Dec. 26, 1939. J. C. LUCCOUS 2,184,393

PARAFFIN REMOVING DEVICE

Filed Aug. 9, 1937 2 Sheets-Sheet 1

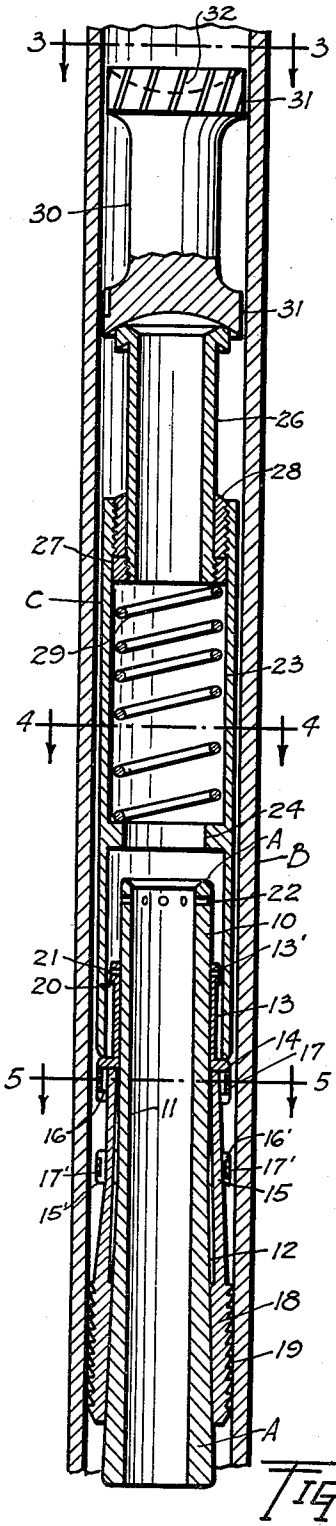


FIG. 1

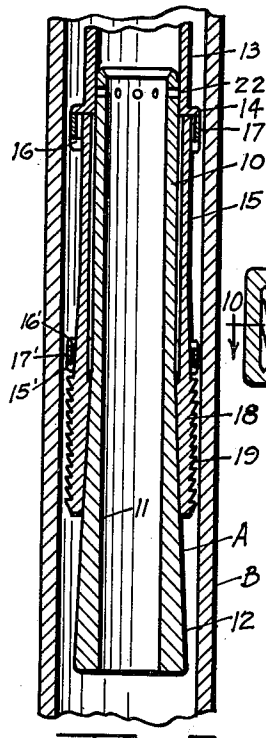


FIG. 2

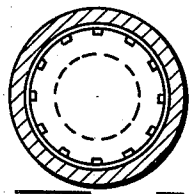


FIG. 3

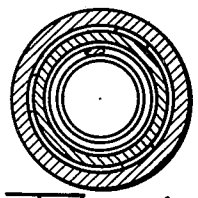


FIG. 4

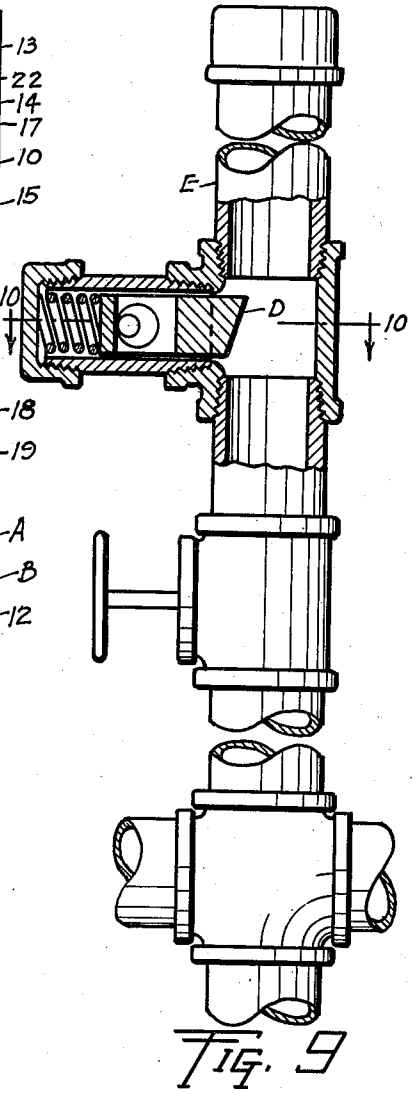


FIG. 9

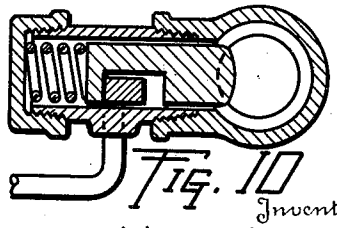


FIG. 10

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PARAFFIN REMOVING DEVICE

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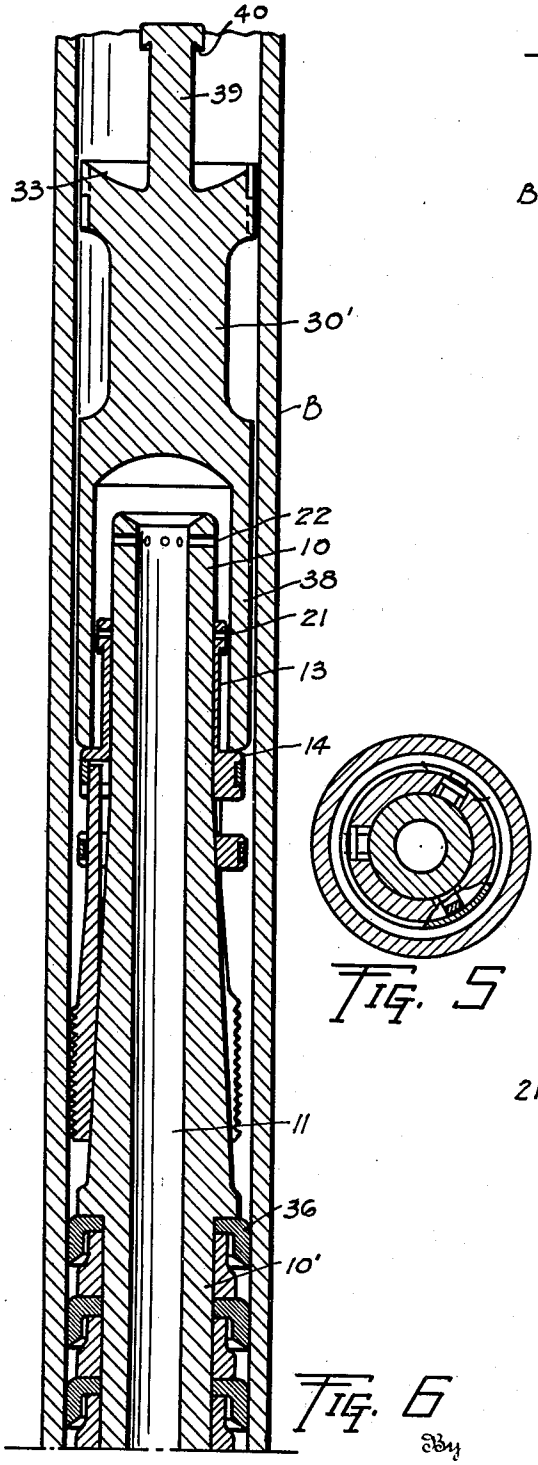


FIG. 6

FIG. 5

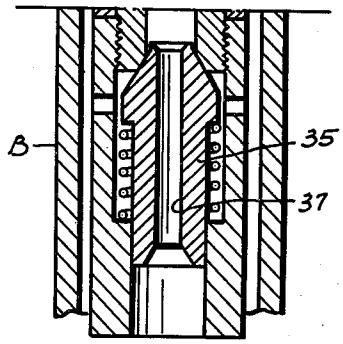


FIG. 7

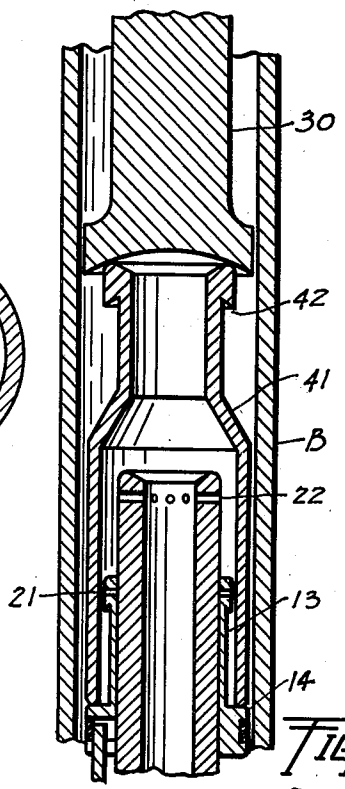


FIG. 8

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UNITED STATES PATENT OFFICE

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PARAFFIN REMOVING DEVICE

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Application August 9, 1937, Serial No. 158,168

12 Claims. (Cl. 166—18)

This invention relates to new and useful improvements in paraffin removing devices.

One object of the invention is to provide a device for removing paraffin from the walls of a well tubing including an improved scraper and an improved stop.

An important object of the invention is to provide an improved device for removing paraffin including a scraper adapted to be actuated by the flow of the well fluid or by fluid pressure together with an improved stop therefor, which stop may be located at any point within the well tubing, whereby the device may be used in wells under various well conditions without removing the well tubing to properly locate a stop therein.

Another object of the invention is to provide an improved stop for a paraffin scraper so arranged that it may be lowered into the well tubing from the surface and located at any suitable depth therein, and which is adapted to be removed from the tubing at any time without pulling or removing the tubing from the well, whereby the bore of said tubing may be left open for the lowering of pressure bombs therethrough, or for other well operations.

A further object of the invention is to provide a removable stop which may be located at any suitable point within the well tubing, and an improved scraper which may be dropped through the tubing so as to be supported on said stop, there being a coaction between the scraper and stop, whereby said scraper will not dislodge or move the stop from its position, within the tubing.

Another object of the invention is to provide a paraffin scraping device including, an improved stop on which a rest is arranged to be supported, and a scraper adapted to be dropped through the well tubing so as to be supported on said rest; the rest being so constructed that shock absorbing means may be incorporated therein if desired, whereby the shock or jar of stopping the falling scraper is absorbed by the rest.

Still another object of the invention is to provide an improved stop and a paraffin scraper arranged to be lifted by fluid pressure to perform its scraping operation, said stop being constructed to be employed in combination with a flow restricting means for restricting the flow through the tubing, whereby the velocity of flow may be increased to assure lifting of the scraper within the tubing; the use of the restricting means being optional and particularly desirable in wells having a relatively low flowing velocity.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Figure 1 is a transverse, vertical, sectional view of an apparatus, constructed in accordance with the invention.

Figure 2 is a transverse, vertical, sectional view of the stop in its released position,

Figure 3 is a horizontal, cross-sectional view, taken on the line 3—3 of Figure 1,

Figure 4 is a horizontal, cross-sectional view, taken on the line 4—4 of Figure 1,

Figure 5 is a horizontal, cross-sectional view, taken on the line 5—5 of Figure 1,

Figure 6 is a view, similar to Figure 1 of the upper portion of another form of the apparatus,

Figure 7 is a continuation of Figure 6, showing the lower end of the apparatus, and

Figure 8 is a transverse, vertical, sectional view of still another form of the invention.

Figure 9 is a view partly in elevation and partly in section of the upper end of the well tubing, and showing the latch for the paraffin scraper, and

Figure 10 is a horizontal cross-sectional view taken in the line 10—10 of Figure 9.

In the drawings, the letter A designates a stop or obstructive device which is adapted to be set at any point within a well tubing B. The device comprises an elongate mandrel 10 having an axial bore 11 extending therethrough. The outer surface of the mandrel is inclined outwardly toward its lower end to form a slip expanding surface 12. A tubular sleeve, or slip carrying member 13 is slidable on the upper portion of the mandrel and an outwardly extending collar or flange 14 is preferably formed integral with the lower end of said sleeve. A plurality of gripping elements 15 have their upper ends supported in radial slots 16 which are formed in the collar 14, and a retaining ring 17 which closes the outer end of said slots, confines the upper ends of said elements therein. Each gripping element extends through a radial slot 15' formed in an annular flange 16' which is integral with the mandrel, and the elements are confined within their respective slots by a confining ring 17' secured to the flange, as is clearly shown in Figure 1. Obviously, with this arrangement the gripping elements 15 are carried by the tubular sleeve or member 13 and said elements may slide with relation to the mandrel 10.

Each gripping element 15 includes an arcuate gripping slip 18 and the inner surface of said slip engages the inclined surface 12 of the mandrel. The outer surface of each slip is formed with gripping teeth 19 which are adapted to move into engagement with the inner surface of the tubing wall and when engaged with said wall, prevent an upward displacement or movement of the device.

The upper end of the tubular sleeve or slip carrying member 13 is provided with an outwardly extending annular flange 13' which flange has its lower end undercut as shown at 20 so as to receive a suitable fishing tool, as will be explained. Radial openings 21 are formed in the flange 13' whereby a lowering tool may be engaged over said flange and pins (not shown) pass through openings in said tool (not shown) and through the openings 21, whereby the sleeve or member 13 is connected to the lowering tool. When it is desired to lower the device within the well tubing B, a lowering tool is connected to the sleeve 13 by pins (not shown) as explained, and thus the entire device is suspended from such lowering tool. When so suspended, the parts assume the position shown in Figure 2 with the mandrel lowered with relation to the slips 18, whereby said slips engage the upper portion of the inclined outer surface 12 of said mandrel, which places the slips in their retracted position. In this position, the tops of the slips 18 are engaged with the underside of the flange 17' on the mandrel, whereby said mandrel is suspended from the slips.

The device may then be lowered through the tubing B without the slips 18 engaging the side wall of said tubing and the lowering continues until the device reaches an elevation within the tubing at which it is to be set. In order to set the slips, the line which is carrying the setting tool is suddenly slackened, which permits the sleeve 13 and the gripping elements 15 carried thereby to move downwardly more rapidly than the mandrel 10, whereby the slips 18 ride downwardly on the inclined surface 12 of said mandrel. This downward movement of the slips with relation to the mandrel causes said slips to be moved outwardly into engagement with the wall of the tubing B. A jar is then imparted to the lowering tool, which will cause the pins extending through the openings 21 to be sheared. The running tool, after being disconnected from the member 13, is then lowered to engage the flange 14 and continued jarring on said flange causes the slips 18 to ride downwardly on the inclined surface 12 to expand said slips into tight engagement with the tubing wall. The lowering tool is then raised and removed from the tubing. Thus it will be seen that the device may be lowered into the tubing and set at any point therein.

It is pointed out that if desired the lowering tool may be connected to the mandrel 10 instead of to the sleeve or slip carrying member 13. The setting of the device would be accomplished by an upward pull on the lowering tool (not shown), whereby the free riding slips 18 would be moved outwardly to engage the tubing wall. Repeated upward jarring tends to more firmly set the slips until the shear pins passing through the openings 22 in the mandrel are broken, after which the lowering tool may be removed.

After the stop or obstructing device 10 has been set in its proper position within the tubing B, and after the lowering tool has been removed, a scraper rest C which may have incorporated therein a shock absorber, is lowered through the tubing so as to be supported by the device 10. This shock absorber comprises an elongate tubular body 23, which is of such diameter that its lower end may telescope the upper end of mandrel 10 and the sleeve 13 so that its lower end may rest upon the collar or flange 14. An internal flange 24 is formed within the bore of the body 23, while the upper end of the bore of said body is internally screw-threaded at 25. A sleeve 26, having an outwardly directed annular flange 27 at its lower end, which flange may be formed by screwing a collar onto the lower end of the body, is slidable vertically within the upper portion of the body 23 and upward displacement of the sleeve from said body is prevented by a retaining collar 28 which is threaded into the upper end of the bore of the body. As is clearly shown in Figure 1, the sleeve 26 is slidable through the retaining collar 28 and its flange 27 is adapted to engage the under side of said collar. A coiled spring 29 is confined between the sleeve 26 and the internal shoulder 24 within the body 23 and this spring exerts its pressure to constantly urge the sleeve 26 to its uppermost position (Figure 1).

After the stop A and the rest C have been positioned within the tubing B, as has been explained, a paraffin scraper 30 is dropped through the tubing B. This scraper is preferably cylindrical in cross-section, being provided with flanges 31 at its upper and lower ends. The external diameter of the flanges is less than the diameter of the bore of the tubing B, whereby a clearance between the tubing wall and the outer surface of the flanges is had. The upper flange 31 of the scraper is formed with inclined grooves 32 whereby cutting teeth are provided and the lower flange may, if desired, be formed with similar grooves. The scraper 30 is preferably metallic and obviously as it falls downwardly through the tubing it will gain considerable momentum. As said scraper drops, it will contact the upper end of the sleeve 26 whereby said sleeve will be forced downwardly against the pressure of the spring 29 and thus, it will be seen that the spring absorbs the shock of the sudden stopping of the scraper. The jar of said scraper striking the shock absorber of the rest will be imparted to the sleeve 23 thereof and through this sleeve, transferred to the flange or collar 14 of the slip carrying member 13. This downward jar or thrust is, therefore, received by the slip carrying member, rather than by the mandrel and the tendency is to more firmly set the slips. Such arrangement eliminates the possibility of the jar, imparted by the sudden stopping of the scraper, dislodging the stop from its position within the tubing. It is noted that in some instances, it may be desirable to move the scraper downwardly in the tubing by fluid or other pressure instead of depending upon gravity to lower said scraper.

After the scraper 30 has been lowered into the tubing, the connections (not shown) at the upper end of the tubing are opened to cause flow of fluid upwardly through the tubing B at sufficient flow velocity to act against the underside of the scraper 30 to raise the same and move it upwardly through said tubing, whereby the peripheral edge of the scraper contacts the paraffin on the wall of the tubing to scrape said paraffin therefrom. The top of the scraper 30 is preferably recessed as shown at 33 whereby a sharp

peripheral edge is formed, which edge performs the scraping action. After the wall of the tubing has been cleaned of paraffin by the upward travel of the scraper, said scraper may be permitted to fall to its position on the rest C and the rate of flow again cut down until only a normal production flow will pass upwardly through the tubing. The clearance between the scraper **30** and the tubing wall may be such as to permit this normal flow of fluid upwardly through the tubing without lifting said scraper. This permits the apparatus to remain in the tubing until such time as sufficient paraffin has accumulated to make it desirable to again scrape the same from the tubing wall, at which time the connections at the upper end of the tubing may again be opened to raise the scraper. It is specifically noted that it is preferable that the normal flow of the well does not raise the scraper **30** as the clearance between said scraper and the tubing wall permits such normal flow. Under such conditions, it is necessary that the flow velocity be increased so that a pressure differential is set up by this increased velocity across the scraper, which pressure differential moves the scraper upwardly in the well tubing.

When it is desired to remove the device from the well tubing, the scraper **30** is lifted by the fluid to the well surface, and subsequently removed from the tubing. The upper end of the sleeve **26** of the rest C is provided with an undercut flange **26'**, whereby a suitable fishing tool (not shown) may be lowered through the tubing and engaged beneath said flange, whereby the rest may be lifted and removed from the tubing. After the rest is removed, the fishing tool (not shown) is again lowered through the tubing and is engaged beneath the flange **13'** on the upper end of the sleeve or slip carrying member **13**. A downward jar on the mandrel **10** and an upward pull on this member by means of the fishing tool will raise the gripping slips **18** with relation to the mandrel **10**, whereby said slips riding up the inclined or tapered surface **12** of said mandrel are retracted from engagement with the wall of the tubing B. Such retraction of the slips will, of course, permit withdrawal or removal of the stop or obstructive device A from the tubing B. The removal of the device from the tubing leaves the bore of the tubing clear so that the running of pressure bombs or other operations may be performed. The stop A may be returned to the tubing at any desired time and may be set at any point therein. In some instances it may be set at one depth and at a later date set at a different depth within the same tubing. The removability or the stop, together with the ease in seting at any desired point, are important features of the invention. The position at which the stop is set will vary with each field and well, said stop being positioned in the tubing a sufficient distance below the lower limits of the paraffin deposit to permit the flow to attain sufficient velocity to move the scraper upwardly to perform the scraping function satisfactorily.

In some cases, it is desirable to keep the scraper **30** out of the tubing B when said scraper is not in use and in such cases, a suitable means may be provided for receiving the paraffin scraper and holding the same from falling back into the tubing. Such a means may be in the form of a spring pressed latch D located in a lubricator E (Figure 9) above the usual flow cross of the upper end of the tubing. The scraper would be carried upwardly past the flow cross into the lubricator by the flow of the fluid. Upon entering the lubricator, said scraper would engage the latch and be held within said lubricator out of the flow line until such time as it is again needed.

Conditions may arise where the velocity of the flowing fluid is not sufficient to lift the scraper **30** and in such instances, it would be desirable to utilize a choke or flow bean **35** (Figure 7). This bean is mounted in the lower end of the mandrel which is formed with an extension **10'** as is clearly shown in Figures 6 and 7. Suitable packing cups or other packing elements **36** are mounted on the extension **10'** below the gripping element **15** and these elements serve to pack off the annular space between the mandrel **10** and the tubing B, whereby all of the fluid must flow upwardly through the bore **11** of the mandrel. The flow bean **35** is provided with an axial bore **37** of a desired diameter, whereby the restriction of the flow at this point may be properly controlled. The employment of a bean **35** increases the velocity of the flow so that the upward movement of the scraper **30** is assured.

Although the rest C incorporating the shock absorber therein is desirable it is not essential that the same be used. When it is eliminated, a scraper **30'**, as shown in Figure 6, is employed. This scraper is constructed in substantially the same manner as is the scraper **30** except that it is provided with a rest in the form of a depending annular skirt or sleeve **38** which sleeve is arranged to telescope or move downwardly over the upper end of the mandrel **10** and the sleeve **13**, with its lower end resting on the collar **14** of the slip carrying member **13**. An axial stem **39** may be formed integral with the upper end of the scraper **30'** and an undercut shoulder or fishing neck **40** is formed at the upper end of the stem. The stem and neck facilitate the removal of the scraper **30'** by means of a fishing tool. The operation of the scraper **30'** is exactly the same as that of the scraper **30** shown in Figure 1.

The paraffin scraper **30**, as shown in Figure 1, may be lowered into the tubing without the rest C having the shock absorber located therein. In place of the shock absorber, an annular rest or casing **41** is first lowered through the tubing so as to be supported on the flange **14** of the slip carrying sleeve or member **13**. This annular rest has its upper end reduced and provided with a fishing neck **42**, whereby said rest may be removed by a suitable fishing tool (not shown) when not in use. In this instance, the scraper **30** would drop through the tubing B and engage upon the upper end of the rest **41** which is substituted for the rest C.

What I claim and desire to secure by Letters Patent is:

1. In combination in a paraffin removing device, a stop arranged to be mounted at any desired elevation within a well tubing, and a paraffin scraper having scraping blades and a depending sleeve arranged to be dropped through the tubing and supported by the stop, said sleeve telescoping the upper end of the stop.

2. A paraffin removing device including, a removable stop locked at any suitable point in the well tubing, and a paraffin scraper having a depending sleeve arranged to be dropped through the tubing so as to rest upon the stop, said sleeve telescoping the upper end of the stop and engaging the locking means on said stop to prevent displacement of the stop by the jar of the sudden stopping of said scraper.

3. A paraffin removing device including, a stop

removably located within the well tubing, a tubular rest having its lower end telescoping the upper end of the stop and supported by said stop, and a paraffin scraper supported on said rest and arranged to be lifted by fluid pressure.

4. In combination, a stop having retractible means for locking it in a well tubing at any desired elevation, a paraffin scraper rest removably mounted on said stop in engagement with the locking means, whereby a downward thrust upon the rest is transmitted to said locking means to prevent displacement of the stop.

5. In combination, a stop having retractible means for locking it in a well tubing at any desired elevation, a paraffin scraper rest removably mounted on said stop in engagement with the locking means, whereby a downward thrust upon the rest is transmitted to said locking means to prevent displacement of the stop, and a paraffin scraper engaging said rest and arranged to be moved upwardly in the tubing by the well fluid.

6. A paraffin removing device including, a stop having means for engaging the wall of the well tubing at any point irrespective of the tubing collars for securing said stop at any desired elevation, a shock absorber carried by the stop, and a paraffin scraper arranged to strike and rest upon the shock absorber.

7. A paraffin removing device including, a stop having means for engaging the wall of the well tubing at any point irrespective of the tubing collars for securing said stop at any desired elevation, and a paraffin scraper having scraping blades and a depending annular skirt arranged to telescope the upper end of the stop and come to rest on the fastening means of said stop.

8. In a paraffin removing device the combination of, a stop having means for engaging the wall of the well tubing at any point irrespective of the tubing collars for securing said stop at any desired elevation, a tubular rest arranged to telescope the stop and come to rest on the fastening means thereof, and a paraffin scraper arranged to engage the upper end of the rest, whereby its downward movement is arrested.

9. In a paraffin removing device the combination of, a stop provided with vertically movable locking means for engaging the wall of a well tubing for fastening the stop at any desired elevation, and a scraper rest having a depending portion arranged to overhang the upper end of the stop and rest upon said locking means, whereby the rest telescopes the stop and forces the locking means into tighter engagement with the well tubing, and a scraper sustained by the rest at the lower end of the scraping stroke.

10. In a paraffin removing device the combination of, a stop including an elongate mandrel having an annular slip expanding surface on its lower end and provided with an axial bore extending therethrough, slips mounted on the mandrel, and a slip carrier slidable on the mandrel and having an annular collar, in combination with a scraper rest having a depending cylindrical portion arranged to receive the upper end of the stop and rest upon the collar of said slip carrier.

11. In a paraffin removing device the combination of, a freely adjustable stop having expandible gripping means for gripping the inner wall of a well tubing to position said stop at any desired elevation in said well tubing, means carried by said stop for actuating the gripping means into gripping engagement with said tubing, and a paraffin scraping device having peripheral scraping blades thereon and movable vertically in said tubing, and means engaging and resting upon the gripping actuating means for arresting the scraping device at the bottom of its down stroke, whereby thrust resulting from the downward movement of said device acts to force the gripping means more tightly into engagement with the wall of the tubing.

12. In a paraffin removing device the combination of, a stop member having means for gripping the wall of a well tubing, means for actuating said gripping means, a shock absorber mounted on said stop and having a portion engaging said actuating means, and a paraffin scraper arranged to strike upon the shock absorber, the impact of the paraffin scraper being transmitted to said gripping means to more firmly secure the stop in the tubing.

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