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PARAFFIN SCRAPER

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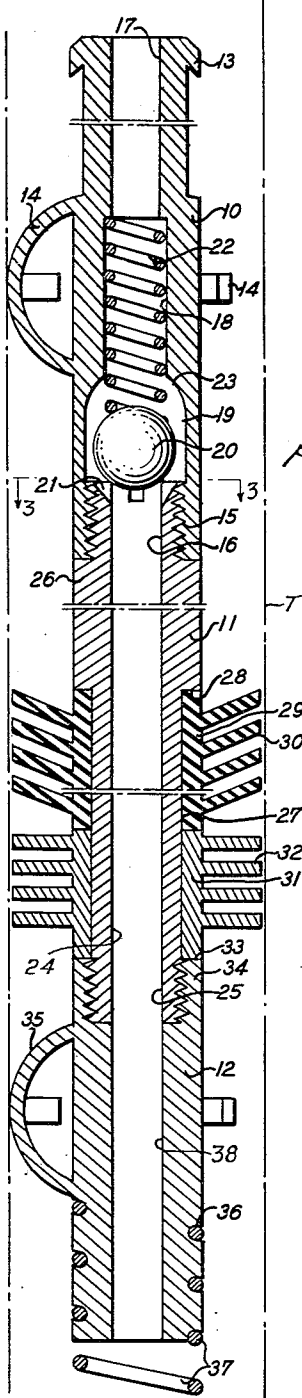
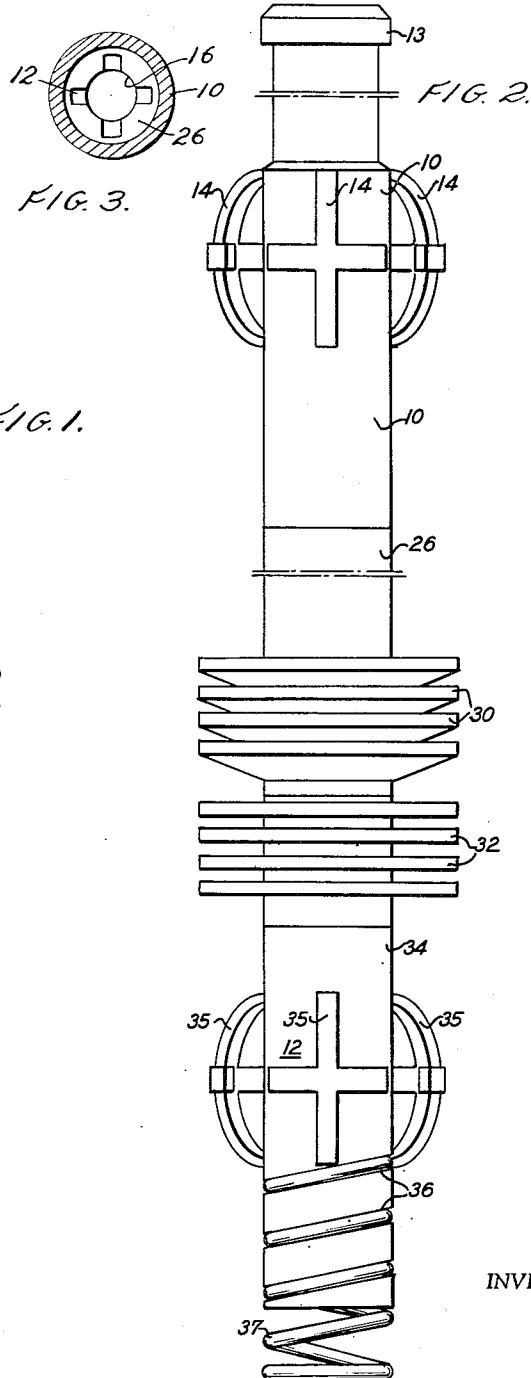


FIG. 1.



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PARAFFIN SCRAPER

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4 Claims. (Cl. 166—170)

This invention relates to paraffin scrapers for oil wells and is particularly concerned with automatically reciprocating scrapers of the general type disclosed in Patent No. 2,655,996, issued October 20, 1953, entitled Paraffin Cleaner, and with respect to which the present invention is an improvement.

The device of the prior patent, above referred to, the disclosure of which is incorporated herewith, by reference, provided for the automatic reciprocation of a scraper within a well tubing by the use of a deformable frusto-conical cup which received the upward flow of well fluid to lift the tool to the top of the tubing with such flow and which was thereafter compressed, permitting the scraper to drop by gravity to the bottom of the tubing where the cup was released to engage the fluid stream, so that the tool would again be raised by the well fluid in a repeated reciprocating cycle. While the prior device is effective and efficient in certain types of wells, limitations as to its scope of operability are inherent in its design. Furthermore, as compared to the present device, its manufacturing costs were high and its useful life limited by the durability of the flexible cup under repeated compressions and releases.

It is, therefore, among the primary objects of the present invention to provide a new and improved automatically reciprocating paraffin scraper of more economical construction and of greater durability.

Another object of the invention is to provide a scraper of the character referred to, having positively operable pressure responsive valve means for responding to the upward flow of well fluid in such manner, as to cause the device to be lifted by such upward flow.

A further object of the invention is to provide an automatically reciprocating paraffin scraper operable in response to the opening or closing of the well as distinct from the continual reciprocation of the device of the above prior patent.

It is also an object of the present invention to provide a device of the character described, with means for automatically precluding a waste of gas from the well.

Numerous other objects, features and advantages of the present invention will become apparent from a consideration of the following specification taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a vertical sectional view of one preferred embodiment of the present invention;

Fig. 2 is a side elevation of that form of the invention presented in Fig. 1; and

Fig. 3 is a sectional view on the line 3—3 of Fig. 1.

In general terms, the structure of that form of the present invention, here presented, as illustrative of the inventive concept, may be characterized as including a tubular open ended mandrel adapted for free reciprocation within a well tubing. An internal pressure responsive valve is mounted in the mandrel to be closed upon upward flow of well fluid whereby the mandrel will move upwardly with such fluid and whereby upon closing of the well, the valve will open to permit the device to

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drop by gravity. Paraffin scraper blades are mounted on the outer walls of the mandrel to disengage adhering paraffin from the internal tubing surface as the mandrel is reciprocated. The operation of the valve is assisted by the provision of spaced flanges on the outer wall of the mandrel and such flanges provide a swab action for lifting water and/or for restraining the loss of gas.

More specifically, and by reference to the drawings, it will be seen, that the mandrel or body of the device may be formed of three threadedly inter-connected sections, an upper tubular section 10, an intermediate tubular section 11 and a lower tubular section 12. The upper free end of the section 10 is preferably provided with a terminal fishing neck 13 by which the device may be grappled and withdrawn from the well in case of emergency, as when there is insufficient force in the well to flow the tool to the surface. On the outer wall of the upper mandrel section 10, intermediate the ends, there is provided crossed semi-circular scraper blades 14. As here shown, three sets of such blades may be arranged in equally spaced, circumferential relation. The bottom end of the upper section 10 is provided with internal threads 15 for engaging a mating threaded upper pin end 16 of the top of the intermediate section 11.

As indicated, the section 10 is tubular having an upper bore 17, a larger central communicating counterbore 18 and a bottom terminal communicating valve chamber 19. A ball valve 20 is located within the chamber 19 and is urged downwardly towards the fluted end 21 of the pin 16 of the intermediate section 11 by a spring 22 seated within the counterbore 18. By this arrangement, it will be seen, that the fluted end 21 will permit the passage of well fluid through the mandrel when the ball 20 is seated against the pin 16, by pressure of the spring 22. However, when the well fluid pressure exceeds the tension of the spring, as when the well is opened and is flowing, the ball 20 will be forced from its seat upon the fluted end 21 and will engage the semi-spherical upper seat forming wall 23 of the valve chamber 19. In such position, upward flow of well fluid through the mandrel is precluded and hence, the mandrel will be lifted with the fluid to move upwardly in the well tubing.

The bore 24 of the intermediate section 11 is of uniform diameter and extends through the section from the upper pin 16 thereof, to a similar lower externally threaded pin 25. The external diameter of the upper end 26 of the intermediate section 11 is preferably equal to the external diameter of the upper section 10. Below the upper end 26, however, the intermediate mandrel section is of reduced diameter forming a neck 27 terminated by an upper shoulder 28 where the neck joins the upper end 26. Seated upon the upper portion of the neck 27 and bearing against the shoulder 28 is a flexible sealing and swabbing member 29, preferably of rubber and having cone-shaped flexible lips or flanges 30 which may bear against the inner walls of the tubing, as the tool is floated upward, thus, to lift with it, water which may have accumulated above the tool while the well is shut down and the tool is at the bottom and which may also, act to prevent upward flow of gas about the mandrel.

On the neck 27, below the member 29, there is also mounted a flow resisting or turbulence creating member 31, preferably of rigid construction and having annular rigid flanges 32 of a diameter somewhat less than that of the tubing. Such flanges 32 substantially bridge the annulus between mandrel and tubing to cause turbulence and restrain fluid flow upwardly about the mandrel. Thus, when the well is opened and with the tool lowered therein, the flanges 32 will divert fluid flow upward within the mandrel. Pressure exerted by the fluid will unseat the valve ball 20 from the fluted end 21 and seat it against the wall 23 to preclude further upward flow through

the mandrel and the mandrel will then move upward with the fluid.

The members 29 and 31 are retained upon the neck 27 by the upper end 33 of the internally threaded box 34 of the upper end of the lower mandrel section 12. The lower mandrel section 12 is of equal external diameter with that of the upper portion 26 of the intermediate section 11 and is provided intermediate its ends on its outer walls, with semi-circular scrapers 35 corresponding to the scrapers 14. Below the scrapers 35 a helical groove 36 is formed in the outer wall to receive and retain the upper turns of a helical spring 37 which extends below the mandrel to provide a shock absorbing abutment adapted to engage a stop or the like, to cushion the tool as it drops downwardly. The internal bore 38 of the lower section 12 communicates with the bore 24 of the intermediate section 11 and is preferably of equal diameter therewith.

In the operation of the device with the tubing T inserted in the well bore, a conventional stop is lowered and set, as by means of a wire line. With the well shut down, the present tool is then lowered to the stop, not shown, the spring 37 cushioning any impact of the tool against the stop. Thereafter, when the well is opened upward flow will move the tool upward in the manner described. In such upward movement, the scrapers 14 and 35 will engage the inner walls of the tubing to scrape and dislodge adhering paraffin. In so moving the upper flanges 30 of the member 29, will lift any water which has accumulated above the tool and will, likewise, inhibit upward passage of gas about the annulus formed between the mandrel and the tubing. During the flowing of the well, the device will be retained at the top of the tubing by the pressure of flowing fluid. However, when the well is shut down, the spring 22 will force the ball valve 20 from the seat 23 and against the fluted end 21 of the intermediate mandrel thus allowing the well fluid to pass through the mandrel, as the mandrel sinks in the well to again engage the stop. In such downward movement, the walls of the tubing will again be scraped by the blades 14 and 35.

While the structural features of the invention, as herein set forth, present an effective, efficient rugged and durable device well adapted to meet the demands of economic manufacture, it is to be understood, that the invention is not limited or restricted to such structural detail. Therefore, numerous changes, modifications and the full use of equivalents may be resorted to in the practice of the invention without departure from the spirit or scope thereof, as outlined in the appended claims.

What is claimed is:

1. A paraffin scraper for the inner surface of well tubing, said scraper comprising a tubular mandrel including upper, intermediate and lower tubular sections threadedly joined to provide a continuous axial fluid passage, an enlarged axial recess in the lower end of said upper section providing a valve chamber, said recess terminating at the upper end in a valve seat, a counterbore extending upwardly in said upper section from said recess and terminating in a shoulder, a compression spring disposed in said counterbore, a ball valve disposed in said chamber, one end of said spring engaging said shoulder and the opposite end engaging said valve, flutes in the upper end of said intermediate section to permit flow of fluid around said valve when in open position in engagement with the upper end of said intermediate section, a portion of reduced diameter at the lower end of said intermediate section, said reduced portion terminating at the upper end in a shoulder, a sleeve received on said reduced portion in engagement with said shoulder, a plurality of axially spaced, flexible, cone shaped, circular flanges extending outwardly from said sleeve, a second sleeve received on said reduced portion in engagement with said first sleeve, a plurality of rigid, axially spaced,

annular flanges on said second sleeve, the upper end of said lower section engaging said second sleeve to secure said sleeves on said reduced portion, radially extending scraper elements on said upper and lower sections, and a resilient shock absorber on the lower end of said lower element.

2. A paraffin scraper for the inner surface of well tubing, said scraper comprising a tubular mandrel including upper, intermediate and lower tubular sections threadedly joined to provide a continuous axial fluid passage, an enlarged axial recess in the lower end of said upper section providing a valve chamber, said recess terminating at the upper end in a valve seat, a counterbore extending upwardly in said upper section from said recess and terminating in a shoulder, a compression spring disposed in said counterbore, a valve disposed in said chamber, one end of said spring engaging said shoulder and the opposite end engaging said valve, flutes in the upper end of said intermediate section to permit flow of fluid around said valve when in open position in engagement with the upper end of said intermediate section, a portion of reduced diameter at the lower end of said intermediate section, said reduced portion terminating at the upper end in a shoulder, a sleeve received on said reduced portion in engagement with said shoulder, a plurality of axially spaced, flexible, cone shaped, circular flanges extending outwardly from said sleeve, a second sleeve received on said reduced portion in engagement with said first sleeve, a plurality of rigid, axially spaced, annular flanges on said second sleeve, the upper end of said lower section engaging said second sleeve to secure said sleeves on said reduced portion and radially extending scraper elements on said upper and lower sections.

3. A paraffin scraper for the inner surface of well tubing, said scraper comprising a tubular mandrel including upper, intermediate and lower tubular sections threadedly joined to provide a continuous axial fluid passage, an enlarged axial recess in the lower end of said upper section providing a valve chamber, said recess terminating at the upper end in a valve seat, a ball valve disposed in said chamber, resilient means urging said valve away from said seat, flutes in the upper end of said intermediate section to permit flow of fluid around said valve when in open position in engagement with the upper end of said intermediate section, a portion of reduced diameter at the lower end of said intermediate section, said reduced portion terminating at the upper end in a shoulder, a sleeve received on said reduced portion in engagement with said shoulder, a plurality of axially spaced, flexible, cone shaped, circular flanges extending outwardly from said sleeve, a second sleeve received on said reduced portion in engagement with said first sleeve, a plurality of rigid, axially spaced, annular flanges on said second sleeve, the upper end of said lower section engaging said second sleeve to secure said sleeves on said reduced portion and radially extending scraper elements on said upper and lower sections.

4. A paraffin scraper for the inner surface of well tubing, said scraper comprising a tubular mandrel including upper, intermediate and lower tubular sections threadedly joined to provide a continuous axial fluid passage, an enlarged axial recess in the lower end of said upper section providing a valve chamber, said recess terminating at the upper end in a valve seat, a ball valve disposed in said chamber, resilient means urging said valve away from said seat, flutes in the upper end of said intermediate section to permit flow of fluid around said valve when in open position in engagement with the upper end of said intermediate section, a portion of reduced diameter at the lower end of said intermediate section, said reduced portion terminating at the upper end in a shoulder, a sleeve received on said reduced portion in engagement with said shoulder, a plurality of axially spaced, flexible,

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circular flanges extending outwardly from said sleeve, a second sleeve received on said reduced portion in engagement with said first sleeve, a plurality of rigid, axially spaced, annular flanges on said second sleeve, the upper end of said lower section engaging said second sleeve to secure said sleeves on said reduced portion and radially extending scraper elements on said upper and lower sections.

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