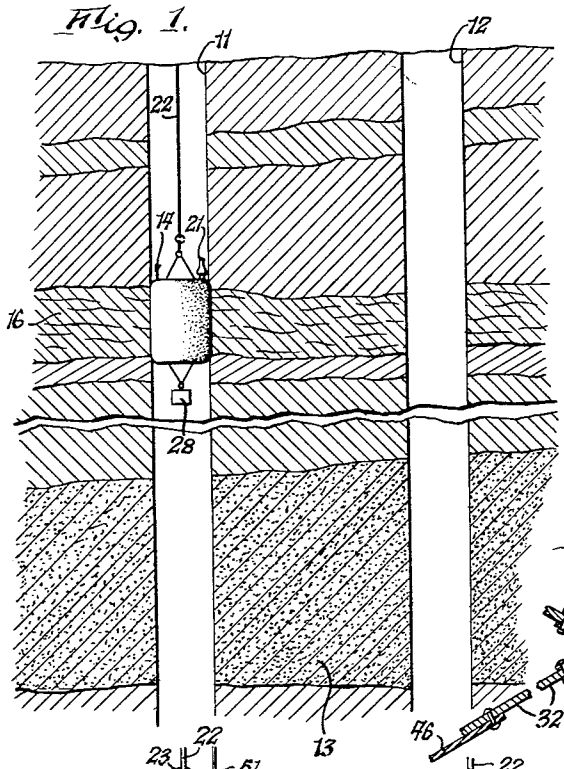
July 25, 1961 L. C. FONS ET AL 2,993,540

PACKER FOR WELL BORES

Filed Aug. 8, 1957

Fig. 1.



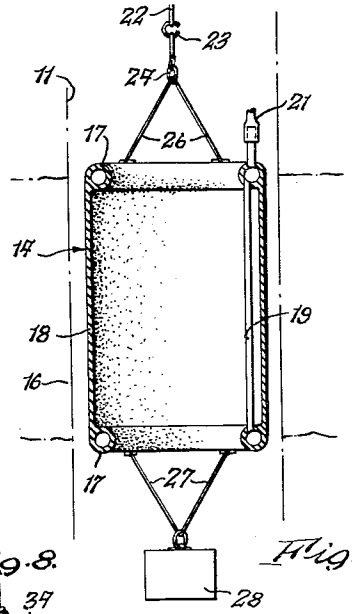
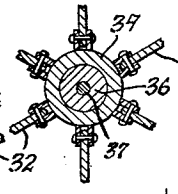


Fig. 2.

Fig. 8.



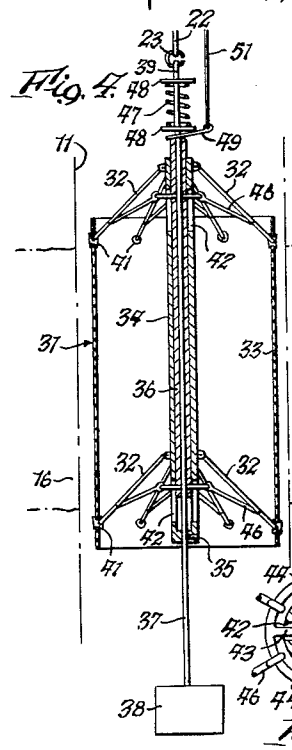


Fig. 4.

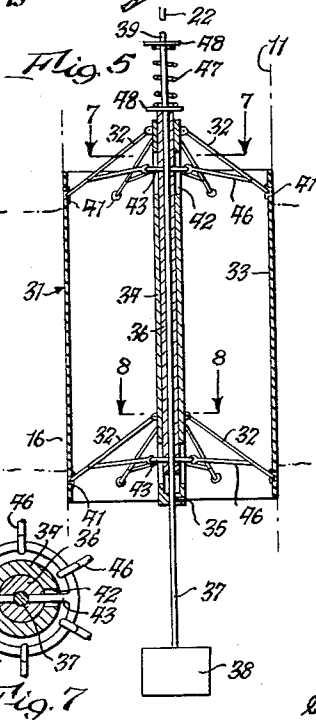


Fig. 5

Fig. 7

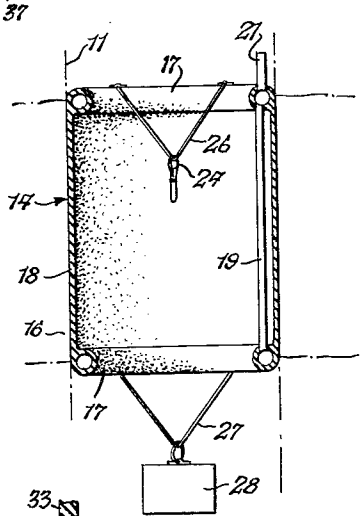


Fig. 3.

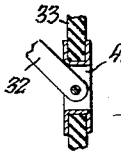


Fig. 6

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PACKER FOR WELL BORES

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3 Claims. (Cl. 166—187)

This invention relates to the well drilling art, and more particularly to a method of preventing movement of liquid, gas, or suspended solid material in the well bore from entering previously selected permeable formations that are exposed to the bore hole.

In the oil, gas, brine, and water well art, it is often desirable to seal or plug a permeable formation zone, to prevent escape of pressure fluids being admitted to the well bore. Such a sealing procedure may be used to stimulate production of these substances. Such a sealing procedure may be utilized wherein gas or liquid pressure is to be applied upon an underground body of oil, or the like, to force it into an adjacent well bore. By sealing the permeable formation zones of the well bore, a pressure loss may be avoided, or greatly reduced, to thereby render the overall operation practical, and/or improve the efficiency thereof.

The present invention affords a means for selectively sealing, or plugging a permeable formation zone of a well bore, whereby loss of pressure, or fluid flow may be avoided, or reduced by a considerable degree. In addition to the possibility of selectively sealing permeable formation zones in a well bore, the present invention is characterized by extreme simplicity of application, and one which affords greater economies in oil recovery operations.

The main object of this invention is to provide a means for selectively sealing predetermined areas of a well bore to selectively prevent or minimize fluid flow and loss of pressure.

A further object of the invention is to provide a well bore selective sealing means which is simple, effective, and which affords greater overall economies in oil recovery operations.

These and further objects and features of the invention will become more apparent from the following description and the accompanying drawings wherein:

FIG. 1 is a section view of well bores illustrating a device of the invention as used to seal a permeable formation zone in one of the well bores;

FIG. 2 is a section view illustrating the device of the invention in greater detail, and prior to application against a permeable formation zone in a well bore;

FIG. 3 is similar to FIG. 2, but showing the device after application to a permeable formation zone of a well bore;

FIG. 4 is a section view of a device representing another embodiment of the invention, and prior to application against a permeable formation zone in a well bore;

FIG. 5 is the same as FIG. 6, but showing the device after application to a permeable formation zone of a well bore;

FIG. 6 is a section view illustrating a detail of the device of FIG. 4;

FIG. 7 is an enlarged section view as seen from line 7—7 in FIG. 5; and

FIG. 8 is an enlarged section view as seen from line 8—8 in FIG. 5.

Referring now to the drawings and more particularly to FIG. 1 numeral 11 identifies a well bore which extends downwardly into the ground parallel to an adjacent well bore 12, both of which pass through the same oil and water bearing formation sands 13, the oil from which it is desired to pump, or force to the surface of the ground. A sealing or plugging device 14, representing an embodiment of the invention, is shown positioned in well bore 11 in front of a permeable water bearing formation zone 16 through which the well bore 11 extends. The sealing device 14 is shown expanded and just prior to final installation in the region of the permeable zone 16, and before placement means, to be described in greater detail hereinafter, have been removed from the sealing device.

The sealing device 14, as best seen in FIG. 2, is tubular, or cylindrical in form and comprises a pair of toroidal, or doughnut-shaped end pieces 17, inter-connected by a tubular membrane, or sheath 18. The end pieces 17, as well as the sheath 18, are formed of a flexible and expandable material such as rubber or the like, and which is impervious to fluid flow therethrough. A pipe, or tube 19 connects the interior of the end pieces 17, so that pressure fluid admitted to the upper end piece by means of a pipe, or hose 21, can flow to the lower end piece so that the pressure in each end piece 17 is equal.

Placement means in the form of a cable, or rope 22, is affixed to the upper end piece 17 by way of an expandable link 23, an eyelet piece 24 and a plurality of rope, or cable members 26. Affixed to the lower end piece 17 by means of rope, or cable members 27, is a weight 28, which serves to pull the sealing device 14 downwardly in the well bore.

To apply the sealing device 14, it is lowered into the well bore 11 until it is adjacent to the permeable formation zone 16 desired to be sealed. A gas, or other pressure fluid is introduced into the end pieces 17 by way of the hose 21 to expand the end pieces radially, so that they roughly engage the wall of the well bore. Liquid or gas is then pumped into the top of the bore hole 11 creating a pressure differential across the sealing device walls 18. The pressure in the hole on the inside of the device now being greater than the formation pressure causes the device to be pushed tightly against the bore hole wall. Next, the cable 22 is pulled upwardly and is released by opening of the expandable link 23. The hose 21, may also be removed at this time since the differential pressure across the sealing sheath 18 is holding the sealing sheath against the wall with great force. The pressure medium which forces the sheath 18 against the side of the well bore, also passes downwardly to act upon the oil in the permeable oil sands 13, to force it in the direction of the production wells.

It will be seen that the sealing device 14 of the invention may thus be utilized to seal, or plug, any predetermined region of the well bore to prevent loss of pressure, or escape of pressure fluid being used to force the oil upwardly from an oil bearing formation zone(s) into well bore 12. The sealing device 14 will effectively block flow of pressure fluid in the well bore 11 from escaping into a region of permeable formation, since the sheath 18, being formed of an elastic or flexible material, will naturally accommodate itself to the surface of the well bore when pressure is applied on the inside of the sheath, hence the sealing device will operate effectively in well bores having less than perfectly round peripheries.

Another embodiment of the invention comprising a sealing device 31, which may be utilized to achieve the same results as the sealing device 14, is illustrated in FIGS. 4 to 8 inclusive. The main difference between the sealing device 31 and the one previously described, resides in the details of structure permitting initial positioning of the device in the well bore. More particularly, instead of incorporating an inflatable end piece such as end piece 17 as used in the sealing device 14, the sealing device 31 utilizes a plurality of radially disposed

arms 32 which function somewhat in the nature of umbrella ribs to expand each end of a tubular flexible membrane, or sheath 33. The arms 32 are pivotally affixed at one end to a pipe, or tubing 34, which slidably encloses a pipe, or tubing 36. A rod 37, to which the tubing 34 is affixed by means of a set screw 35, extends through the tubing 36 and has a weight 38 affixed to the lower end, and an eyelet 39 formed at the upper end. The ends of the arms 32 are each pivotally attached to a grommet 41 which are secured to the sheath 33. The tubing 34 has vertically disposed slots 42 to slidably receive radially disposed arms 43 of a ring 44, as best seen in FIG. 7. Pivotally affixed at one end to the ring 44 is a plurality of arms, or ribs 46, the other end of each arm being pivotally affixed to one of the arms 32.

A compression spring 47 surrounds the upper end of the rod 37 which spring is arranged between washers 48 the upper washer being in engagement with the bottom of eyelet 39, while the lower washer is in engagement with a trigger means 49. A rope, or cable 51, attached to the trigger means 49, is adapted to release the trigger means from holding engagement of the lower washer 48 allowing spring 47 to expand and cause downward movement of the tubing 36 relative to the rod 37. As a result, the arms 43 will move downwardly and cause arms 46 to swing the arms 32 outwardly, whereby the upper and lower end regions of the sheath 33 will be brought into engagement with the wall of the well bore 11. A pressure fluid is then admitted to the well bore 11, which forces the sheath against the wall of the well bore 11, as illustrated in FIG. 5, to thereby seal the zone of permeable formation against fluid flow therein. The cable 22 is then pulled upwardly and released by opening of the expandable link 23. In such manner the sealing device 31, may be applied to a predetermined zone in the well bore.

From the foregoing it will be seen that the invention provides a means for selectively sealing permeable zones of a well bore to prevent flow of pressurized medium into said zones, and that the method of the invention affords extreme simplicity of application, and contributes to greater economies in oil recovery operations.

The foregoing description has been given in detail without thought of limitation since the inventive principles involved are capable of assuming other physical embodiments without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. A sealing device for a well bore comprising an impermeable and expansible open ended cylindrical sheath, a toroidal shaped expansible element arranged within and connected to each end of the sheath, said toroidal shaped element being expansible radially outwardly from the center of the toroidal shaped element, means for admitting pressure fluid to the interior of said toroidal shaped expansible elements whereby the ends of the sheath will be brought into contact with the wall of a well bore, means for holding said sheath vertically distended, and a cable means for lowering the sealing device into a well bore to a predetermined depth.

2. A sealing device for a well bore comprising an impermeable and expansible open ended cylindrical sheath having an integral toroidal shaped element formed around the inside of each end thereof, said toroidal shaped element being expansible radially outwardly from the center of the toroidal shaped element, means interconnecting the interiors of the toroidal shaped elements, a pressure line for admitting fluid under pressure to the toroidal shaped elements to cause said radial expansion thereof whereby the ends of the sheath may be brought into contact with the wall of a well bore, a cable releasably affixed to the upper end of the sealing device for lowering it into a well bore, and a weight attached to the lower end of the sealing device.

3. A sealing device for a well bore comprising an impermeable and expansible open ended tubular sheath having an integral toroidal shaped portion around the inside of each end, said toroidal shaped portion being expansible radially outwardly from the center of the toroidal shaped portion, a hose interconnecting the interiors of the toroidal shaped end portions, a pressure line removably affixed to the upper toroidal shaped element for admitting fluid under pressure to cause said radial expansion of said toroidal shaped end portions whereby the ends of the sheath may be brought into contact with the wall of a well bore, a cable releasably affixed to the upper toroidal shaped end portion for lowering the sealing device into a well bore, and a weight affixed to the lower toroidal shaped element.

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