Solvents For Paraffin Control

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The accumulation of paraffin deposits in oil wells and flow lines presents a production and transportation problem that is very costly to the oil industry. This problem has been attacked in many ways but, until a few years ago, the removal of such deposits was accomplished by mechanical means only. These usually involved lost time, extra labor, and special tools, all of which were expensive to the operator. Because of the high cost of such mechanical methods, it was found that, in many cases, chemical solvents, when properly applied, removed paraffin deposits from the well and flow line, with far less expense to the operator. Also, that mechanical methods and solvents could be combined to give the operator a better overall job at a lower cost.

Paraffin Deposits

We have talked briefly of the problems and methods of paraffin removal but actually, what is paraffin? As used in oil field terminology, it consists of waxy or asphalt material deposited onto producing equipment from the crude oil. These deposits, usually brown or black in color, result from changes in temperature and loss of the more volatile components, such as gas, from the oil. Thus, the heavier paraffin deposits occur in the top few hundred feet of the well, and the first few joints of the flow line.

The different types of deposits encountered vary greatly in chemical composition and characteristics. In some fields, they are almost pure paraffin, which dissolve with little difficulty when a suitable solvent is applied properly. Sometimes, however, the deposits contain additional substances, such as asphalt, silt, sand or gums, that make removal more complicated. Also, when deposits have built up gradually over a period of several months, they are usually very hard and dense. In such cases, the removal requires more time than if the deposition is soft and plastic, and more than one application of solvent may be necessary.

Field Testing

Before attempting a paraffin removal treatment, a sample of paraffin from the well should be tested using several different solvents. Results of these solubility tests will indicate which is the best solvent to use. The easiest and most convenient method to field-test paraffin is by means of a testing kit, such as shown in Figure 1. The kit consists of an electric motor, to which is attached an eccentric arm that raises and lowers a rocker arm. Suspended on wires from this rocker arm are wire screens on which are placed samples of the paraffin to be tested. These screens are alternately raised and lowered, dipping the paraffin into test tubes filled with the various solvents to be tested.

Paraffin Solvents

A number of different organic solvents for paraffin removal are on the market. Each has its own specific advantages and uses. In field application the commercial solvent is frequently used in combination with white gasoline or kerosene, if the paraffin is not too difficulty soluble.

One commercial solvent is a chlorinated hydrocarbon, extremely effective on pure paraffins; however, it is not too effective on asphaltic materials. Another is a propriety solvent containing a high proportion of organic thio-compounds. This solvent has superior dissolving and dispersing properties for asphaltic paraffin accumulations. An added advantage of these two solvents is their high specific gravities. In order to get any appreciable penetration through the paraffin and oil in the well, the solvent used must be heavier than the paraffin or oil encountered.

White gasoline and kerosene are sometimes used for paraffin removal, however, their solvent action is limited. They are very similar chemically to the paraffin they are to dissolve, because all belong to the same chemical family. Gasoline and kerosene are the lighter members in the family while solid paraffins are heavier members. Due to their light weight (about 6.2 lbs./gallon for gasoline and 6.8 lbs./gallon for kerosene) poor penetration through the oil and paraffin is usually obtained. However, these agents are useful, in many instances, for blending with commercial solvents. As high as 50 percent gasoline or kerosene has been used successfully, and in rare instances up to 75 percent gasoline or kerosene has been employed. The ease with which the specific paraffin accumulation will dissolve is understandably a factor in determining the extent of blending that is feasible.

In some instances wetting agents are added to solvents to increase their ability to penetrate the paraffin deposit. This can be especially helpful where emulsified water is present in the deposit.

Treating Techniques

After the best solvent has been selected by testing, the proper treating procedure should be determined. There are several methods of treating a pumping well:

A. If considerable gas is pumped with oil: Release back pressure at the trap and allow the tubing to partially empty itself. Lift the stuffing box, insert a funnel and pour in the solvent between the polish rod and the walls

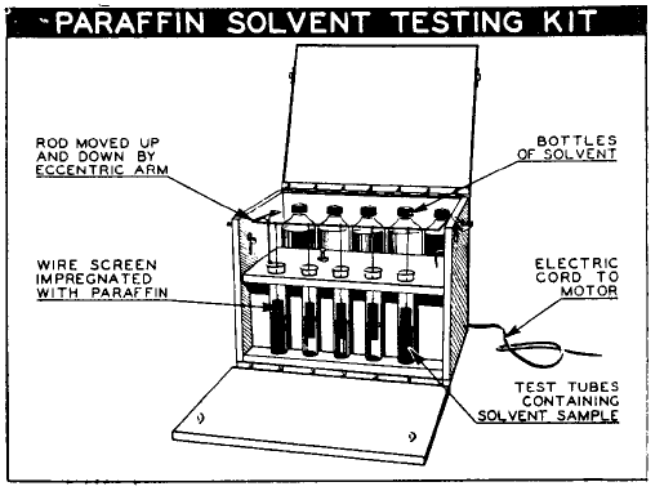

FIGURE 1

of the tubing. Leave the well shut-in for 6 to 8 hours.

B. If there is insufficient gas to unload the tubing: Lift the rods sufficiently to unseat the standing valve, permitting the oil to recede down the hole. Introduce the solvent into the annular space between the polish rod and the tubing. The well should then be shut-in for 6 to 8 hours.

C. If the pump leaks at the bottom of the hole sufficiently to permit the oil to recede down the tubing: Remove the stuffing box and introduce the solvent into the annular space between the polish rod and the tubing. The well should then be shut-in 6 to 8 hours.

D. The more popular method of treating pumping wells is to inject the solvent through a lubricator as shown in Figure 2. The solvent is poured into the lubricator and the top valve is closed. The valve to the tubing is then opened and the solvent will gravity into the tubing when the pressure equalizes. This method saves time and the lubricator can be easily installed.

E. If the well is heavily paraffined and there is reason to believe that the pay face has become partially plugged, the circulation method should be used (Figure 3). The solvent is injected down the annular space and the well is shut-in overnight. The flow line is then tied into the casing and the well circulated for 24 hours. In using the circulating method be sure the casing pressure is kept below 125 psi so that the pump mechanism will seat. This can be accomplished by running a vent from the casing. In this type of treatment, from 30 to 50 gallons of solvent, mixed with 100 to 150 gallons of kerosene or white gasoline, is used. This method not only cleans the tubing and pay face, but in many instances, increases the production of the well.

In cleaning lead lines the solvent should be injected thru a lubricator or upright nipple as near the well as possible. Large slugs of the solvent should be used. The amount used will depend on the size and length of the line, and the amount of deposit. The solvent slugs should be forced through the line by cracking the valve at the well and letting gas force the solvent through, or by pumping oil in behind the solvent. The solvent then should contact the paraffin at all points along the line. The longer the solvent can stay in contact with the paraffin, the better will be the results. A minimum of 24 hours should be allowed for a line 1500 feet long.

In cleaning a badly plugged line, use a small slug of solvent first to open the line gradually and prevent clogging. Then follow with a larger amount of solvent. In cleaning lead lines where large volumes are needed, mix 1 part of solvent with 3 parts of kerosene or white gasoline.

Combination Chemical-Mechanical Treatments

A. The newest chemical-mechanical method uses a hollow sucker rod as shown in Figure 4. The rod has a pipe port for the attachment of the hose, or swivel pipe joints, for the injection of solvent. A chemical feeder can be attached to the pipe port and solvent injected down the inside of the rod through the check valve and out thru the perforated hollow pony rod into the production annulus. These rods are usually set in the paraffin area only and this allows the solvent to be injected where it will do the best job. There is no lost time to the operator and this is a very excellent method to apply a paraffin solvent. Using this method, the solvent can be injected continuously, at no extra cost, by adjusting the injection rate on the feeder or can be injected over a 24 hour period. I would not recommend that the solvent be slugged into the well in a short time, because the solvent must have time to work on the paraffin accumulation.

B. If paraffin scraper rods are used, they will keep paraffin from the walls of the tubing. However, paraffin will accumulate on the rods and, in time, will necessitate a pulling and stripping job. This accumulation can be easily overcome by making weekly injections of solvent into the tubing. This will clean the rods and save the operator a costly stripping job.

C. The use of soluble plugs for flow line cleaning is being used in a number of areas. This method can cause a lot of trouble when paraffin accumulation becomes too heavy and the plug builds up a solid plug of paraffin in the flow line. If this happens, it is necessary then to break the line and burn out the paraffin, an expensive operation. This can be very easily prevented by using a good solvent in front of the plug and allowing time for the solvent to soften and dissolve the paraffin in the flow line.

Quantities of Solvent Required

It is impossible to recommend any definite amount of solvent, because of the length of the paraffin accumulation and its thickness will vary on nearly every well. Experience has indicated, however, that wells which paraffin up every two weeks can be kept clean by using 1 to 2 gallons of solvent per week per well. The pumper on the lease can usually tell by checking his pressure gauges whether or not restrictions in the lines are occurring, so that this amount of solvent should be increased or decreased. This preventive measure is not an expensive operation when we consider that the average price for commercial paraffin solvent is about $2.25 per gallon. The expense of extra labor or tools is eliminated also. Thus, solvents be-

TYPICAL WELLHEAD HOOKUP FOR INTRODUCING PARAFFIN SOLVENT

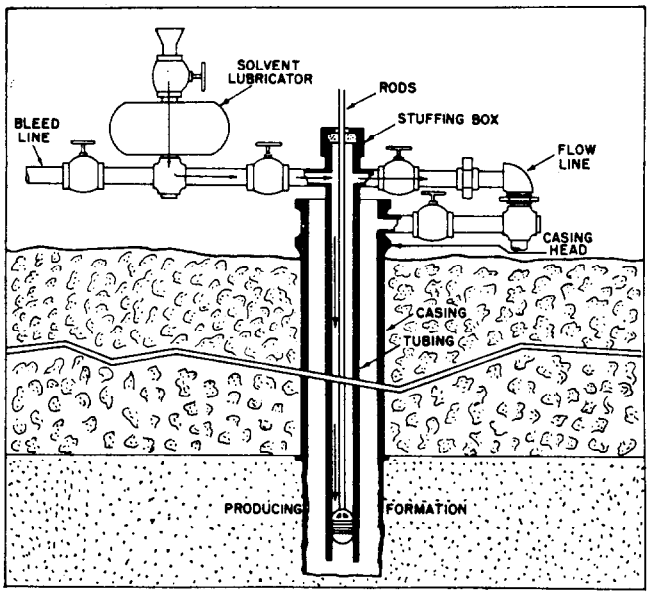

FIGURE 2

PARAFFIN REMOVAL FROM FACE OF PAY AND TUBING

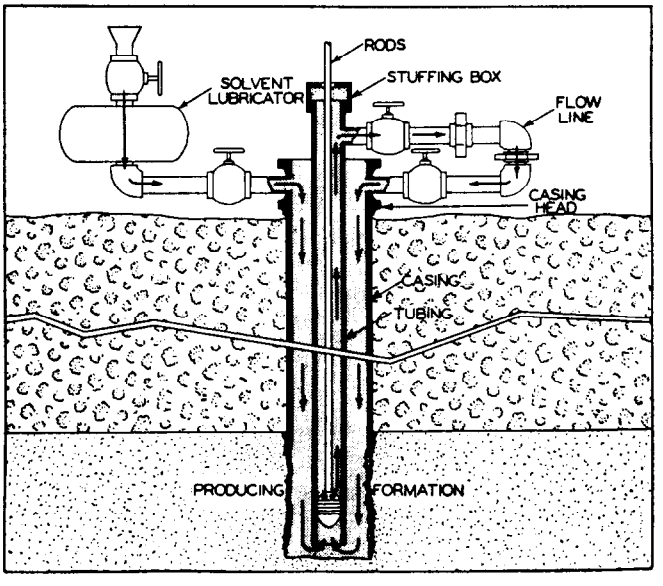

FIGURE 3

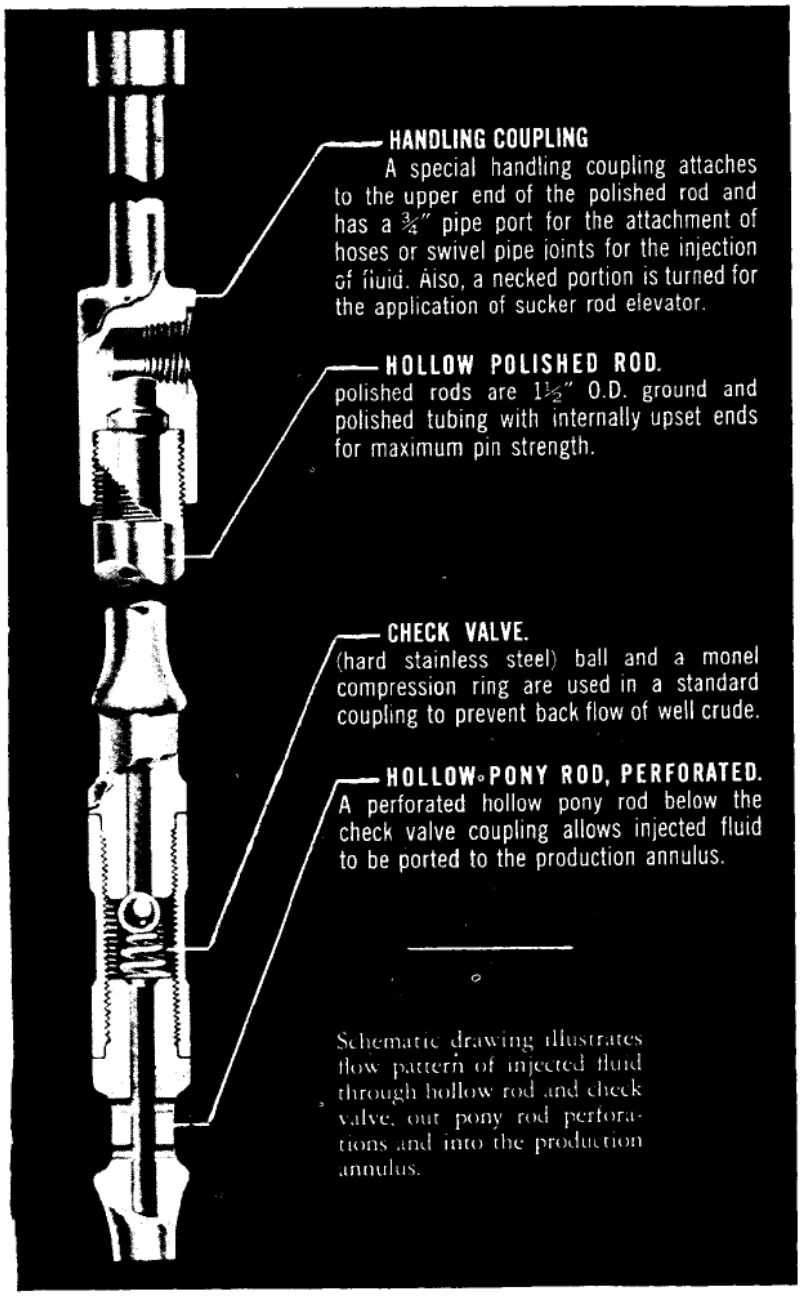

FIGURE 4

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come a measure to eliminate more expensive work-over operations.

By treating wells and flow lines at regular intervals, serious plugging, requiring the use of excessive amounts of solvent, can be avoided. Wells or flow lines that are completely plugged by paraffin deposits, cannot be helped by solvent. In order for solvent to work on paraffin accumulations, it must be able to reach the paraffin and remain in contact for several hours.

Summary

In closing, I would like to call to your attention those steps that will make paraffin control in oil wells and flow lines a success. First, obtain a sample of paraffin from the well or flow line and test the sample using different types of solvents. Next, apply the selected solvents using one of the methods previously discussed. After the solvent has been injected and remains in contact with the paraffin deposit for the required shut-in time, production can be resumed. Finally, and this is very important, set up a regular treating schedule and follow it closely. If mechanical methods are used, the operator should combine them with a good solvent to save him time and expense. If these procedures are followed, your paraffin difficulties can generally be eliminated.