

Sucker Rod Type Paraffin Scrapers

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Paraffin Accumulation in the tubing of pumping oil wells has been a costly problem since the beginning of the oil industry. Some fields have a severe paraffin problem while others do not have enough paraffin accumulation to ever restrict the production of the wells. Each field has a different paraffin problem all its own.

Operators have found through many years of experience that the paraffin problem will change during the life of a well. Some wells will have a diminishing problem while others will increase in paraffin accumulation as the well is depleted. The factor that generally contributes to decrease paraffin accumulation is an increase in water content with the oil being produced. As a well is produced, a decrease in bottom hole pressure is experienced. As this occurs, paraffin accumulation in the tubing will begin at a lower depth in the well. It is common knowledge that paraffin does not break out of the oil until the oil is cooled to a lower temperature than the formation. The bottom hole temperature of a well does not change appreciably to cause paraffin to form farther down the hole. A decrease in bottom hole pressure will naturally lower the static and working fluid level in the well, thus leaving more tubing out of the warm fluid. This will generally cause paraffin to form farther down the well than if an increase in water is not experienced.

The accepted use of sucker rod type paraffin scrapers to remove paraffin from pumping oil wells is relatively new to the industry. Sucker rod type paraffin scrapers became popular between 1946 and 1950.

Prior to this time, operators were using steam, hot oil, chemical solvents or passing coupling type paraffin knives. These methods are expensive to follow and for the most part are only a temporary measure.

To clean the tubing with steam, it is necessary to pull the tubing out and rack it before a thorough job can be performed. Repeated pulling is a costly process, both in labor and loss of production.

Circulating hot oil down the tubing as it is hanging in the well will remove the paraffin from the tubing. This process, however, does not remove the paraffin from a well. It puts the paraffin back into the well to be reproduced. Not all the paraffin will re-accumulate in the tubing, however. Part of the paraffin will remain suspended in solution and be carried out of the well.

The use of chemical solvents to keep paraffin suspended in solution and carried out of the well is a never ending process. For the most part, the chemical is injected in the annular space and allowed to mix with the crude in the bottom of the hole. The questions of whether the chemical ever reaches the fluid in the well or whether it will mix with the oil sufficiently to be effective are often brought up when this type paraffin control is discussed. The point is, this is a never ending process which will contribute to the lifting cost as long as chemical injection is performed.

Coupling type paraffin knives have been used for many years. The couplings are put in at 50 to 100 foot intervals in the well. Periodically, the rods are pulled up sufficiently to pass the scrapers and cut the paraffin from the tubing. It is desirable to have the paraffin carried out of the well as it is cut off the tubing wall. This type paraffin removal leaves the paraffin in the well until the pump can be resealed and the well pumps up. The added cost of using a service unit increases the lifting costs for the operator.

The most popular types of sucker rod paraffin scrapers are: Huber rotating flat blade, Crall type spiral, Tripplehorn spiral and Sunshine continuous spiral. Of the four different scrapers being marketed, three are spiral scrapers

and one (1) is a flat blade. Three of four are short individual scrapers that are equally spaced on the sucker rods. Ten or twelve scrapers are placed on each 25 foot rod. The Sunshine continuous spiral scraper is the exception. This scraper runs the entire length of the rod from the upset on one end to the upset on the other.

The flat blade or paddle type, as it is commonly called, is used in conjunction with a rod rotator. The paraffin is effectively removed by the knife edge of the paddle being reciprocated up and down with each stroke of the pumping unit and the slight rotation of the rod string and subsequently the changing position of the scraper blade with each stroke of the pumping unit. It is intended that the minimum rotation be obtained with each stroke of the unit. This will cut the paraffin in fine strips that are free to be carried up and out of the well as pumping operations continue. Each thirty-seven strokes of the unit will give a 360° rotation of the rods and scrapers.

The flat blade is eight inches long and 1-5/8-in. wide for 2-in. tubing and 2 1/8-in. wide for 2 1/2-in. tubing. The scraper is secured to the rod by shrink welding a U band at each end of the scraper blade. The U band is approximately 1/16-in. too short to go over the rod and engage the flat blade for welding. A special press is used to close the space and hold the scraper in position for welding. The U band is welded to the scraper and neither are welded to the rod. The scrapers are made of mild steel and have a standard spacing of 30-in. centers. It is necessary to have a 26-in. stroke or greater to have effective scraping action.

Spiral Type Scrapers (Intermittent and Continuous):

There are four such scrapers. They appeared on the market in the following order: Sunshine wedge type, Crall, Tripplehorn and Sunshine continuous. Of the four, two are intended for field installation and two are for shop or jig installation.

The Sunshine wedge type was the first spiral type scraper, designed primary for field installation. It consists of two halves with a half spiral welded to either half. When placed around the rod the two halves are so designed as to form a wedge effect and when the desired tightness is gained a tip is folded over to prevent slippage.

These scrapers are made of a soft mild steel and are approximately 5-in. long. The scrapers can be sent to the well and installed at whatever spacing is necessary to accommodate the pump stroke.

The Crall Scraper is a spiral type scraper which is installed by shrink welding a preformed U-clip around the rod and to the scraper. The work must be performed in one of the manufacturers shops which are located throughout the United States and Canada.

The Crall scraper is made of thick mild steel and are approximately 6-in. long. The width of the blade varies, in order to give 1 3/4-in. OD coverage in 2-in. tubing, and 2 1/4-in. OD coverage in 2 1/2-in. tubing, regardless of the size rod used. The 1/8-in. X 1-in. preformed U-bands are made of mild strap steel.

The Crall scrapers have a standard spacing of 10 scrapers per rod, spaced on 30 inch centers. It is important that there be sufficient stroke length to enable the scrapers to pass with each reciprocation of the unit.

The U-bands are placed on the rod in a special die jig and formed the remaining distance around the rod to the scraper blade. The U-bands are held under pressure while they are shrink welded to the blade. Neither scraper nor band are welded to the rod. The scrapers when installed alternate, one

a right spiral and the next a left spiral around the rod, the purpose being to prevent the rods from unscrewing.

The spiral Tripplehorn scraper is made of tough, high carbon steel and is designed for field installation. This scraper is applied by wrapping the performed spiral blade around the rod with the use of a screw driver.

The width of the blade varies to give 1 3/4-in. OD in 2-in. tubing and 2 1/4-in. OD in 2 1/2-in. tubing. The scraper is a die formed perfect spiral with 1/8-in. less ID than the OD of the rod. The scraper is 21-in. long and to determine the number of scrapers per rod add 12-in. to stroke length. For example: 24-in. stroke plus 12-in. equals 36-in. - a scraper would be installed every 36-in. on centers. A sufficient number must be applied to give full coverage of stroke length. To prevent spinning or twisting of rod string, the scrapers are installed alternately -- one right and one left.

The Sunshine Continuous spiral scraper must be installed in one of the manufacturer's shops. It is made of 11 gauge material and is made in varying widths to give the proper OD for 2-in. and 2 1/2-in. tubing regardless of rod sizes.

This full length spiral wing is wrapped around the sucker rod from end to end, encircling the rod every fifteen inches. The wing is fastened on to rod by clips pressed around the rod and held in place under high pressure while the ends of the clip are welded to the wing. The direction of the spiral is reversed at the center of the rod to prevent tendency of rods to unscrew.

When using the Huber or Crall type paraffin scraper, it is necessary to have a stroke length of 24-in. to 26-in., or greater, to have effective scraper passage and paraffin removal. The reason being, these scrapers are shop fabricated on a standard 30-in. spacing. The use of the Sunshine continuous spiral, Sunshine wedge type or the Tripplehorn spiral do not limit the stroke length used. The Sunshine continuous spiral runs the full length of the rod, while the Sunshine wedge type and Tripplehorn spiral are put on by the operator in the field and should be spaced to accomodate the minimum stroke length anticipated.

One of the more important factors that will contribute to the success of sucker rod type paraffin scrapers is the depth the scrapers are run in a well. In a field where the production does not go to water, the paraffin level will lower as the well is depleted. Generally speaking, 500' to 1000' additional scrapers will take care of the additional paraffin that can be expected during the life of the well.

Sucker rod type paraffin scrapers are not intended to be a cure-all for paraffin trouble. Paraffin elimination is impossible. Effective and continuous paraffin removal by using sucker rod type paraffin scrapers will show a payout as versus other paraffin removal methods performed intermittently. Reduced lifting costs are achieved by the original investment in paraffin removal continuing for the life of the well.