Jan. 2, 1940. L. F. ROLLINS 2,185,522

WELL FLOW CONTROLLING DEVICE

Filed Oct. 28, 1937 2 Sheets-Sheet 1

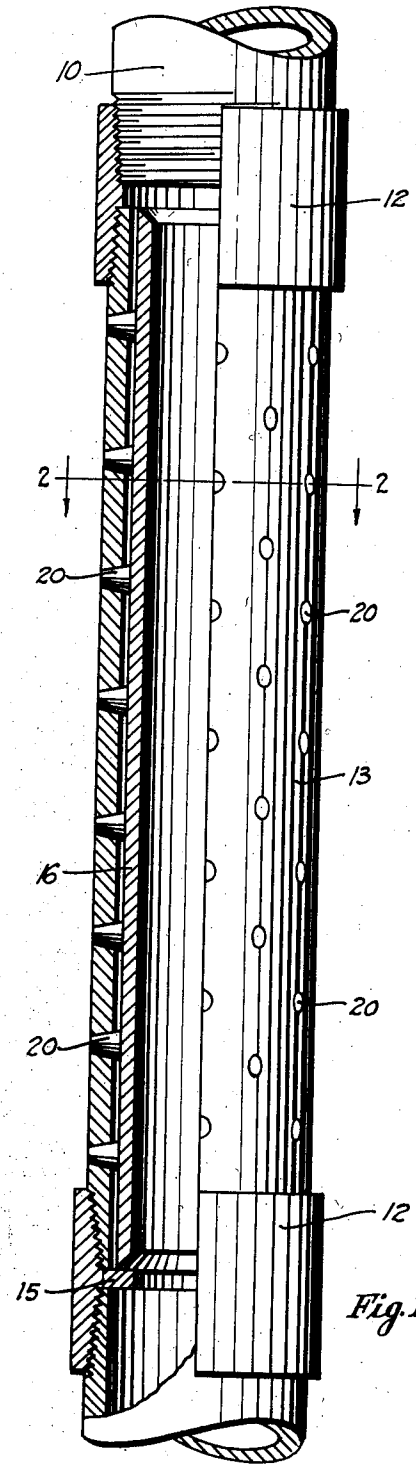


Fig. 1

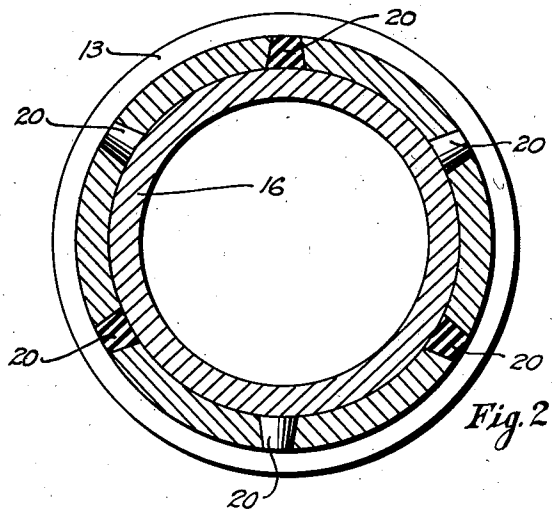


Fig. 2

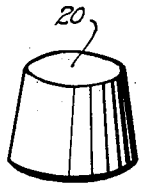


Fig. 3

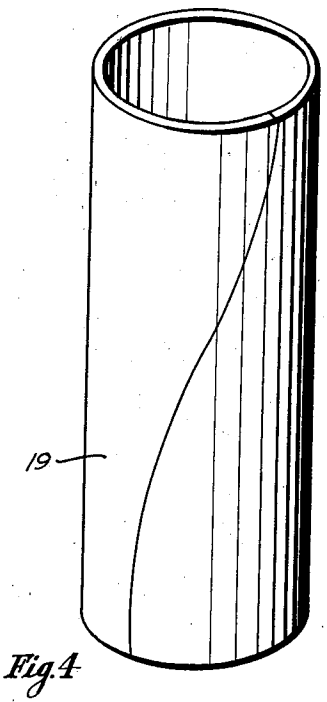


Fig. 4

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Jan. 2, 1940. L. F. ROLLINS 2,185,522

WELL FLOW CONTROLLING DEVICE

Filed Oct. 28, 1937 2 Sheets-Sheet 2

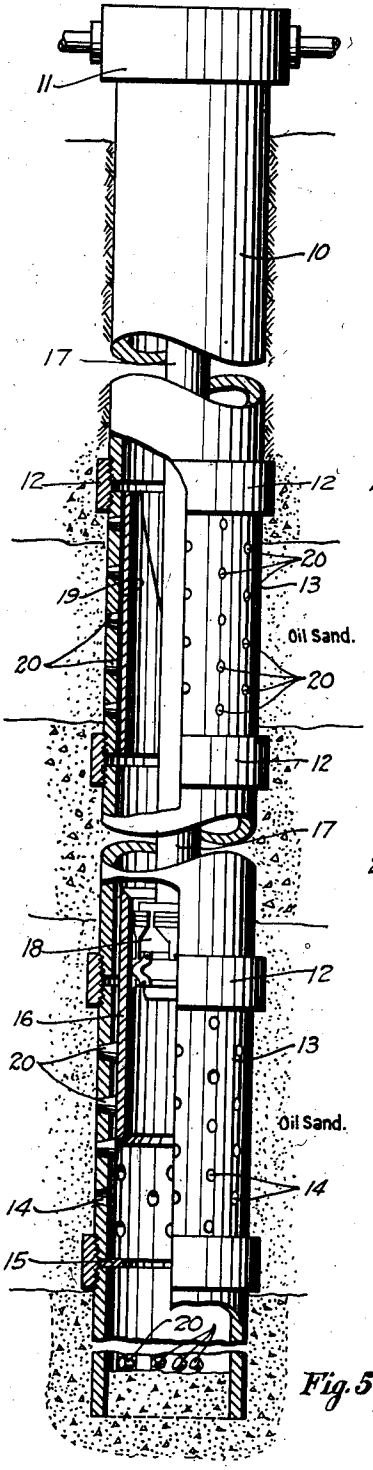


Fig. 5

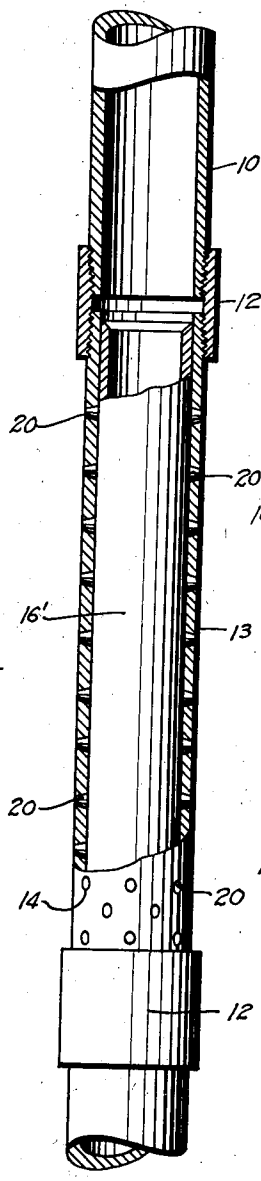


Fig. 7

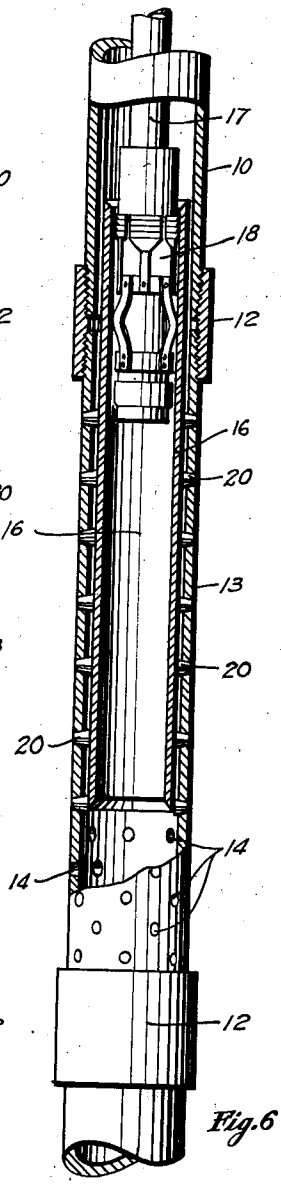


Fig. 6

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UNITED STATES PATENT OFFICE

2,185,522

WELL FLOW CONTROLLING DEVICE

Leon F. Rollins, Houston, Tex.

Application October 28, 1937, Serial No. 171,475

9 Claims. (Cl. 166—5)

My invention relates to the art of controlling the flow of fluids in a well and is particularly adapted to use in oil wells when it is desired, at times, to control, regulate or entirely cut off, the flow of oil and gas.

I am aware that many devices have been used for this, or similar, purposes but from my experience such have all failed to function in a way to satisfy the demands, and real needs, of the oil industry.

The object of my invention is to produce a device for these purposes, sure and true in its functioning, economical to manufacture and easy to position and operate. One of the principal objects of the invention is to provide such a device which may be prepared, for its function, as the casing is being connected, above ground, and being lowered into the well.

A further object is to do away with the necessity of shooting, for perforating, a casing after it has been positioned in the well.

Another object is to provide regular, and sufficient, openings in the well casing so that the regulation of oil, or other, flow, may be sure and certain and easily and quickly accomplished, without the necessity of employing skilled and highly trained mechanics but which can be satisfactorily placed, adjusted and regulated, by any mechanic working in the oil field.

A further object is to simplify the whole proceeding of preparing an oil well for proper and efficient regulation as to the flow of the oil and gas.

Another important object is to efficiently take care of a condition wherein a casing is set in a well piercing a multiplicity of oil sands, so that all but one, if desired, may be cut off entirely and the remaining one regulated as to its flow, or be entirely cut off also.

A further object is to render it unnecessary to plug perforations in casings with cement, or similar substance, or to be compelled to cut off oil sands by cementing between the casing and the wall of the well.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

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

Figure 1 is a view partly in elevation and partly in section showing the relationship of the perforated part of the casing and sleeve therein,

Figure 2 is a horizontal cross-section taken on line 2—2 of Figure 1,

Figure 3 is an isometric view of one of the plugs I employ,

Figure 4 is an isometric view of a split sleeve I employ,

Figure 5 is a view partly in elevation and partly in section showing the casing with perforations therein at two different points, one section containing perforations having my controlling sleeve therein and the second perforated section having a cut-off sleeve for the perforations therein,

Figure 6 is a view partly in elevation and partly in section of my device with the controlling sleeve partly raised, and held in position, to permit a limited flow of oil into the casing, and

Figure 7 is a view partly in elevation and partly in section showing a modified form of the invention wherein the sleeve fits snugly in the casing and engages the plugs.

Referring to the accompanying drawings the reference numeral 10 indicates a well casing, topped by the usual casing head 11, the sections of the casing being joined by the customary collar coupling 12. The numeral 13 indicates a section of the casing which is provided with a number of tapered perforations, 14, these perforations being, preferably, arranged in a uniform manner. The numeral 15 indicates a spacing ring which I place between certain of the casing sections, which will hereinafter be more fully explained, said ring extending inwardly from the inner wall of the casing to form a shoulder, as shown.

An important element of my invention is the sleeve 16, which I preferably make of less outside diameter than the inside diameter of the casing, so as to provide an annular space therebetween. This sleeve is of a length sufficient to cover all of the perforations in a given section of the casing and the spacing ring 15 is secured between the lower end of the perforated section and the next lower section of the casing, and, by its mounting and formation, forms a shoulder in the casing on which my sleeve 16 is adapted to come to rest when lowered into the casing. In order to suspend the sleeve I mount a suitable tool 18 having gripping slips, on the lower end of an ordinary string of tubing 17, whereby said sleeve may be raised and lowered in the casing.

The tapered perforations received tapered plugs 20 which are first inserted therein by hand and are then forced into said perforations by the sleeve 16, when the latter is telescoped into the

casing section. These plugs may be made of rubber compound, Duprene or any other material suitable for the purpose.

In forming the perforations in certain of the casing sections I prefer to form them with beveled sides, the wider part of the opening being innermost and, obviously, the plugs **20** may be formed with the same bevel, to fit therein, but this is simply for convenience and is not essential to the proper functioning of my device.

In practical operation, as the casing is being made up and lowered into the well, a perforated section is placed in the string so as to be properly positioned with respect to the oil producing sand. The location of this sand is, of course, well known from the recordings taken during the sinking of the well. If there are more than one oil sand a perforated section is placed in the string of casing to be properly positioned with respect to each oil sand.

In the event two or more oil or gas or oil and gas sands are pierced and it is desirable to shut off one of said sands, I provide a split metallic sleeve **19**, preferably of resilient metal. This sleeve will hold the plugs in place and owing to the frictional engagement with the plugs, will itself be held in place.

The casing being made up with one or more perforated sections having plugs and sleeves therein, is lowered into the well in the usual manner. The perforations being sealed by the plugs **20**, the oil, gas and water are shut off. It is the practice to cement the casing in the well. In order to raise the sleeve **16**, a suitable tool, such as a spear **18** with expansible slips is lowered on the end of a string of tubing, so that the slips engage in the upper end of the sleeve.

By raising the tubing the required distance, which may be accurately done, the sleeve **16** will be likewise elevated, thus releasing the plugs therebelow. The pressure of the fluids from the sands being exerted against the small ends of the plugs **20**, would displace the same into the casing, whereby the complementary apertures **14** will be opened and flow into the casing established. If salt water or other extraneous fluids should flow into the casing, the tool **18** is removed for the purpose of pumping cement into the casing and filling the perforations. Owing to the frictional contact between the plugs and the sleeve, the latter will remain in its raised position when the tool is removed.

It is pointed out that one sleeve **19** is positioned within each perforated section desired to be kept plugged, whereby said sleeve prevents the displacement of the plugs of said section. When only one oil or gas or oil and gas sand is pierced, only one perforated section is made up in the casing and, therefore, the sleeves **19** are unnecessary and are not used. The latter are usually employed in the upper sections as shown in Figure 5 and have internal diameters of sufficient size to permit the tubing string and tool or spear **18** to pass therethrough. However, it is noted that the sleeve **19**, being positioned above the sleeve **16**, may be raised therewith, if desired, by a continued upward movement of the tubing.

In Fig. 7, I have shown a modified form in which the sleeve **16'** is machined so as to have a close sliding fit in the casing section **13** and this will aid in preventing a flow or passage of fluids between the sleeve and casing. However, I prefer to make the sleeve smaller as in Figs. 1, 5 and 6, thus saving the expense of machining. When the plugs **20** are forced into the perforations **14**, their smaller ends may protrude from the outside of the casing section, and in such case the projecting ends may be cut off before the casing is lowered into the well.

It is to be understood that the forms of my invention, herewith shown and described, are to be taken as preferred examples 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 my invention, or the scope of the appended claims.

What I claim and desire to secure by Letters Patent is:

1. The combination in a well flow controlling device, of a casing, a perforated section in said casing positioned at flow strata, plugs for filling the perforations to shut off the flow of fluids therethrough, and movable means for holding said plugs in place.

2. In a well flow controlling device, a casing section having spaced perforations, yieldable plugs inserted in the perforations of said section for closing the same, and a sleeve slidable in said section and held in place by frictional contact with said plugs.

3. The combination in a well flow controlling device of a casing, a perforated section in said casing positioned at the flow strata, said perforations being formed with inclined walls the inner opening being larger than the outer opening, beveled plugs to be inserted in their respective perforations, and a split sleeve inserted in the casing and engaging the said plugs.

4. The combination in a well flow controlling device of a casing, a perforated section in said casing positioned at the flow strata, a second perforated section in said casing positioned at a second flow strata, removable means for closing the perforations in said second section, a sleeve slidably mounted within said casing and designed to open and close the perforations in the first mentioned perforated section, and means to selectively position said sleeve with respect to said perforations.

5. The combination in a well flow controlling device of a casing, a perforated section in said casing positioned at the flow strata, a second perforated section in said casing positioned at a second flow strata, removable means for closing the perforations in said second section, a sleeve slidably mounted within said casing and designed to open and close the perforations in the first mentioned perforated section, means to selectively position said sleeve with respect to said perforations, and a stop in said casing for the sleeve to position same for closing all of said perforations in the first mentioned perforated section.

6. The combination in a well flow controlling device of a casing, a plurality of perforated sections in said casing one positioned at each flow strata in the well, plugs to be inserted in the perforations in each perforated section positioned at a flow strata, removable means to hold said plugs in the perforations of one of said sections at a strata to be worked, means to selectively position said sleeve with respect to the plugs to release the same.

7. The combination in a well flow controlling device of a casing, a perforated section in said casing designed to be positioned at a flow strata and exposed on its outer surface to the pressure fluid in said strata, removable closures in the perforations of the casing section exposed to the

exterior fluid pressure, movable means normally holding said closures in place to shut off the external pressure fluid from the casing, and means operable from the top of the well for moving said movable means to release selected closures, whereby the pressure fluid from said strata may displace said selected closures into the casing and flow thereinto.

8. The combination in a well flow controlling device, of a casing, a perforated section in said casing designed to be positioned at a flow strata, and exposed on its outer surface to the pressure fluid in said strata, removable plugs in the perforations of the casing section exposed to the exterior fluid pressure, movable means normally holding said plugs in place to shut off the external pressure fluid from the casing, and means operable from the top of the well for moving said movable means to release selected plugs, whereby the pressure fluid from said strata may displace said selected plugs into the casing and flow thereinto.

9. The combination in a well flow controlling device, of a casing, a perforated section in said casing designed to be positioned at a flow strata and exposed on its outer surface to the pressure fluid in said strata, removable plugs in the perforations of the casing section exposed to the exterior fluid pressure, movable means normally holding said plugs in place to shut off the external pressure fluid from the casing, means to release selected plugs, whereby the pressure fluid from said strata may displace said selected plugs into the casing and flow thereinto, and means for limiting the downward movement of the sleeve.

LEON F. ROLLINS.