Sept. 3, 1963 R. W. GROUNDS 3,102,590

BY-PASS TREATERS

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Fig. 1

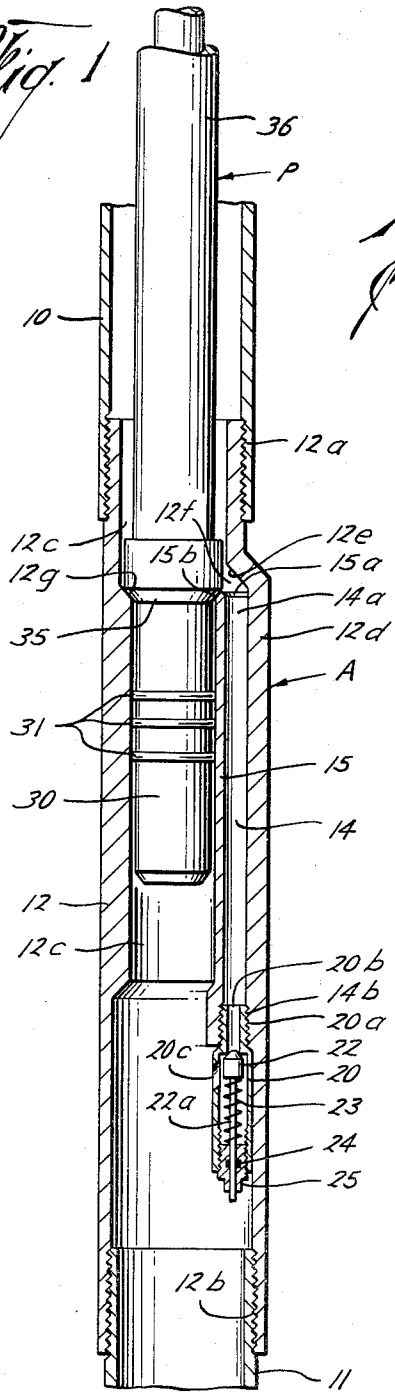
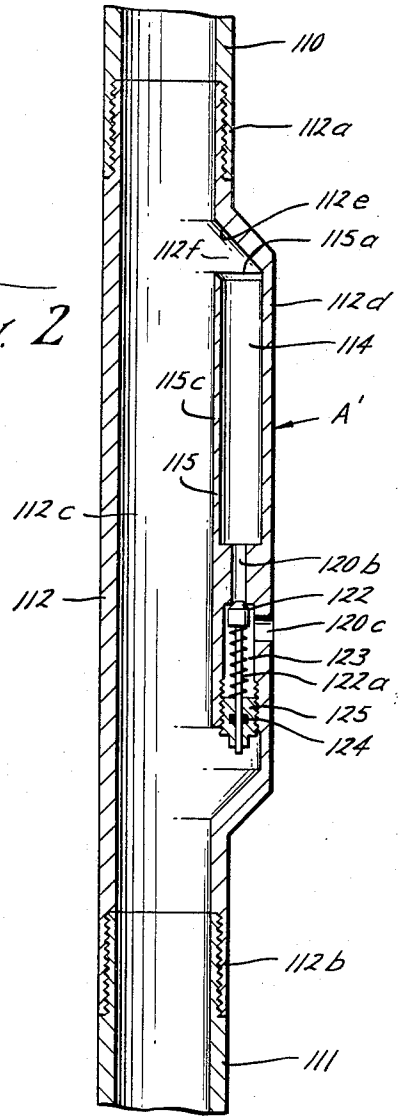


Fig. 2



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BY-PASS TREATERS

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This invention relates to by-pass treaters adapted to be used in a pipe string.

As is well known, rod pumps and other down-hole pumps are customarily used in well tubing or pipe string for pumping oil or other liquids to the surface. During such pumping, it often becomes necessary or desirable to circulate or flow liquids down the tubing or pipe string. Heretofore, in order to effect such downward flow or circulation, it has been necessary to remove or lift the pump upwardly in the tubing or pipe string. Since down-hole pumps are usually used with well head pumping apparatus at the surface of the well, the derrick used during drilling is generally removed. Therefore, the removal or lifting of the pump requires the setting up of a portable derrick or some similar structure at the surface of the well. Such procedure is not only costly but is time consuming.

It is therefore an object of the present invention to provide a new and improved apparatus for flowing or circulating fluid downwardly in a tubing or pipe string while a downhole pump is in such tubing or pipe string and without requiring a removal or lifting of the pump.

An important object of this invention is to provide a new and improved apparatus adapted to be mounted in a tubing string or pipe for by-passing fluid around a pump which is seated in the string or pipe.

Another object of this invention is to provide a new and improved apparatus for use in a well pipe, wherein the apparatus has a pump seat for seating a down-hole pump and a by-pass means for permitting downward fluid flow in the well pipe but preventing upward fluid flow except through the pump.

A further object of this invention is to provide a new and improved apparatus for use in a well pipe for discharging fluid from the well pipe at one or more selected elevations.

A particular object of this invention is to provide a new and improved tubular adapter having a channel therein with a valve means adapted to open at a selected pressure for discharging fluid from the channel.

The preferred embodiment of this invention will be described hereinafter, together with other features thereof, and additional objects will become evident from such description.

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

FIG. 1 is a longitudinal view, partly in elevation and partly in section, illustrating one form of the apparatus of this invention; and

FIG. 2 is a view, partly in elevation and partly in section, illustrating another form of the invention.

In the drawings, the letter A designates generally the by-pass treater or apparatus of this invention. The by-pass treater or apparatus A of this invention is adapted to be connected in a well pipe or tubing string, partial sections of which are designated with the numerals **10** and **11** in FIG. 1. As will be explained more in detail, the treater or apparatus A of this invention includes a body **12** which has a by-pass channel or passage **14** therein which is adapted to flow or by-pass fluid downwardly

around a down-hole pump P without requiring a removal or lifting of the pump P upwardly in the drill string.

Considering the invention more in detail, the body **12** is formed with external threads **12***a* at its upper end for providing a threaded connection with the section **10** of the tubing string or well pipe which extends above the body **12**. The lower end of the body **12** is provided with internal threads **12***b* for connecting with the section **11** of the well pipe or tubing string which extends below the body **12**. The body **12** also has a fluid flow passage or bore **12***c* extending longitudinally therethrough.

The by-pass passage or channel **14** also extends longitudinally and is laterally offset with respect to the main fluid flow passage **12***c*. As shown in FIG. 1, the by-pass channel **14** is formed by an enlarged offset section **12***d* of the body **12** and a substantially semi-cylindrical channel member **15** which is welded or otherwise secured within the body **12** to form the passage **14**. The channel member **15** may of course be formed integrally with the body **12**. The upper end **15***a* of the channel member **15** is disposed below the inclined portion **12***e* of the offset **12***d* so as to provide an inlet opening **12***f* to the open upper end of the channel or passage **14** so that there is fluid communication between the main fluid flow passage **12***c* and the upper opening **14***a* of the passage **14**.

The lower end of the by-pass channel or passage **14** is provided with an internally threaded opening **14***b* which is adapted to receive external threads **20***a* of a valve housing **20**. The valve housing **20** has an upper inlet port **20***b* and a lower outlet port **20***c*. A longitudinally movable valve member **22** is positioned within the housing **20** and is urged upwardly to a position closing the port **20***b* by a spring **23** or other suitable resilient means. The valve member **22** has a valve stem **22***a* therewith which extends through a fluid seal **24** such as an O-ring made of rubber or similar material. The seal **24** is mounted in a packing gland or nut **25** forming the lower portion of the housing **20**. By moving the packing nut **25** upwardly and downwardly within the housing **20**, the extent of the compression of the spring **23** may be adjusted to change the amount of fluid force required to move the valve member **22** downwardly to open the port **20***b*. Therefore, the valve member **22** is adapted to be moved downwardly to an open position when a predetermined fluid pressure is exerted downwardly from the channel **14** on the valve member **22**. When the fluid pressure in the channel **14** falls below such predetermined amount, the spring **23** acts to move the valve member **22** upwardly to close the port **20***b*.

In the form of the invention shown in FIG. 1, the body **12** is provided with an inwardly extending shoulder **12***g* which is at the same elevation as an inwardly extending shoulder **15***b* formed on the channel member **15**. The shoulders **12***g* and **15***b* are preferably tapered or sloped downwardly and inwardly as shown in FIG. 1 to form a pump seat for seating the rod pump or other down-hole pump P.

The pump P illustrated in FIG. 1 is only partially shown since it is of conventional construction and may take numerous forms. As illustrated, the pump P has a lower tubular section **30** with annular resilient seal rings **31** formed on the exterior thereof for engaging the bore or fluid passage **12***c* in sealing contact below the pump seat provided by the shoulders **12***g* and **15***b*. The pump P also has a pump seating surface **35** which is adapted to engage and seat upon the pump seat provided by the surfaces **12***g* and **15***b*. The portion **36** of the pump P above the seating surface **35** is of conventional construction and is of course connected to the usual pump rods known as "sucker" rods for operation in the normal manner.

In the operation of the form of the invention shown in FIG. 1, the pump P is seated in the position shown and the usual pumping operations are performed. The fluid is of course pumped from the well pipe or tubing string below the pump P to the surface at the ground level. The fluid is therefore pumped upwardly from the tubing section **11** and the fluid flow passage **12***c* below the seals **31** through the pump. During the pumping action with the pump P, the valve member **22** is in the closed position shown in FIG. 1 so that it prevents fluid flow upwardly through the by-pass passage or opening **14**. However, should it be desirable to pump a fluid downwardly below the pump P, such downward flow or circulation is obtained by forcing the fluid under a pressure which is sufficient to overcome the spring force of the spring **23**. Such fluid under pressure therefore flows around or by-passes the pump seat and enters the opening **12***f* and the channel **14** and is then discharged through the valve port **20***c* into the area of the flow fluid passage **12***c* below the pump seat. Such fluid flow continues so long as the pressure of the fluid being forced down in the drill string is sufficient to maintain the valve member **22** in the open position. Various conditions may make it desirable to by-pass fluid around the pump P. For example, the drill string **11** may have paraffin in it below the pump P which is interfering with the flow of the well fluid through the pump. By introducing hot oil downwardly through the tubing string above the pump seat and by-passing it around the pump P to the area below the pump P, such paraffin may be melted and then pumped out with the pump P. It will be appreciated that during the flow of the hot oil or other fluid downwardly through the by-pass channel **14**, it will also circulate back up through the pump P unless it is lost or discharged at a lower point in the tubing string.

If salt accumulates in the drilling string below the pump P, water or other fluid which is capable of dissolving the salt may be introduced through the by-pass channel **14** in the same manner as previously described in connection with the hot oil or other fluid. The salt will of course be dissolved by the water or similar fluid and will then be conveyed upwardly through the pump P to the surface. During the flow of the fluid downwardly through the passage or channel **14**, the pump P remains seated as shown in FIG. 1 and it is therefore not necessary to disturb the pump P during the aforesaid treatments.

In FIG. 2, another form of the treater or apparatus of this invention is shown and it is generally indicated by the designation A'. The treater or apparatus A' is connected in a tubing string, generally above a down-hole rod pump which is located further down in the drill string. The sections **110** and **111** of the tubing string are connected to the threads **112***a* and **112***b*, respectively of the body **112**. The body **112** has a main fluid flow passage **112***c* which has a full bore diameter equal to the diameter of the tubing sections above and below the body **112**.

The treater A' has a by-pass passage or channel **114** which corresponds with the passage or channel **14** of FIG. 1. Such passage or channel **114** is formed in an offset **112***d* of the body **112** by means of a substantially semi-cylindrical channel member **115**, the outer surface **115***c* of which is substantially in line with the inner wall of the tubing string thereabove and therebelow as can be clearly seen in FIG. 2. The upper end **115***a* of the channel member **115** terminates below an inclined surface **112***e* of the body **112** to provide for a fluid passage **112***f* into which fluid may flow for communication with the passage or channel **114**. The channel **115** is preferably formed integrally with the body **112**, although it may be separately formed and welded thereto if desired.

The treater or apparatus A' has a valve member **122** which corresponds with the valve member **22** of FIG. 1

and it operates in the same manner except that the outlet port **120***c* is provided in the body **112** so that fluid flowing from the channel **114** through the inlet port **120***b* flows outwardly to the area exteriorly of the body **112**.

The valve member **122** is normally urged upwardly to its closed position by a spring **123** and such spring **123** has a predetermined strength which must be overcome by the fluid force acting downwardly in the channel **114** before the valve member **122** can be moved downwardly to open the flow passage **120***b*. A seal **124** is also provided around the valve stem **122***a*. An adjustable packing nut **125** is provided for adjusting the amount of pressure exerted by the spring **123** on the valve member **122**. It will also be understood that both the spring **123** and the spring **23** may be of various strengths and may be changed as desired for providing different opening pressures for the valve members **122** and **22**, respectively.

The operation of the modified apparatus A' is basically the same as described in connection with the apparatus A. However, since the apparatus A' is not used adjacent to a pump seat, and since it discharges the fluid to the area externally of the body **112**, it normally is used in the tubing string at a point above the pump or other well tool located in the drill string. Thus, if it is desirable to remove paraffin in the tubing string, hot oil may be pumped downwardly and at a sufficient pressure to overcome the spring pressure **123** to thereby open the valve member **122** and discharge the hot oil with the dissolved paraffin to a point exteriorly of the tubing string. Several of the treaters A' may be located in a single drill string at different elevations for discharging the paraffin or other undesirable material from the tubing string. In fact, the modified treater A' may be located in the same string with the treater A. In such case the treater A' would be located at an elevation in the tubing string above the treater A.

The foregoing disclosure and description of the invention is illustrative and explantory thereof and various changes in the size, shape and materials, as well in the details of the illustrated construction, may be made within the scope of the appended claim without departing from the spirit of the invention.

What is claimed is:

A treater apparatus for use with a bottomhole pump, comprising a tubular body adapted to be connected in a pipe string, said body having a main fluid flow passage therethrough having a smooth bore throughout its length, a pump seat formed in said body and surrounding said main fluid flow passage for receiving a bottomhole pump, a bottomhole pump seated on said pump seat for pumping fluid upwardly through said main fluid flow passage, said pump having a lower tubular section which is slidably received in said main fluid flow passage, seal means between said lower tubular section and main fluid flow passage to seal therebetween, said body having a longitudinally extending by-pass passage with an upper opening in fluid communication with the area of said fluid flow passage above said pump seat and seal means, said by-pass passage also having a lower opening in communication with the area of said fluid flow passage below said pump seat and below said seal means, and valve means for permitting downward fluid flow through said by-pass passage to by-pass said pump seat and said pump seated thereon when the fluid pressure above said valve seat is at a predetermined amount sufficient to open said valve means.

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