therein.

After the locking cams **19** have been released an additional downward force is applied on to the supporting rod **33** to force the pump unit **10** downward until the serrated ends **36** of the locking cams are overcentered with respect to the longitudinal axis of their pivot shafts **18** and positively connected to the inner wall surface of the well casing **11**.

The rod **33** is then disconnected from the pump unit **10** and withdrawn from the well casing **11**. The electric

cable 32' is permitted to freely extend beyond the uppermost adaptor ring 13 and through the well casing 11, as shown in FIG. 1.

For proper operation of the pump unit 10 it is necessary to prevent recirculation of the liquid within the well casing 11, and this is accomplished through the presence of the sealing ring 25. As shown in FIG. 1 one sealing ring 25 is mounted on the pump unit 10 at a point below the lowermost adaptor ring 13. As the liquid within the well casing 11 is pumped through the pump unit 10 it will create a back pressure on the tail section 32 of the gasket 31, forming an effective seal between the gasket 31 and the inner wall surface of the casing 11. In the event that there is an excess amount of back pressure created by the liquid in the casing 11 a series or a tandem arrangement of seals may be employed to restrict recirculation of the liquid in the well casing.

In the event that the installation is to include a turbine type pump 37, then, as is shown in FIG. 2, adaptor rings 13 are connected to the turbine bowl 38 and the intake sleeve 39 so as to cooperate to concentrically position the pump 37 within the well casing 11 in the manner hereinbefore described. A sealing ring 40 like the one associated with the submersible pump unit 10, as shown in FIG. 1, is positioned about the intake sleeve 39 of the turbine pump 37 beneath the lowermost adaptor ring as shown.

The turbine pump 37 is operated by a rotatable driven shaft 41 which extends downwardly through the well casing 11. To position the driven shaft 41 within the well casing 11 there is provided a number of shaft housings, one of which is shown as at 42. The shaft 41 is freely journaled through the shaft housing 42, and is concentrically positioned by the housing 42 within the well casing 11.

As shown in FIG. 6, the housing 42 consists of a number of radially extending legs 43 as well as a pivotal locking cam 44 of the type hereinbefore described. The housing 42 is freely mounted on the shaft 41 between a pair of spaced apart bearings 45 and 46, which are in turn fixedly connected to the shaft 41. The bearings 45 and 46 each provided confronting flange members 47 and 48 which are adapted to engage enlarged circular shoulders 49 and 50 provided by the housing 42.

In positioning the turbine pump 37 within the well casing 11 the adaptor rings 13 and sealing ring 40 function in the same manner as hereinbefore described, when the locking cams of the adaptor rings 13 and the locking cam 44 of the housing 42 are simultaneously released through the withdrawal of the release cable 51. The positioning of the driven shaft 41 concentrically within the well casing 11 is accomplished by the shaft housing 42. Additional downward force on the driven shaft 41 will cause the locking cams to be overcentered into latching contact with the inner wall surface of the casing 11 to accomplish their intended purpose.

From the foregoing it is apparent that I have devised a subterranean pump installation without the necessity of including within the well a water column, or any extensive supports for the pump units. The weight of the pump unit and the pressure of the liquid against one side of the seal function to maintain the pump unit in a self-supported position within the well casing.

While I have illustrated and described the preferred form of construction for carrying my invention into effect, this is capable of variation and modification without departing from the spirit of the invention. I, therefore, do not wish to be limited to the precise details of construction set forth, but desire to avail myself of such

variations and modifications as come within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent is:

1. A self-supporting pump unit for installation in a subterranean well defined by a tubular casing including:
   (a) carrying means connected to the pump unit for moving the same through the tubular casing to a position below the static liquid level of the well,
   (b) an adaptor ring carried by the pump unit and having a plurality of fixed radially extending legs and a locking cam pivotally connected thereto and equally spaced from the fixed legs with the locking cam having an operative and inoperative position,
   (c) spring means for moving said locking cam into a radially disposed operative position for cooperating with said fixed legs of said adaptor ring for engagement with the inner wall surface of the tubular casing to latch the pump unit in a predetermined location within the well after the pump unit has been moved interiorally of the casing by said carrying means,
   (d) means for releasably maintaining said locking cam in an inoperative position out of engagement with the casing while the pump unit is moved into a predetermined position within the well by said carrying means, and
   (e) means provided by the pump unit for sealing the pump unit within the casing and to prevent circumventing circulation of the liquid in the well about the pump and through the casing.

2. A self-supporting pump unit as defined by claim 1 wherein said means for sealing the pump unit within the casing comprises a sealing ring mounted on the pump unit adjacent its lowermost end, and having a gasket in contact with the inner wall surface of the casing which under the weight of the liquid in the casing above the sealing ring seals the casing so as to prevent circumventing circulation of the liquid in the well about the pump.

3. A self-supporting pump unit, as defined by claim 1 wherein said carrying means comprises an elongated non-supporting shaft having a diameter less than the diameter of the casing, and freely movable therethrough and connected at one end to the pump unit for moving the same therewith through the longitudinal length of the casing.

4. A self-supporting pump unit as defined by claim 3 wherein said means for sealing the pump unit within the casing comprises a sealing ring mounted on the pump unit adjacent its lowermost end, and having a gasket in contact with the inner wall surface of the casing which under the weight of the liquid in the casing above the sealing ring seals the casing so as to prevent circumventing circulation of the liquid in the well about the pump.

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