

Jan. 24, 1967

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3,299,831

SAND SHIELD-FILTER

Filed Jan. 25, 1965

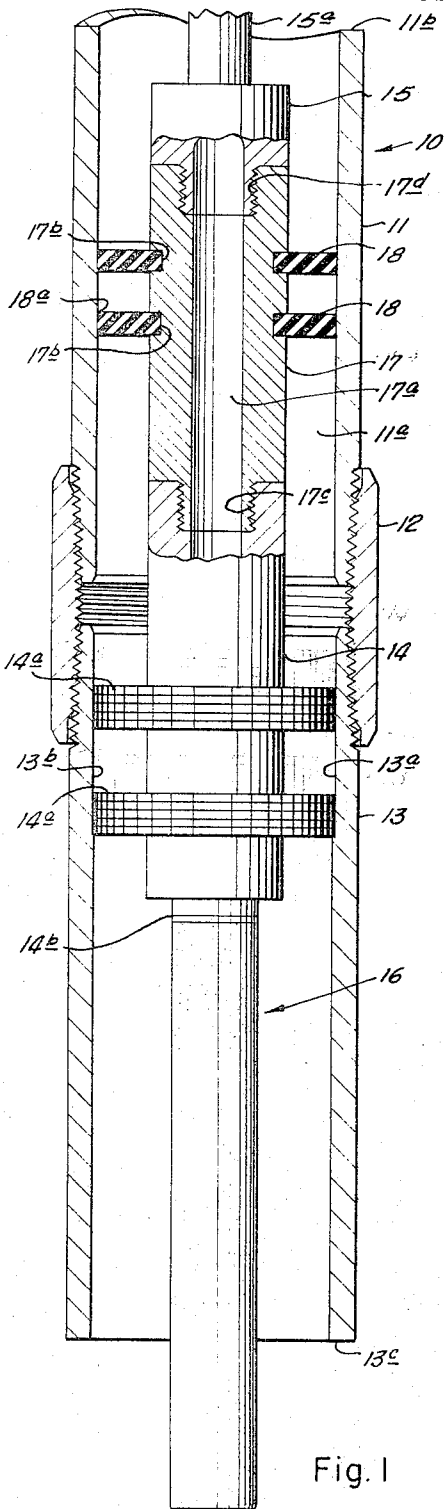


Fig. 1

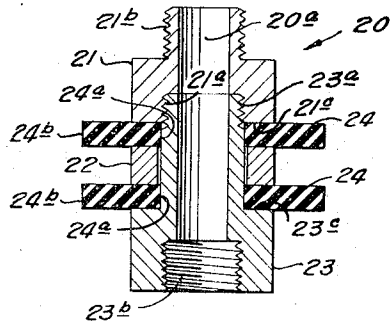


Fig. 2

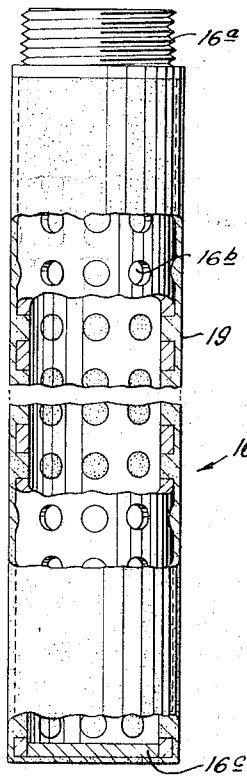


Fig. 3

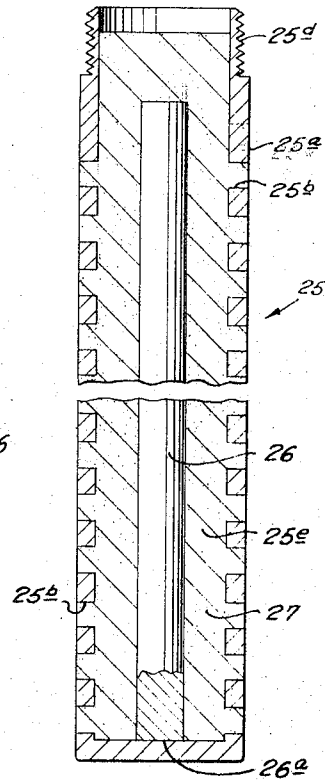


Fig. 4

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SAND SHIELD-FILTER

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Filed Jan. 25, 1965, Ser. No. 427,740

2 Claims. (Cl. 103—220)

This invention relates to sand-preventers, and more particularly to such sand elimination equipment adapted for operation in an oilwell tubing string or other tubular member.

Although our invention is described herein with reference to the tubing string of an oilwell, it is to be emphasized that such wells are used for illustrative purposes only and that our invention is in no way limited to such use.

After an oilwell has been drilled, cased, and tubing installed, it is oftentimes, and usually, found necessary to pack-off the tubing string near its lower end for various reasons. One of these reasons is to provide for pumping action to raise the oil to the surface of the earth. In order to accomplish this, a packer must be inserted below the pump to seal off the tubing-pump annulus. However, a major difficulty is encountered after the pumping action has been commenced because the oil being pumped above the packer into the tubing string contains sand in various amounts. If the sand content of the oil is appreciable and if the oil is not moved rapidly enough to the surface of the earth, some of the sand will settle onto the packer causing the packer to be "sized" or "frozen" to the tubing string. Such "sizing" or "freezing" of the packer to the tubing string oftentimes necessitates the major and costly action of removing the tubing string from the well in order to remove the packer and the equipment attached to it thereabove.

Furthermore, the sand pumped through the pumping equipment along with the oil is extremely abrasive and can result in a very short time in the destruction of the pump and other equipment through which it passes. Of course, when this occurs the pump must be removed from the tubing and a new one installed. Again, it often becomes necessary to remove the packer and the equipment attached to it thereabove from the tubing string.

Accordingly, a principal object of our invention is to provide means for preventing the "sizing" or "freezing" of the packer in a tubing nipple.

Another object is to provide such means which will reduce the cost of producing oil from an oilwell.

Another object is to provide such means which will prevent the unnecessary destruction of a down-the-hole pump due to abrasion from sand.

Still another object is to provide such means which will improve the efficiency of down-the-hole pumps by reducing the amount of sand passing therethrough.

Yet another object of our invention is to provide means which will permit a packer to be removed from the tubing string without removing the tubing string from the well.

Additional objects will be apparent from a study of the following disclosure and attached claims in conjunction with the drawings, wherein:

FIG. 1 is an elevational view, partially schematic and in section, of our invention installed in a tubing string.

FIG. 2 is an elevational view, in section, of an alternate form of the sand-shield described in the following disclosure.

FIG. 3 is a schematic, elevational view of a sand filter described more particularly hereinafter.

FIG. 4 is an elevational view of an alternate type of sand filter.

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Our invention will be described with reference to FIGS. 1, 2, and 3.

The schematic portrayal 10 of our invention is shown in FIG. 1 as installed in a tubing string. Tubing 11 extends from coupling 12 to the wellhead and, of course, contains a bore 11a. Pump 15 is contained in bore 11a and is connected at 15a to sucker rods (not shown) which extend to the wellhead for activating the pump.

Seating nipple 13 is connected to the tubing string by means of coupling 12. Lower end 13c of the nipple may be cut off as shown or may extend into the producing oil strata.

Nipple 13 contains one or more specially prepared grooves 13b designed to accommodate the cups 14a of packer 14. There are various types of packers on the market at this time designed to coact with the specially prepared nipple 13. As such, the packer and nipple are not part of this invention except that our invention is designed to act in combination therewith.

Connected to packer 14 at 14b is our sand filter 16 which will be described in more detail hereinafter.

Sand-shield 17 is connected at 17c to packer 14 and at 17b to pump 15. One or more flexible members 18 is disposed in one or more grooves 17b machined into the outer surface of shield 17. The outer portion 18a of member 18 is of such diameter that it makes contact with the interior of tubing 11 to prevent any small solid particles in the bore 11a thereabove from falling onto cups 14a.

An alternate type of sand-shield 20 is shown in FIG. 2. Sub 23 extends upwardly from its lower end to its upper end 23a where it is threadedly connected to box 21. As shown in FIG. 2 sub 23 has a shoulder 23c on which a flexible member 24 rests. Member 24 is circular and encircles part of the upper portion of sub 23. A sleeve 22 also encircles part of the upper portion of sub 23. As shown, a member 24 is secured between sleeve 22 and the lower portion of box 21. Of course, any number of members 24 with sleeves 22 may be placed on sub 23 depending on the length of the upper portion of sub 23. Shield 20 is connected at 21b and 23b to pump 15 and packer 14, respectively.

Members 18 and 24 are made of rubber or rubber-like material to provide flexibility. In use the outer circumference 24b of member 24 contacts the interior of tubing string 11.

Sand filter 16 shown in FIG. 3 may be made from a pipe or other tubular member with end 16c sealed. The upper end of the filter is threaded at 16a for connection with the packer 14.

As shown in FIG. 3, a plurality of perforations 16b are made in the pipe. However, instead of perforations circular in nature, same may be slotted or of any other configuration. Also, a portion of the pipe may be cut away and a screen or other sieve-like member secured in the pipe.

Sand or other small particles are mixed with Eposand (trademarked by Shell Oil Company) or other type of binding agent. Then, a rod (not shown) or other instrument is inserted in the bore of filter 16 and the filter is covered with the sand-Eposand mixture and allowed to set until such time as the filter, including perforations 16b, contains the desired thickness of sand-Eposand mixture. The excess sand-Eposand mixture is removed from the filter, the rod is removed therefrom, and the filter is attached to the lower end of packer 14 as previously described.

After filter 16, packer 14, holder 17, and pump 15 are assembled as shown in FIG. 1, the combination is run into the tubing string until the packer is seated in nipple 13 as previously described.

Sand filter 25 shown in FIG. 4 is an alternate type of

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filter. It is comprised of a pipe 25a containing a plurality of perforations 25b and is adapted at 25d for connection with packer 14. Rod 26 is secured to the lower end of and within pipe 25a at 36a. Annulus 25e between rod 26 and the intersurface of pipe 25a is filled with the sand-Eposand mixture described above.

The above-Eposand mixture as described herein, while impervious to sand particles, will prevent the flow of oil and the other liquids therethrough. However, the sand-Eposand mixture is not 100% effective in filtering out the sand suspended in the oil flowing therethrough.

While the sand shield is shown in FIG. 1 as being made up in the packer-pump combination within the tubing string, it can be made of the same dimensions as tubing 11 and be connected in the tubing string above the packer (not shown) securing the tubing string in the casing (not shown).

Its use in the tubing-casing annulus would be for the same purpose as described hereinabove where oil is being produced through the tubing-casing annulus in addition to the tubing string. Of course, this oftentimes is done in the oil industry, particularly where more than one oil stratum is being produced.

After the pumping action has commenced the oil bearing fluid, containing various amounts of sand in suspension, flows through perforations 16b or 25b through packer 14, bore 17a and pump 15 into bore 11a of the tubing string. A large portion of the sand in the fluid is filtered out as the fluid passes through filter 16 or 25. Some of the sand which is not filtered out by filter 16 or filter 25 settles onto members 18 when the fluid is deposited in bore 11a. Were it not for members 18 this sand would settle onto cups 14a causing them to be seized in or frozen to nipple 13.

When it becomes necessary to remove the packer from the tubing string, the packer is unseated in the usual manner by removing the cups 14a from the grooves 13b. At this time the members 18 will be forced in a downward direction due to the upwardly directed force on the pump, sand shield, and packer from the wellhead. At this time the sand collected on members 18 will settle toward cups 14a. However, this will not cause the cups to freeze in nipple 13 for the reason that cups 14a have already been removed from the grooves 13b.

While our invention has been described with respect to a packer seated in a nipple and a pump thereabove, either or both of the filter and sand shield may be used in conjunction with standing valves or any other type of device which might become "sized" or "frozen" in a nipple in an oilwell.

From the foregoing it is seen that means have been provided for preventing the "sizing" or "freezing" of a packer in a tubing nipple.

It is further seen that such means have been provided which will prevent the unnecessary destruction of a down-the-hole pump due to abrasion from sand.

It is also seen that such means are provided which

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will improve the efficiency of down-the-hole pumps by reducing the amount of sand passing therethrough.

It is further seen that such means have been provided which will reduce the cost of producing oil from an oil-well.

It is also seen that such means have been provided which will permit the removal of a packer from the tubing string without removing the tubing string from the well.

It is to be understood that the form of the invention shown and described is to be taken as a preferred embodiment of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the attached claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. A sand shield for use in a well comprising: tubular means having an external, upwardly facing shoulder and connecting means on its upper end; first flexible means positioned on said shoulder, encircling said tubular means, and extending outwardly beyond the outer periphery of said tubular means; sleeve means encircling said tubular means and biasing said first flexible means against said shoulder; second flexible means positioned on said sleeve means, encircling said tubular means, and extending outwardly beyond the periphery of said tubular means; and tubular box means connected to said connecting means biasing said second flexible means against said sleeve means, said flexible means closing the annulus between said tubular means and the interior surface of said well when positioned therein.

2. The combination of the sand shield of claim 1 and a sand filter, for use in a well containing fluid with a packer securing a tubing string to the wall of said well, said sand shield being positioned on said tubing string above said packer in such manner as to prevent solid particles in said fluid above said sand shield from being deposited on said packer and freezing said packer to said wall, said sand filter comprising tubular filter means made up in said tubing string and having a perforation in its wall to permit fluid flow into its bore, said perforation being sealed with particles of sand bonded together in such manner as to prevent the passage of solid particles suspended in said fluid into said bore, said sand shield and said sand filter in combination preventing the freezing of said packer to said wall.

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