

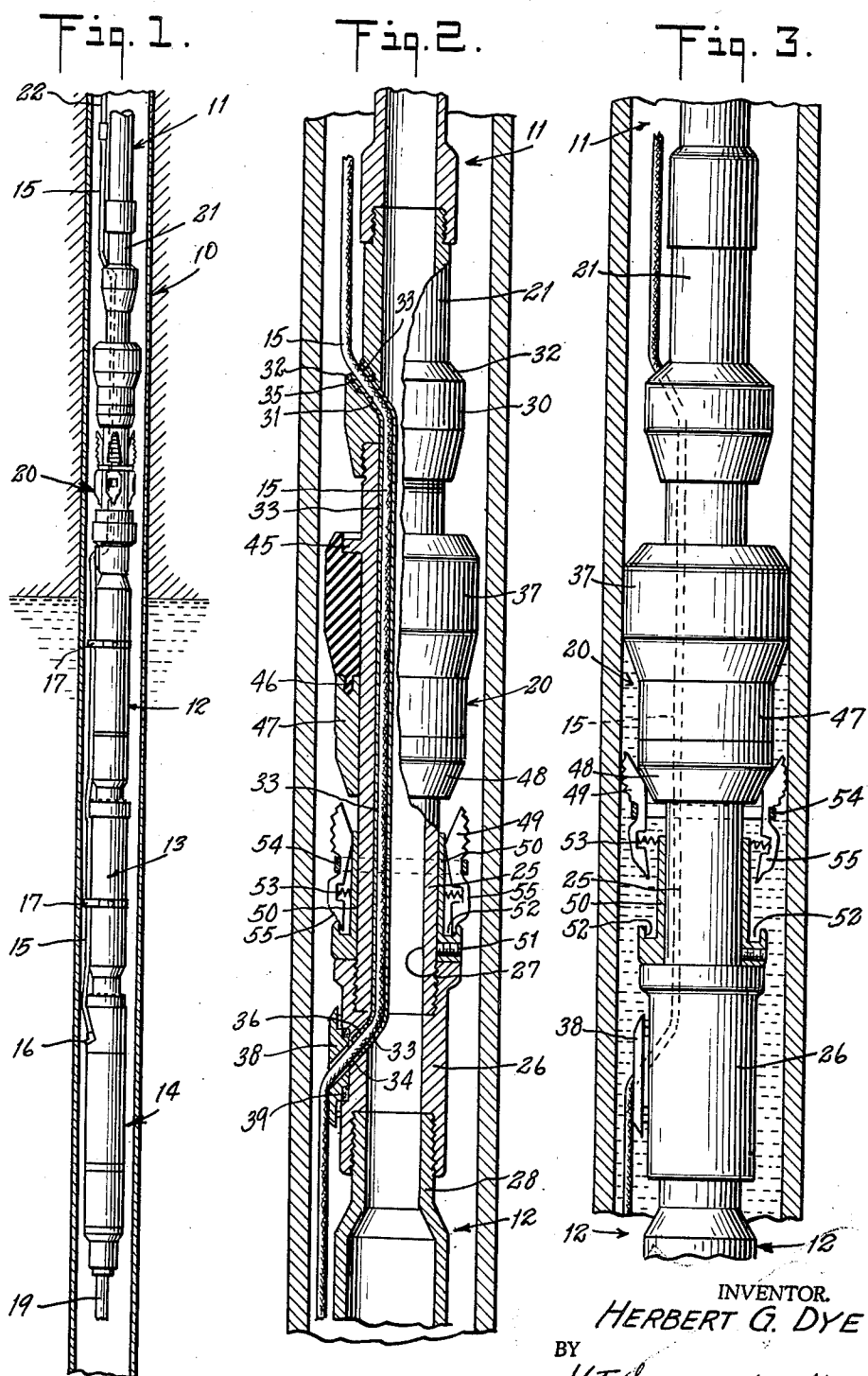
July 27, 1965

H. G. DYE

3,196,948

ISOLATION PACKER FOR WELL PUMP

Filed April 10, 1962



INVENTOR.
HERBERT G. DYE
BY
H. T. Seijan & J. J. Hart
ATTORNEYS

1

2

3,196,948

ISOLATION PACKER FOR WELL PUMP

Herbert G. Dye, Tulsa, Okla., assignor to American Metal Climax, Inc., New York, N.Y., a corporation of New York

Filed Apr. 10, 1962, Ser. No. 186,549
6 Claims. (Cl. 166-65)

This invention relates to an improved isolation packer for sealing off an electric pump submerged in the fluid of a supply well.

Pump units of the indicated type are usually composed of three aligned sections, a centrifugal pump section connected through a protector section to a submergible electric motor, and have an outside diameter which enables them to be lowered to the bottom of wells provided with standard sizes of casing. When in operating position, the pump unit is submerged in the well fluid, and is connected to the surface by the tubing on which it is suspended and a cable which supplies electricity to the motor. So far as applicant is aware, no satisfactory method has been devised to protect this tubing and cable from the corrosive effects of the well fluid. The corrosive action of the well fluid on the cable especially is quite rapid and in a relatively short time, a matter of a few months, causes a dead short therein and consequently the burning out of the pump or motor. As the cost of pulling out the unit to replace the corroded and inoperative parts is a relatively expensive one, attempts have been made by the art to find some method of protecting the equipment against such corrosive action. One effective answer found by the art has been to chemically treat the supply well, but while such treatment has been effective in protecting the equipment against corrosion, it is too costly a procedure to be generally practical.

The principal purpose of the present invention is to provide an improved isolation packer capable of sealing off the cable at the top of the pump unit so that the well fluid cannot corrosively effect the cable extending from the top of the pump unit and through the space between the tubing and the casing to the surface.

The advantages and novel features of the invention will become more apparent from the following description, when read in connection with the accompanying drawings which illustrate one embodiment that may be utilized for practicing the invention, and in which

FIG. 1 is an elevational view, partly in section, of the bottom part of the casing in a supply well and illustrating the manner of placing the equipment in position in the well;

FIG. 2 is an enlarged view, partly in section, of the packer shown in FIG. 1; and

FIG. 3 is a view similar to FIG. 2 showing the packer in sealed position in the well casing.

In the drawings, the reference numeral 10 indicates the wall of the well casing into which the pump unit is adapted to be run by lowering a string of tubing 11. The pump unit illustrated is of the type known as a Reda pump and comprises a multistage centrifugal pump section 12, the shaft of which is directly connected through a protector section 13 to a submergible electric motor on machine 50

section 14. The three sections are in aligned relation with the motor section 14 at the bottom of the unit. Depending from the bottom end of the motor 14 is the anode 19. Electricity is supplied to the motor section 14 through a flat cable 15 which is connected at its lower end to the pot head 16 of the Reda motor 14 and which extends upwardly therefrom along the exteriors of the protector 13 and pump section 12 to the isolation packer of this invention which is designated generally in FIG. 1 of the drawings by the reference numeral 20. The flat

cable 15 is held in place on the exteriors of the Reda protector and pump sections by Monel straps 17, 17.

As is indicated in FIG. 1, the flat cable 15 extends up through the interior of the packer 20 and emerges from the latter just below the connection of the upper end 21 of the packer to the lower end of the tubing string 11, and into the space between such string and the casing 10. Above the packer, the flat cable 15 is spliced to the lower end of the main cable 22 which extends up through the space between the string and the casing to the surface and is held in place on the exterior surface of the string 11 as by Monel bands.

The isolation packer 20, as will be seen more clearly in FIG. 2 of the drawings, is composed of an upper tubular end 21, a tubular body portion 25 and a tubular lower end section 26, which constitute the mandrel of the packer. The bore 27 provided through the outside mandrel by such tubular members 21, 25 and 26, is substantially uniform and approximates that of the tubing string 11, and is in direct communication with the Reda pump unit by reason of the direct connection of the lower end member 26 with the upper end 23 of the pump section 12 thereof. The enlarged lower end 30 of the upper end member 21 is provided with a passageway 31 which extends through the thicker wall portion of such end 30 in upwardly inclined relation to an inclined shoulder 32 at the upper extremity of such end 30. Located within such passageway 31 is the upper bent end of a tube 33 which extends downwardly through the mandrel bore 27 adjacent to the inner wall of such mandrel, and which is provided with a lower bent end that extends into a downwardly inclined passageway 34 provided in the lower mandrel member 26. The tube 33 is made of the same material as the mandrel members, which preferably are constituted of a suitable corrosive resisting metal, and has an inside cross-sectional area large enough to enable the flat cable 15 to be readily threaded therethrough. To facilitate this the upper end of the tube or cable conduit 33 is preferably made flush with the shoulder 32 and is provided with a slight bevel. The upper tube end is sealed in the passageway 31 by an epoxy resin seal 35 to prevent leakage of the well fluid through such passageway into the space between the casing 10 and string 11.

The lower end of the tube or cable conduit 33 terminates short of the outer end of the passageway 34 in the mandrel member 26 and is secured in position therein by an epoxy resin seal 36 to prevent leakage of the well fluid in the bore 27 into the tube 33. The lower end of tube 33 is further sealed against the fluid in the space between the packer and the well casing 10 below the expander rubber 37 of the packer by a packing gland 38 provided with a suitable packing 39, such as graphite.

The annular expander or pack off rubber 37 is mounted on the body member 25 of the mandrel which is provided in its upper end portion with an integral outwardly projecting annular flange 45 that is received in a recess in the upper end of the rubber expander 37 and functions as a stop to prevent upward movement of the expander on the mandrel. The expander 37 is made of any suitable rubber, such as 75 durometer rubber, and has integrally formed on its lower end a depending annular flange 46 which is concentric to mandrel member 25 and is locked in an annular recess provided in the top end of the packer setting member 47 slidable on member 25. The lower end of the setting member 47 is provided with an integral cone 48 with which cooperate a plurality of slips 49.

The slips 49 are associated with an annular ring 50 which is mounted on top of the lower mandrel member 26 and is secured to the lower end portion of the body member 25 of the mandrel by a set screw 51. The ring 50

is formed to provide a J-slot 52 which cooperates with the J-pins on the lower ends of the slips 49 to prevent premature setting of the packer. Associated with pressure dogs 53 formed on the slips 49 are expansion springs 53 which bear against the ring 50 so as to tend to outwardly shift the pressure dogs 50 against the casing 10. The slips 49 are maintained in proper assembly on the fixed ring 50 by the band 54 encircling the same.

It will be understood from the foregoing, that prior to running the packer into a well, the slips 49 are retracted and releaseably locked by the engagement of the J-pins thereof with the J-slot 52 on the assembly ring 50. As the packer is run into the well, the pressure dogs 55 of the slips under the pressure of springs 53, bear with a slight tension on the interior surface of the well casing 10 and act as a guide for the apparatus being lowered into such casing. When the packer reaches the desired depth at which it is to be set, the tubing string 11 is picked up about twelve inches and then rotated to the right about three quarters of a turn. During this rotational movement of the tubing string 11, the slip assembly is held stationary by the tension of the pressure dogs 55 on the inner wall of the casing, but the mandrel and the rest of the packer are caused to rotate to move the J-slot to a position relative to the slips at which the J-pins can be released from locking position. When the J-pins and the J-slot arrive at this relation, the slip assembly will become loose and the springs 53 will expand the slips out into pressure contact with the interior surface of the well casing 10. The tubing string 11 is then set down, and the substantial weight thereof will force the tapered section 43 into the tapered area defined by the upper ends of the slips and cause the latter to bite into the casing wall. At the same time, the pack off rubber 37 will be compressed into sealing relation with the interior surface of the well casing, thereby sealing the tube 33 from the fluid in the space between the well casing and the Reda pump unit. The exterior of the entire string 11 of tubing, the Reda flat cable 15 and main cable 22 will then be completely isolated and protected from the well fluid.

To retrieve the apparatus, all that is necessary to do is pick up the tubing string 11. This unpacks the isolation packer, thereby releasing the compressive force on the rubber expander 37 and enabling the isolation packer to be drawn freely up through the casing with the pump unit.

While I have hereinabove describe and illustrated in the drawings, one embodiment of my invention, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention. Thus, the design of the packer mandrel may be altered, the type of rubber expander may be changed, and a different type of slip construction may be utilized. Hence, it is intended to cover all forms of the invention coming within the scope of the appended claims.

I claim:

1. A packer for isolating the portion of an electric cable extending upwardly from an operating unit in a well casing past the packer and beyond the latter toward the surface in the space between the well casing and the tubing string, from the well fluid in said casing below the packer, said packer comprising a tubular mandrel having a fluid bore for connecting the bore of the tubing string with the bore of an operating unit located below said packer, a cable conduit located in said mandrel bore and extending lengthwise thereof, the ends of said cable conduit extending into transverse passageways provided through the wall of said mandrel adjacent to the upper and lower ends of the latter, whereby there is provided in said mandrel bore a longitudinally extending cable conduit which is isolated from such bore and which is in communication at its upper and lower ends with the space between the well casing and the tubing string and packer, means sealing said upper and lower cable conduit ends in said passageways against the well fluid in said mandrel

bore, means sealing the lower end of said cable conduit against entry into said cable conduit of the well fluid in said casing below the packer, a packing element mounted on said mandrel between the upper and lower ends of said cable conduit, and packer setting means operatively associated with said packing element and located on said mandrel between said upper and lower ends of said cable conduit.

2. A packer such as defined in claim 1, in which the means sealing the lower end of said cable conduit against well fluid in said casing below the packer, comprises a packing gland having an opening to receive the cable.

3. A packer such as defined in claim 1, in which said packer mandrel is composed of an upper end member connectable to the lower end of the tubing string, a body member and a lower end member connectable to the operating unit, one of said cable conduit ends extending into a transverse passageway in said upper end member, and the other of said cable conduit ends extending into a passageway in said lower end member, said packing element and said packer setting means being mounted on said body member.

4. A packer such as defined in claim 3, in which said upper end, body and lower end members of said mandrel are separably connected and are held in assembled relation by said cable conduit and said sealing means at the ends of said cable conduit.

5. A packer such as defined in claim 3, in which said upper end member is provided with an upper outer inclined shoulder in the surface of which terminates the outer end of the transverse passageway in said upper end member.

6. Pumping apparatus adapted to be inserted in a well casing comprising a string of tubing extending downwardly through the well casing, an electric pump unit located at the lower end of said tubing string and having an electric power cable extending upwardly to the upper end of the well casing, and a packer connecting said electric pump unit to the lower end of said tubing string and isolating the electric cable from the well fluid pumped upwardly by said pump unit and from the well fluid in the well casing below the packer, said packer comprising a tubular mandrel having a fluid bore connecting said pump unit with said tubing string, a cable conduit located in said mandrel bore and extending lengthwise thereof, the ends of said cable conduit extending into transverse passages through the wall of said mandrel adjacent to the upper and lower ends of the latter to provide in said mandrel bore a longitudinally extending conduit which is isolated from such bore and which is in communication at its upper and lower ends with the casing space between the wall of the well casing and the pumping apparatus, the electric cable from said pump unit passing from such casing space into the lower end of such conduit and returning to such casing space from the upper end of such conduit, means sealing said upper and lower cable conduit ends in said transverse passages against entry into said cable conduit of well fluid in said mandrel bore, means sealing the lower end of said cable conduit against entry into said cable conduit of well fluid in such space below the packer, and packing means mounted on said mandrel between the upper and lower ends of said cable conduit.

References Cited by the Examiner

UNITED STATES PATENTS

798,504	8/05	Gardner	166—60
1,291,302	1/19	Waring	166—60 X
1,820,291	8/31	Strandell	166—60
2,242,166	5/41	Bennett	103—87 X
2,703,620	3/55	Truby	166—65 X
2,739,650	3/56	Hill	166—106
2,849,069	8/58	Baker et al.	166—138
3,074,484	1/63	Conrad	166—138 X

75 CHARLES E. O'CONNELL, *Primary Examiner*.