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D. R. TRIPPLEHORN
SPIRAL PARAFFIN SCRAPERS

2,733,768

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Fig. 1.

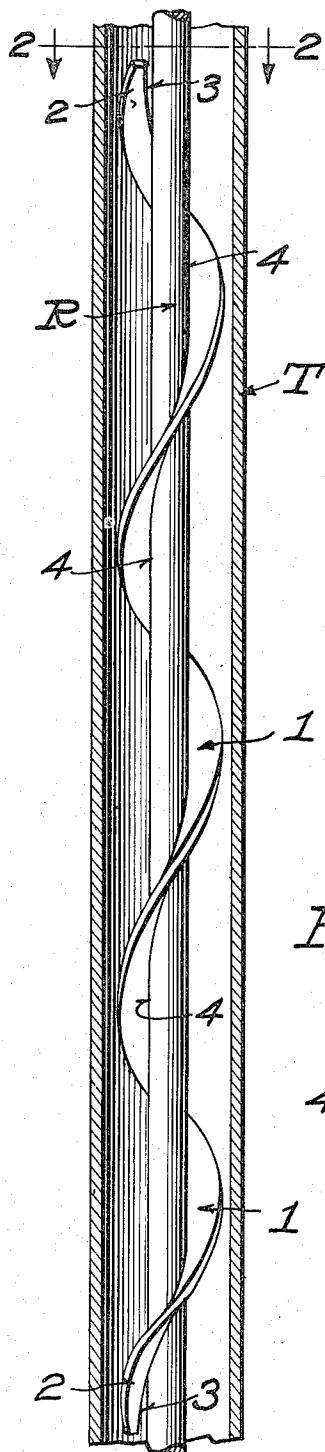


Fig. 2.

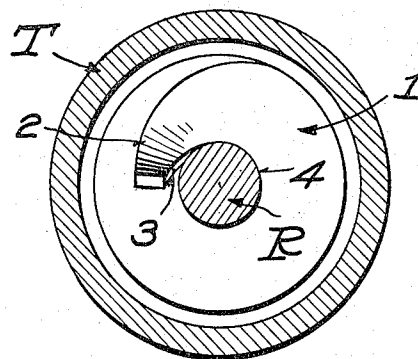


Fig. 3.

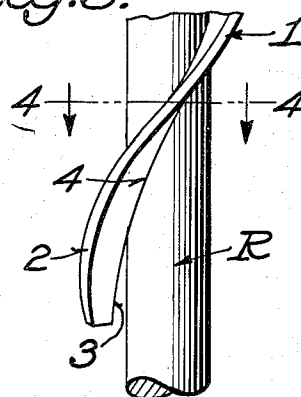


Fig. 4.

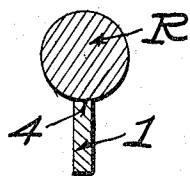
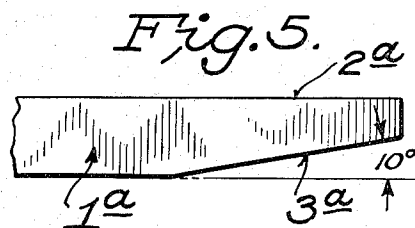


Fig. 5.



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SPIRAL PARAFFIN SCRAPERS

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5 Claims. (Cl. 166—176)

My invention is an improved spiral paraffin scraper of the type which grips a sucker rod and is maintained in position thereon by friction.

The principal object of my invention is to provide a spring steel spiral paraffin scraper which may be quickly and easily installed on or removed from a sucker rod by any member of a drilling crew at the well site. According to a recent survey made of the oil industry it appears that the most common type of paraffin scraper is the type shown in Patent No. 2,453,199, this scraper being secured in place by welding. Because of the fact that the welding of the ends of the scraper to a sucker rod destroys the temper of the rod in the vicinity of the weld, it is not practical to attempt to weld a scraper to a rod at the well site, and it is therefore necessary and common practice to ship the sucker rods to an installation factory where metal bands are shrunk around the rods, the scrapers being subsequently welded to these bands instead of to the rods. I have therefore provided the paraffin scraper which is the subject of the present patent application and which is entirely satisfactory to both the well operators and to the manufacturers of the sucker rods. My invention eliminates the necessity of shipping the rods to an installation factory for installation of scrapers, and at the same time provides a paraffin scraper which, according to actual tests, grips the rods so tightly that a force, well in excess of those encountered in normal well operations, is required to cause the scraper to slip on the rod. The elimination of the necessity of shipping sucker rods to installation factories to have scrapers welded thereon effects a considerable saving in cost and time.

Another very important object of my invention is to provide a paraffin scraper which will not nick or bite into the sucker rod in the manner intended and set forth in some prior-art disclosures, showing a spiral paraffin scraper having each end turned in so as to bite into the rod. Such a bite into the rod by the end of the scraper, of course, increases the grip of the scraper on the rod, but the nicking of the rod causes frequent breakage thereof by creating a weak spot therein. Consequently this type of scraper is definitely not recommended by manufacturers of the drill rods, and, in fact, has apparently not been marketed at all.

Another important advantage of my paraffin scraper is that, since the latter is installed at the well site, the spacing between adjacent scrapers may be altered to suit the length of stroke of the particular pump which is used, thereby obviating the disadvantage of the type of paraffin scraper which is welded to the sucker rod which can not be longitudinally repositioned at the site of the drilling operation, and can not be transferred to a new rod from a damaged one.

Another important object of my invention is to provide a spiral paraffin scraper which may be economically manufactured of heat treated spring steel, the present practice being to use No. 1095 spring steel having a Rockwell hardness of 43 when heat treated.

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The principal feature of novelty of my invention resides in the ends of the scraper which, like the body of the scraper, are substantially rectangular in cross-section and which are perpendicularly disposed with respect to the surface of the rod. It is an important object of my invention to provide a paraffin scraper having ends which are each tapered both inwardly and outwardly in a direction radially of the rod as shown in the accompanying drawing. Each end of the scraper is tapered inwardly so as to prevent the end from engaging on tool joints in the well tubing; and in addition, the inside edge of each end of the scraper is tapered outwardly from the surface of the sucker rod so as to insure that the frictional gripping of the helix of the scraper on the sucker rod will occur and will be uniform along the entire inner periphery of the scraper intermediate its tapered ends. Otherwise the inner periphery of the helix may be bowed outwardly from the rod somewhere along the line of contact caused by distortion of the helical shape of the scraper when one or both ends bite into the rod. The tapering of the inner periphery at the ends assures that there will be no inwardly projecting discontinuities.

Another advantage of tapering the end of the scraper outwardly from the surface of the sucker rod is to provide a small clearance at each end between the inner periphery of the scraper and the surface of the sucker rod so that a screw-driver or other tool may be inserted therebetween for the purpose of removing the scraper from the rod.

Another very important object of my invention is to provide a scraper having ends which are not bent very far from the original shape of the bar stock prior to shaping of the helical scraper. It has been found that, during the manufacture of spiral scrapers wherein each end of the scraper is bent through a considerable angle so as to provide hooked ends such as are shown in some prior-art disclosures, when this type of scraper was tested in actual operation within oil wells, the ends frequently break off of the scraper and not only reduce the gripping power of the scraper but also tend to wedge between moving parts within the well and cause damage to the tubing and sucker rod or to the remaining portion of the scraper. Further tests were run in order to determine the cause of such breakage and it was discovered that the breakage was due to the complex bending of the ends of the annealed bar stock during shaping of the scraper and prior to final heat treating thereof. If the ends of the scraper are bent very sharply or in several different directions, the grain structure of the annealed spring steel is overstressed in such a way as to cause hidden damage thereto. My invention eliminates most of this complex bending of the ends of the scraper so that the device set forth in the present application has substantially as strong a grain structure at its ends as it has elsewhere along its length.

Another important object of my invention is to provide a helical scraper having its end portions lying in a continuation of the helical form of the body of the scraper so that there are no complex bends which increase turbulence in the flow of the oil therepast, such turbulence greatly restricting the flow of fluid upwardly through the tubing. Paraffin tends to build up on complex bends to the extent that free flow of well liquid is retarded.

Another advantage of my scraper is that since the ends thereof conform with the helical shape of the body of the scraper, it is possible to nest more of these scrapers together for the purpose of shipment than is possible with scrapers of the type wherein the end structure of the scraper does not conform with the helical shape of the body and thereby prevents nesting of a large number of scrapers together for shipment.

Other objects and advantages of my invention will become apparent during the following discussion of the drawing wherein:

Figure 1 is a longitudinal view of a pump tubing, broken away to show the sucker rod within said tubing having one of my spiral paraffin scrapers fixed thereto.

Fig. 2 is an enlarged section view along line 2—2 of Fig. 1.

Fig. 3 is an enlarged view of one end of my spiral paraffin scraper secured to the sucker rod.

Fig. 4 is a section view along line 4—4 of Fig. 3.

Fig. 5 is a view of one end of the rectangular spring steel stock from which my paraffin scrapers are made, this view showing the end of the rod tapered at an angle of approximately 10° for the purpose hereinafter discussed.

Referring now to the drawing, Figs. 1 and 2 show a pump tubing T having a sucker rod R axially disposed therein, the tubing and the rod being standard equipment and forming no part of the present invention. A spiral paraffin scraper 1, according to the present invention, is shown frictionally gripping the rod R, the scraper having identical upper and lower ends. Each of these ends is tapered inwardly toward the rod R as at 2 so as to prevent snagging of the scraper on the joints of the tubing T, and each end of the inner periphery of the spiral scraper is tapered outwardly from the rod R as at 3, for the purpose hereinafter stated. Attention is called to the fact that each end of the paraffin scraper conforms with the general helical form of the body of the scraper and is a continuation thereof so that the paraffin scraper ends are perpendicular to the adjacent surface of the sucker rod and do not tend to turn over or lie flat thereagainst. The fact that the scraper ends conform to the general helical shape of the body of the scraper permits the spiral flow of well fluids to wash all exposed surfaces of the scraper and the rod to prevent the building up of paraffin deposits.

The paraffin scraper itself is manufactured from substantially rectangular 1095 spring steel stock, which stock has been cut at each end in the manner shown in Fig. 5 so as to provide at the terminal portions of the stock an approximate 10° angle before the stock is formed into the helix. After the spring steel stock 1a is formed into the helical shape, the outer surface of the stock at the ends thereof in the vicinity of 2a, Fig. 5, is bent slightly inwardly so that the tapered surface 3a partially approaches the inner periphery of the helix. In this manner both the inner and the outer edges of the terminal portions of the scraper are shaped with a minimum bending of the annealed spring steel.

During the forming of the spring steel flat stock 1a into the helical scraper 1, the inner periphery 4 of the helix is formed to provide a uniform diameter somewhat less than the outer diameter of the sucker rod which the scraper is intended to grip, and this inner diameter is uniform along the full length of the scraper between the tapered ends 3 so that the grip of the scraper on the sucker rod will be uniform along substantially its full length except at the terminal ends which do not contact the rod.

In operation

My paraffin scrapers are manufactured in both right-hand and left-hand helixes so that the two types of helix may be installed alternately on the sucker rod if desired for the purpose of eliminating any tendency which the rod joints may have to be unscrewed by the passage of well fluids past the scraper. Alternatively, however, all right-hand helixes may be installed on one sucker rod and all left-handed helixes on the adjacent rod so that in the event one helix slips it can slide on the rod and interwind within one of the adjacent similar scrapers so as to permit the operation to continue practically undisturbed. Severe stresses occur tending to stretch sucker rods when a pump fails or sands up. When a rod is stretched by a pulling rig trying to free a stuck plunger,

the diameter of the rod is decreased enough to permit a scraper to slide thereon and approach an adjacent scraper.

My scraper is quickly and easily installed on a sucker rod without necessitating special tools, such installation being carried out merely by hand with the assistance of a screw-driver or tire iron to maintain one end of the scraper in place on the rod while the body of the scraper is manually wound therearound. When one end and the body of the scraper are secured in place, the other end of the scraper may be positioned by placing a screw-driver under that end and against the rod and snapping the end in place on the rod. Removal of the scraper from the rod, of course, is easily accomplished by merely sliding a screw-driver between the sucker rod and the inner periphery 3 of one end of the scraper and prying that end of the scraper off of the rod, the disengagement of the body of the scraper being easily accomplished by manual unwinding thereof.

Tests of actual production models of this scraper show that it grips the sucker rod so tightly that a force of 2350 pounds is required to cause slippage thereof on the rod, and tests made during actual operation in wells show that even after a rod has been stressed or stretched so that its diameter is slightly reduced, my paraffin scrapers do not slip on the rod under normal operating conditions.

I do not limit my invention to the exact form shown in the drawing, for obviously changes may be made therein within the scope of the claims.

I claim:

1. A removable spiral paraffin scraper adapted to frictionally engage a sucker rod within the tubing of a well, said scraper comprising a blade of spring material having opposed narrow edges and being wound in the form of a helix, said blade frictionally engaging said rod along one narrow edge and standing normal to said rod along the full length of the scraper, the said narrow edges being tapered at the ends of said scraper to partially approach each other.

2. A removable spiral paraffin scraper adapted to frictionally engage a sucker rod within the tubing of a well, said scraper comprising a spiraled blade of spring material having an inner periphery defining a bore through the scraper, the bore being normally of smaller diameter than the diameter of the sucker rod whereby said inner periphery will tightly grip said rod when the scraper is engaged thereon, said blade being of helical shape and being disposed normal to said rod along the full length of the scraper, and the inner periphery at the ends of the scraper being tapered outwardly away from the rod whereby the ends of the scraper will be prevented from biting into said rod.

3. In a scraper as set forth in claim 2, said blade having an outer periphery, and the outer periphery being tapered inwardly toward said rod at the ends of the scraper to prevent snagging of the scraper in said tubing.

4. A spiral paraffin scraper adapted to engage a sucker rod within the tubing of a well through which tubing fluid is flowing, said scraper comprising a spiraled blade of spring material having narrow surfaces forming respectively the outer and inner peripheries of the scraper said inner periphery frictionally gripping said sucker rod, and said blade having broad surfaces disposed substantially normal to said rod along the full length of said scraper, and each end of said blade having a terminal portion whereat said inner and outer peripheries are tapered respectively toward each other, said terminal portions forming continuations of the spiral shape of said body to thereby present a minimum impedance to the flow of said fluid.

5. A spiral paraffin scraper adapted to engage a sucker rod within the tubing of a well, said scraper comprising a spiraled blade of spring material substantially rectangular in cross section, said blade having narrow surfaces forming respectively the outer and inner peripheries of the scraper said inner periphery frictionally gripping said

sucker rod, and said blade having broad surfaces disposed substantially normal to said rod along the full length of said scraper, and each end of said blade having a terminal portion whereat said inner and outer peripheries are tapered respectively toward each other thereby tapering the terminal portion of the outer periphery inwardly toward the rod to prevent snagging of the ends against said tubing and tapering the terminal portion of the inner periphery outwardly away from the rod whereby the grip of the scraper on the rod will occur intermediate said terminal portions.

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