# Sucker Rod Pump Accessories

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## INTRODUCTION

The first Oil Lifting Short Course was held in Lubbock, Texas, on April 22 and 23, 1954. In that program many subjects were presented from which you selected the ones that would be of special interest to you. In a few cases, some of us attended classes to see if we agreed with the things that were said that we already had been schooled and trained in. The most significant result was that, in every case, when we came away from this or that class we had been given some new approaches to that particular subject — something that could be applied to our problems in the field. Therefore, this program that all of us attend each year is a place where we can exchange methods and ideas whereby the lifting of oil can be accomplished with more efficiency and economy.

We have heard many authors speak on subsurface pumps and feel that the subject has been covered pretty thoroughly in the past by competent people. Therefore we shall present to you some of the "accessories" that can be installed on your sucker rod pumps to make them more effective, reduce pulling expense and give longer life to your present existing subsurface pump. However, before we present the "accessories", we feel that it is necessary for us to discuss the basic parts of the pump and advise you of the many items available as basic parts that are designed to combat sand, corrosion, gas and other well conditions.

## ACCESSORIES

Sucker rod pumps consist of four basic units. The barrel, the plunger, the standing valve and the traveling valve. The barrel is a tube which furnishes one half of the pump's fluid seal. The plunger works in the barrel to furnish the other half of the seal and to lift the oil. The standing valve, at the bottom of the pump, opens on the up strokes to let oil into the pump from the well bore and closes on the down stroke to hold it in the pump. The traveling valve, at the top end of the pump, opens on the down stroke to let the oil above the standing valve pass through the plunger and closes on the up stroke to send the oil upward through the tubing.

The two basic classifications of sucker rod pumps are the tubing type and the rod type. The tubing type is run on the tubing, and the rod type is run on the rods through the tubing. Either can have a full barrel, sectional liners or a full liner. The rod pump (previously called "insert type") can have either a stationary barrel or a traveling barrel. The stationary barrel rod type can be seated with a top or bottom hold-down. The traveling barrel rod pump has a bottom hold-down. The tubing pump can be run with or without an extension nipple, but it must have a shoe in which the standing valve assembly is seated.

We have gone over the basic classifications of pumps. As time will not permit us to explain the advantages and disadvantages of each type pump, we will go on with the presentation of the wide assortment of barrel tubes, plungers, balls and seats and fittings necessary to make up a complete pump and the intended use of each.

### Materials

First we will list some of the available materials from which barrel tubes are made that are available to the operators for their different well conditions.

1. Carbon steel tubes with a low initial cost.
2. Different alloy steel tubes to resist abrasion, corrosion, errosion, wear, and having the required physical properties to operate successfullv in deep oil wells of the present day.

For corrosion, monel metal, which is largely nickel, is recommended. The highest types of stainless steel contain nickel and chromium; nickel for corrosion resistance and chromium for abrasion resistance. Bronze is used for shallow wells where the physical requirement is not beyond the elastic limit of the material. Bronze is an economical metal to use for salt water corrosion in relatively shallow wells.

The cast alloy irons are materials that are used in many wells. They have a graphitic content that is helpful where gaulding or lack of lubrication is present. Chromium and nickel plating are helpful when applied properly to the metal tubes for certain well conditions. There are several different methods of hardening the inner surface of a metal tube which promote longer life and better performance for certain types of well conditions.

We have briefly outlined the barrel which provides one half of the seal in the oil well pump.

### Plungers For Pumps

Plungers for your pumps are also available in many metals and types for your problem wells. Metal plungers are available in pin end type, box end type and sand shaver type. They can be chrome plated for sand and abrasion. Composite plungers made of cast iron alloy centrifugally spun castings containing nickel-chromium boron and other alloys are available for your wells that are corrosive.

New materials are being spun on steel tubes of desirable metals that resist corrosion and abrasion. Some of these are called by trade names — "Tuffy," "Spray Metal," "Comoloy Spray," etc. They are all designed to work in problem wells. Some of these plungers use tungsten carbide, cobalt and nickel to make up a very hard plunger and to give the maximum in resistance to abrasion, distortion and corrosion. Cup plungers, composition ring plungers and flexite ring plungers are popular in proper environment.

## BALL AND SEAT

The heart of an oil well pump is in the valves. The valves used in the pumps in the relatively shallow wells in Pennsylvania were made of brass and leather. The leather was attached to a bronze drop with a screw. The leather seated against a smooth surface of a seat and provided an effective seal. The very best grades of leather were used in the early valves and at shallow depths did a very good job.

Of the many different shapes used in valves in oil well pumps the ball proved over a long period of time to be the best shape for this type of valve. In wells that had paraffin, sand, or scale, the valve ball, owing to its spherical shape, would find its proper seating surface in the seat. Small pieces of wood and foreign substances, such as pieces of valve cup or packing, find their way into the valve of an oil well pump. The ball, because it was round, would cut up and allow the article to wash out of the pump and the valve would resume its normal sufficient action.

Many different patented valves have been made during

the last 50 years, some of them quite complicated. The present design of the API flat type ball and seat is very efficient, simple, and effective. It represents years of engineers' efforts toward simplicity of design and the economical use of precious metals. The early valves used in wells around 3000 ft. in the early 1920's were largely made from straight carbon steel. Breakage and corrosion caused wells to be pulled every few days.

Stainless steel, when it was first introduced and used in valves for oil wells, greatly improved the performance and life of oil well pumps and showed a substantial reduction in lifting cost per barrel of oil. As the wells and drills go deeper to reach the oil, the chemical problems encountered, owing to the greater number of minerals in the earth, present corrosion problems and a real need for better valves.

Most manufacturers have a number of different metal combinations that allow the oil producer to choose one that will successfully function in the valves of the oil well pump. Some fields, especially the deeper fields with temperature and sand and salt and sulphur, require the very best metals that can be manufactured. Synthetic sapphire and the most advanced ceramics have been used to meet the different well conditions.

The well that will run several years with a standard stainless variety of balls and seats would not require a precious metal composed of tungsten, cobalt, and nickel costing many times more than the stainless ball and seat; but, in a well where it would take several hundred dollars to pull a pump to replace the valves, the best ball and seat manufactured is the most economical to use.

## SAND FRAC METHODS

The sand frac methods of well stimulation have imposed an additional problem for users of subsurface pumps. This sand is coarse and can tear up a pump in short order. We found that by installing a sand wiper assembly on top and bottom of our plungers that we could, in many cases, wipe the sand from the wall of the barrel tubes and deposit it inside of the plunger where it could be lifted out of the well through the plunger and into the tubing along with the fluid. This method is becoming more and more popular with operators having this sand problem. It can also be used when wells make natural sand and well trash that stick plungers in the barrel tubes. (Refer to Fig. 1)

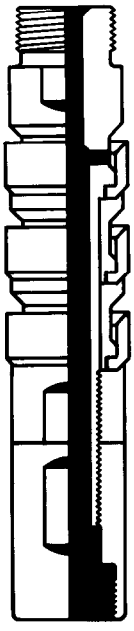


Fig. 1

There are several types of wipers offered to you producers for installing on your pump plungers. One manufacturer uses a metal grooved section and fits it about as close as the plunger fit (that is from one thousandth to two thousandth inch clearance). The other manufacturers use valve cups on special extensions drilled to allow the sand to divert inside the plunger above a blind cage and ball and seat on traveling barrel pump. When used on stationary barrel type pump it is installed on top of the plunger immediately below the pull rod adapter.

We have found that by installing a two or three cup wiper with inverted bups on the bottom of the plungers we can prevent the sand from lodging between the barrel tube and plunger when the plunger is on the down stroke or when the well starts flowing through the pump. The use of small or California pattern balls in the blind cages of your pumps can be of great assistance when pumping wells that carry frac sand or paraffin. API balls and seats will have a tendency to stick open due to larger balls fitting the guides close inside the cages and bridging or blocking the ball from dropping on the seat.

Bottom discharge valves that produce a small volume of fluid on the down stroke of stationary barrel type pumps also can be of great help in preventing a pump from becoming sanded in due to well trash falling down along the outside of the pump barrel and building up until sufficient trash has settled around this pump that it cannot be unseated.

Several pump manufacturers have designed a top seat device that can be installed on any stationary barrel type pump with bottom hold-down to prevent sand and well trash from settling down around the pump barrel tube. The design permits it to be set at any depth that you desire without any problem of the barrel bursting due to pressure differential. One company makes a flexite ring seal assembly to prevent the sand from settling back around the tube. Another company makes a special rubber seal and packer arrangement to accomplish the same thing. Both are effective and do a good job.

Cages for your pumps are of the greatest importance. These cages are available in the following materials: steel, heat treated steel, stainless steel, monel, bronze, drop forged for heavy duty pumping. Rubber lined cages are preferred by some and others prefer stellite or carbide lined cages for long service under extreme heavy duty pumping. Each one of the cages mentioned has a place in this oil lifting industry. Place the proper cage in your pumps and witness a longer and more economical pump operation.

Rod guides on top of your pump to guide the plunger pull rod straight to the center of the barrel tube can help reduce pull rod breaks and will also prevent uneven plunger wear and early pump failure. On traveling barrel pumps it will prevent barrel tube and tubing wear as it centers the pump in the center of the tubing. (Refer to Fig. 2)

## BROOKS GAS ANCHOR

Another effective device for use with pumps handling foamy, gaseous fluids is the Brooks gas anchor. Baffle chamber allows gas to stabilize and fluid enters the pump with the gas and oil in a homogeneous stage. Thus more liquid is carried along with the gas, and valve action in the pump is quicker because of the lower gas/oil ratio.

The Brooks gas anchor is installed below the standing valve of the pump. A ball and seat must be used in the cage (#693H1) at the bottom of the anchor as well as in the standing valve above the anchor.

## SPRING LOADED PLUNGER PUMP

This pump was designed for troublesome gassy fluid wells or wells that carry well trash. It was designed at

Fig. 2

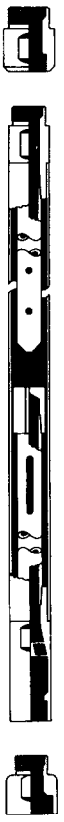


Fig. 3

first for use on central powers that carry relatively short polish rod strokes, where temperature difference causes stroke variation and pumps cannot be set for close valve spacing. The first pumps were made up using eight-cup plungers but experience has proved that metal plungers applicable to your well conditions can be used with the same fine results.

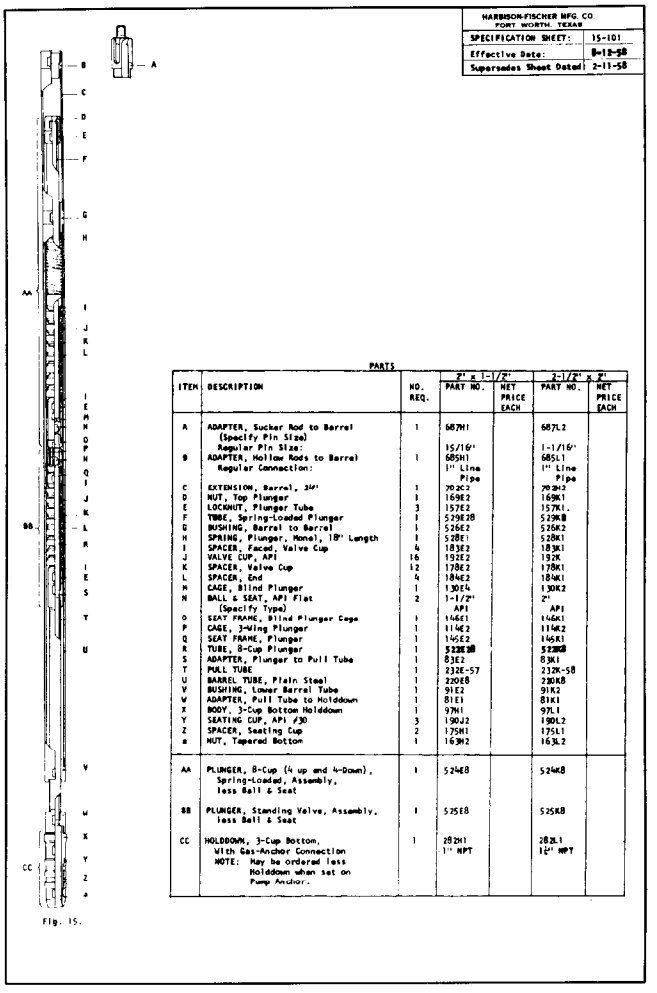
## Operation

On down stroke, pump is set so that spring loaded plunger is partially depressed against spring cushion on each stroke. (Maximum travel or spring is 12 inches.) This engagement permits extra close valve spacing and serves to insure that pump chamber is completely cleared of gassy fluid on each up stroke. On up stroke, tubing pressure load holds spring-loaded plunger down.

This pump can be spaced to allow the two cages that contain balls and seats to strike against each other, if necessary, in order to jar out any trash that otherwise would be difficult to jar out in conventional pumps. The shock to the rods and pumping unit is minimized by the hydraulic effect of the fluid column above the top pump plunger. This spring-loaded plunger assembly can easily be adapted to your existing subsurface pump.

## SUMMARY

It will pay you to remember that when installing this assembly always remove standing valves and install them on top of the lower plunger. If double valves are favored by you, install them both on top of this lower plunger. Never place a ball and seat in the top of the pump as this will defeat the principle of the operation. An adapter is standard equipment that will not permit the use of a ball and seat; but an existing open cage with a seat only can be used if you desire to reduce costs. The seat only serves to permit a tight fit with shoulder to the bushing on top of the extension nipple. (Refer to Fig. 4)



HARBISON-FISCHER MFG. CO
FORT WORTH, TEXAS

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|---|---|
| SPECIFICATION SHEET: | 15-101 |
| Effective Date: | 8-15-58 |
| Supersedes Sheet Dated | 2-11-58 |

PARTS

| ITEM | DESCRIPTION | NO. REQ. | 2" x 1-1/2" PART NO. | 2" x 1-1/2" NET PRICE EACH | 2-1/2" x 2" PART NO. | 2-1/2" x 2" NET PRICE EACH |
|---|---|---|---|---|---|---|
| A | ADAPTER, Sucker Rod to Barrel (Specify Pin Size) Regular Pin Size: | 1 | 687H1 | | 687L2 | |
| | | | 15/16" | | 1-1/16" | |
| B | ADAPTER, Hollow Rods to Barrel Regular Connection: | 1 | 685H1 | | 685L1 | |
| | | | 1" Line Pipe | | 1" Line Pipe | |
| C | EXTENSION, Barrel, 36" | 1 | 702C2 | | 702H2 | |
| D | NUT, Top Plunger | 1 | 169E2 | | 169K1 | |
| E | LOCKNUT, Plunger Tube | 3 | 157E2 | | 157K1 | |
| F | TUBE, Spring-Loaded Plunger | 1 | 529E28 | | 529K8 | |
| G | BUSHING, Barrel to Barrel | 1 | 526E2 | | 526K2 | |
| H | SPRING, Plunger, Monel, 18" Length | 1 | 528E1 | | 528K1 | |
| I | SPACER, Faced, Valve Cup | 4 | 183E2 | | 183K1 | |
| J | VALVE CUP, API | 16 | 192E2 | | 192K | |
| K | SPACER, Valve Cup | 12 | 178E2 | | 178K1 | |
| L | SPACER, End | 4 | 184E2 | | 184K1 | |
| M | CAGE, Blind Plunger | 1 | 130E4 | | 130K2 | |
| N | BALL & SEAT, API Flat (Specify Type) | 2 | 1-1/2" API | | 2" API | |
| O | SEAT FRAME, Blind Plunger Cage | 1 | 146E1 | | 146K1 | |
| P | CAGE, 3-Wing Plunger | 1 | 114E2 | | 114K2 | |
| Q | SEAT FRAME, Plunger | 1 | 146E2 | | 146K1 | |
| R | TUBE, 8-Cup Plunger | 1 | 529E28 | | 529K8 | |
| S | ADAPTER, Plunger to Pull Tube | 1 | 83E2 | | 83K1 | |
| T | PULL TUBE | 1 | 232E-57 | | 232K-58 | |
| U | BARREL TUBE, Plain Steel | 1 | 220E8 | | 220K8 | |
| V | BUSHING, Lower Barrel Tube | 1 | 91E2 | | 91K2 | |
| W | ADAPTER, Pull Tube to Holddown | 1 | 81E1 | | 81K1 | |
| X | BODY, 3-Cup Bottom Holddown | 1 | 97H1 | | 97L1 | |
| Y | SEATING CUP, API #30 | 3 | 190J2 | | 190L2 | |
| Z | SPACER, Seating Cup | 2 | 175H1 | | 175L1 | |
| a | NUT, Tapered Bottom | 1 | 163H2 | | 163L2 | |
| AA | PLUNGER, 8-Cup (4 up and 4-Down), Spring-Loaded, Assembly, less Ball & Seat | 1 | 524E8 | | 524K8 | |
| BB | PLUNGER, Standing Valve, Assembly, less Ball & Seat | 1 | 525E8 | | 525K8 | |
| CC | HOLDDOWN, 3-Cup Bottom, With Gas-Anchor Connection NOTE: May be ordered less Holddown when set on Pump Anchor. | 1 | 282H1 1" NPT | | 282L1 1" NPT | |

Fig. 15.

Fig. 4