Oct. 16, 1962 J. C. TRIPPLEHORN 3,058,524

MIGRATORY PARAFFIN SCRAPER

Filed Sept. 14, 1959

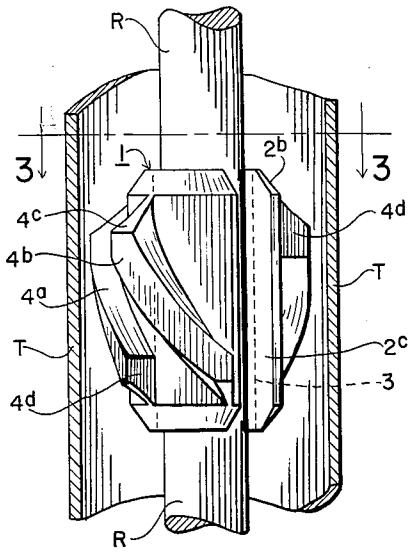


Fig. 1

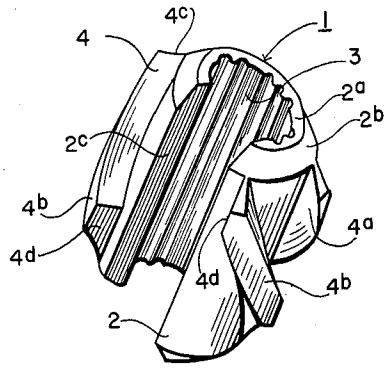


Fig. 2

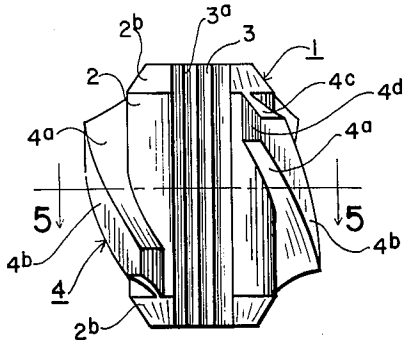


Fig. 4

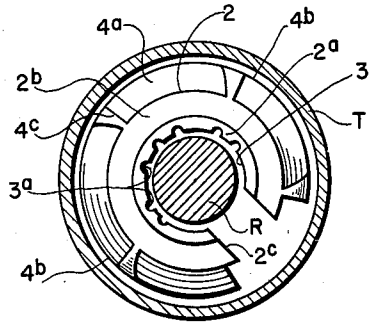


Fig. 3

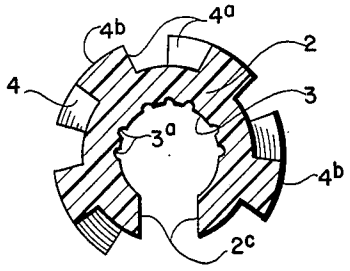


Fig. 5

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MIGRATORY PARAFFIN SCRAPER

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This invention relates to paraffin scrapers of the type which is applied loosely to a sucker rod while the latter is being reciprocated within a tubing string during pumping of an oil well, and more particularly the invention relates to migratory paraffin scrapers which are free to move up and down not only with respect to the tubing but also with respect to a length of the sucker rod to which the scraper is applied, the scraper also serving as a rod guide tending to space the rod from the walls of the tubing.

It is a principal object of this invention to provide an improved paraffin scraper which is free to move axially on the sucker rod which it surrounds so as to prevent the building up of paraffin deposits on the sucker rod by scraping the rod itself, the travel of the scraper being confined either to that particular rod, or being further confined to a certain longitudinal portion of the rod by abutments which may comprise fixed types of rod guides or scrapers which are not free to move axially of the rod.

It is another primary object of this invention to provide a migratory paraffin scraper which may be installed on a standard rod having standard tool joints without the necessity of severing the rod or otherwise altering it.

It is another major object of this invention to provide a paraffin scraper which is in the form of a C-shaped body having a central bore therethrough adapted to receive and freely pass the sucker rod, the inside diameter of the body being larger than the sucker rod and the body having a plurality of scraping blades disposed on its outer surface at an angle inclined with respect to the axis of the body which coincides with the axis of its bore. The blades have outer bearing surfaces coinciding with the surface of a cylinder coaxial with the body, and the outside diameter of these bearing surfaces is smaller than that of the pump tubing in which the sucker rod and scraper are intended to operate. The C-shaped body terminates circumferentially in a slot provided to permit forceable installation of the body on a sucker rod, the slot also assisting the body to present minimum restriction of the oil passage space between the sucker rod and the well tubing. The meetings of the side surfaces of the blades with the outer bearing surfaces thereof are purposely made abrupt so that the blades will have scraping edges which are satisfactory for scraping the inner surfaces of the well tubing. I have also provided a plurality of scraping edges within the bore of the body by including a series of grooves therein, said inner scraping edges cleaning the outside surfaces of the rod. The present paraffin scraper consists of a one-piece molded body integrally connected with the scraper blades and of sufficient axial length that it cannot tilt crosswise in the tubing far enough to become wedged therein.

It is a further very important object of the present invention to provide a paraffin scraper which is made of a plastic which can be molded and hardened to retain its shape, and in addition which plastic, at the temperatures encountered in oil wells, is dimensionally stable and

resistant to attack by oil and acids. The electrical insulating properties of the plastic are also important since they prevent the attack on other adjacent metal parts in the well by electrolysis. A range of suitable plastics includes the following:

Vinylidene chloride—Rigid compound
Polyamides—Molding types, Nylon 1001 known as Zytel
Polytetra-fluoro ethylene
Polychloro-tri fluoro ethylene
Polymethyl alpha chloro-acrylate
Polyester diallyl phthalate
Poly acetal resin

The use of plastic in connection with such a scraper is important for several reasons. In the first place, manufacturing of such a product can be conveniently and economically carried out by molding or by some other plastic handling process in order to produce the desired form. In addition to obvious advantages which the plastic has over metals, plastics found in the above range also exhibit spring-like qualities generally thought of in connection with metals, which spring-like qualities permit the scraper to flex open when being installed on a sucker rod without damage or breakage. Another advantage in the use of the above plastics results from the fact that the very substance to be scraped by the scraper, namely the paraffin, has very little tendency to adhere to the plastic scraper since paraffin does not tend to adhere to the smooth non-porous surface. Therefore, the build-up which occurs on metal paraffin scrapers is substantially absent when the above plastics are substituted for the metals, and this fact is especially important in connection with the scraping grooves in the bore of the present scraper, which grooves would become filled and clogged with paraffin if the scraper were made of a material to which paraffin adheres.

Another benefit which results from the use of plastics comes about because of the fact that the specific gravity of the above plastics is very similar to the specific gravity of the liquids found in oil wells, and not nearly as different as the specific gravity of most spring-like metals would be. This feature is of considerable importance because of the fact that the paraffin scraper when made of a material having a specific gravity approximating that of the oil liquids will migrate through considerable distances during reciprocation of the sucker rod within the well tubing. For example, in the case where the stroke of the sucker rod in the tubing is 3 feet, a relatively short scraper, perhaps only a few inches or so long, will clean a 10- or 15-foot vertical length of sucker rod and tubing despite the relatively short stroke of the pump.

Because of the fact that the specific gravity of the scraper is nearly the same as that of the well liquids, the scraper will work its way along the tubing from one abutment to the next adjacent abutment even though this distance may be many times the length of the pump stroke and many times the length of the scraper. The scraper, of course, does not pass over such a length of sucker rod in one or two strokes, but may require a considerable time to cover the greater length. Tests have shown, however, that it does periodically cover such a length and that such coverage tends to be repeated at regular enough intervals that the migratory scraper will satisfactorily prevent the building up of paraffin deposits on both the rod and the tubing. It is well known that the well fluids are

not homogeneous but contain oil and water, more or less solid objects, lumps of paraffin, and gas pockets. This non-homogeneous character of the fluid which is being pumped upwardly partially accounts for the fact that the scraper is caused to migrate over a greater length of rod and tubing than the length of the pump stroke.

When the present migratory scrapers are employed in combination with fixed scrapers as disclosed in my co-pending application relating to "Paraffin Scraper Combination," Serial Number 672,268, filed July 16, 1957, now Patent 2,997,106, when the sucker rod is descending the column of fluid is standing substantially still in the vertical direction but it may be caused to rotate by the downward passage of helical blades of scrapers fixed on the sucker rod. Since the migratory scrapers have inclined blades on their outer surfaces, and since these scrapers are initially not rotating with the well fluids but have rotational inertia, they are forced to travel in an axial direction by their "screw action" in the column of liquid as the column rotates faster and faster during the down-stroke of the rod. However, during the up-stroke of the pump rod this "screw action" forces the scrapers to travel in the opposite axial direction in the rotationally decelerating fluid. The relative rates of rotation in the two directions between the fluids and the migratory scrapers are varied by collisions between the scrapers and the above-mentioned solid objects, lumps of paraffin, and gas pockets. Although during the up-stroke of the pump the migratory scrapers are carried upwardly by the fluid flow, and perhaps by abutment against the next lower fixed scraper, the migratory scrapers also tend to sink during down-strokes of the rod and may also be forced downwardly by abutment against the next higher fixed scraper. Also they drop rapidly through gas pockets in the fluid column. It is only when the migratory scrapers are relatively lighter than the usual steel scrapers that the above migratory forces all play significant roles in providing migration of the scrapers over a length of rod greater than the length of the stroke.

A further object of the invention is to provide a paraffin scraper which as it is reciprocated performs rotational motion which tends to reserve in direction as the direction of reciprocation of the rod in the tubing is reversed. This rotational-reciprocating action exhibits excellent scraping characteristics.

It is another object of the present invention to provide a flattened surface at each end of the scraper, which surface lies in a plane disposed normal to the axis thereof, and serves as a "land" for contacting the abutments which confine the ambulatory scraper to a certain portion of the sucker rod.

Other objects and advantages of the present invention will become apparent in the following discussion of the drawing, wherein:

FIG. 1 is an elevation view of a migratory paraffin scraper according to the present invention applied to a sucker rod which reciprocates within pump tubing, the tubing being shown cut away so as to render the scraper visible;

FIG. 2 is a perspective view of the scraper shown in FIG. 1;

FIG. 3 is a cross-section taken along line 3—3 of FIG. 1 and showing the scraper in plan view;

FIG. 4 is an elevation view smiliar to the view of the scraper shown in FIG. 3 but showing the scraper rotated about its axis to a different position;

FIG. 5 is a cross-section taken along line 5—5 of FIG. 4.

Referring to the drawing, FIG. 1 illustrates a length of sucker rod R passing through a length of tubing T in which it reciprocates. Around the rod R and within the tubing T is disposed a migratory paraffin scraper **1** according to the present invention and shown in a suspended position with respect to the tubing and sucker rod. The scraper **1** as illustrated in the drawing includes a C-shaped body **2** having an outer surface of generally cylindrical form and having transverse end surfaces **2***a* connected with the outer cylindrical surface by chamfered surfaces **2***b*.

The scraper **1** has a longitudinally disposed central bore **3** therethrough, the bore **3** being of greater diameter than the sucker rod R as can be seen in FIGURE 3. The bore is also provided with a series of longitudinally disposed grooves **3***a* in its wall, which grooves are intended to provide abrupt scraping edges along the lines where they meet the surface of the bore **3**.

The body **2** of the scraper is further provided with a slot **2***c* through its wall and communicating into the bore **3** so as to permit mounting of the body on a sucker rod R. As can be seen in FIG. 3, the width of the slot **2***c* is slightly less than the diameter of the sucker rod so that a certain amount of force is required to place the scraper body **2** on a sucker rod.

The scraper **1** further includes a plurality of scraper blades **4** which form an integral part of the scraper and which have side surfaces **4***a* which are joined substantially at right angles to the outer cylindrical surface of the body **2**. The scraper blades also include outer bearing surfaces **4***b* adapted to bear against the inner surface of the tube T. These outer bearing surfaces **4***b* coincide with a cylinder which is coaxial with the axis of the scraper and its bore. The scraper blades **4** have tapered ends **4***c* which blend smoothly into the chamfered surfaces **2***b* of the body **2**. The blades **4** are further streamlined by longitudinally disposed surfaces **4***d* near their ends which narrow the end area of each blade **4** so that it will present less impedance to the flow of oil past the scraper, thus both ends of each scraper blade are effectively tapered down to a very small end area so as to reduce to a minimum the impedance to oil flow therepast.

The blades **4** are provided at an inclined angle with respect to the longitudinal axis of the scraper **1** and are of substantially helical form. The disposition of the blades at an inclined angle causes the scraper to rotate rapidly by virtue of the screw action of the blades in the well fluids passing the scraper.

The side surfaces **4***a* of each blade meet the outer bearing surfaces **4***b* thereof at right angles or at an acute angle so as to provide abrupt and relatively sharp scraping edges. Likewise the grooves **3***a* meet the surface of the bore **3** at substantially right angles so as to form abrupt or relatively sharp inner scraping edges to assist the scraper in cleaning the rod R during rotation of the scraper thereabout.

It is, of course, to be understood that during pumping of a well the sucker rod R tends to lash back and forth transversely within the tubing T and that therefore the tubing and rod will be in frequent although probably intermittent contact with the inner and outer scraping edges of the present migratory paraffin scraper.

The present invention is not to be limited to the exact form shown in the drawing for obviously changes may be made therein within the scope of the claims.

I claim:

1. The combination of a paraffin scraper with a sucker rod wherein said scraper comprises a substantially cylindrical body having a longitudinal bore therethrough to receive the rod and having a longitudinal slot through the body and communicating with said bore, the diameter of the sucker rod being smaller than the diameter of the bore and greater than the width of the slot; a plurality of scraping blades symmetrically disposed around the outer periphery of the body and standing outwardly therefrom, the blades each being disposed at an inclined angle with respect to the longitudinal bore and each having an outer bearing surface forming part of a cylinder coaxial with respect to the bore, the sides of the blades being disposed substantially normal to the outer surface of the body, and the body having a plurality of grooves recessed

into its inner peripheral surface within the bore and providing scraping edges therein.

2. A one-piece molded paraffin scraper consisting entirely of plastic and comprising a substantially cylindrical body having an axially disposed longitudinal bore therethrough and having a slot through the body communicating with said bore, the width of the slot being less than the diameter of the bore; a plurality of scraping blades symmetrically disposed around the outer periphery of the body and standing outwardly therefrom, the blades each being disposed at an inclined angle with respect to the longitudinal bore and each having an outer bearing surface forming part of a cylinder coaxial with respect to the bore, and the sides of the blades being disposed substantially normal to the outer surface of the body; the body having a plurality of grooves recessed into its inner peripheral surface within the bore and providing scraping edges therein.

3. In a scraper as set forth in claim 2, said plastic comprising nylon.

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