United States Patent [19]

Bullen

[11] **4,241,786**

[45] **Dec. 30, 1980**

[54] **WELL TREE SAVER**

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[21] Appl. No.: **35,195**

[22] Filed: **May 2, 1979**

[30] **Foreign Application Priority Data**

May 2, 1978 [CA] Canada 302475

[51] **Int. Cl.**[2] **E21B 19/00;** E21B 33/03; E21B 43/26

[52] **U.S. Cl.** **166/77**

[58] **Field of Search** ..... 166/77, 77.5, 75 R

[56] **References Cited**

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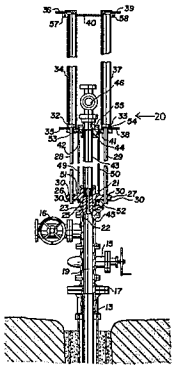
[57] **ABSTRACT**

A bypass attachment is provided to prevent damage to the valves of a well tree when fluid at high pressure is passed into a well, such as during a fracturing process. The bypass attachment is formed of a piston rod removably mounted to the well tree and offset from it, a piston mounted on the piston rod, a cylinder movable on the piston, the cylinder bearing a piece of high-pressure tubing aligned with the passage through the well-head tree, a high-pressure valve to close off the high-pressure tubing and sealing means to seal the space between the exterior of the high-pressure tubing and the interior of the vertical passage through the well-head tree.

11 Claims, 3 Drawing Figures



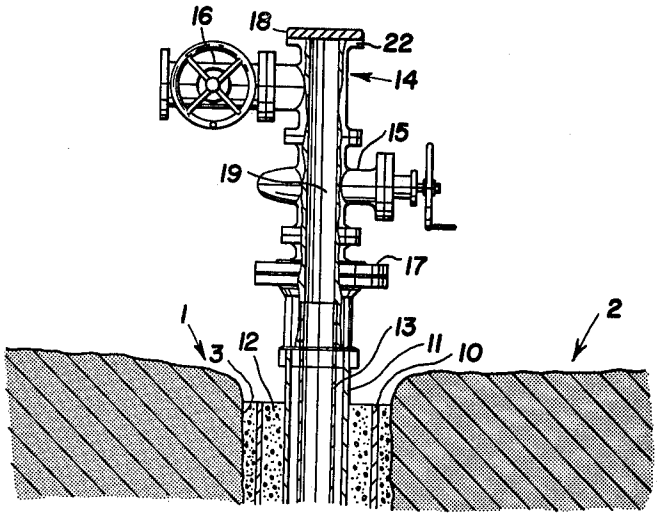
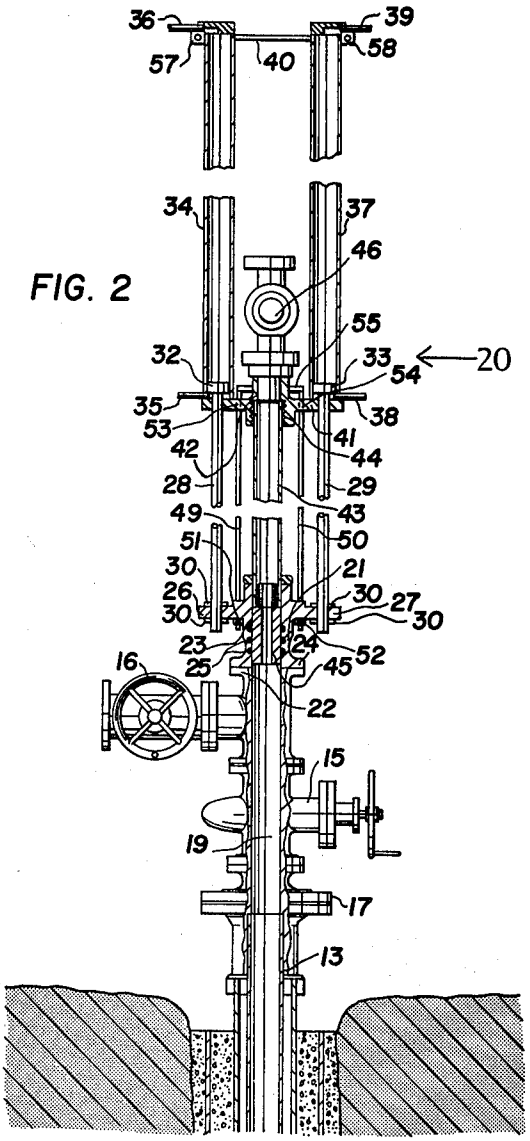


FIG. 1
(PRIOR ART)

FIG. 2



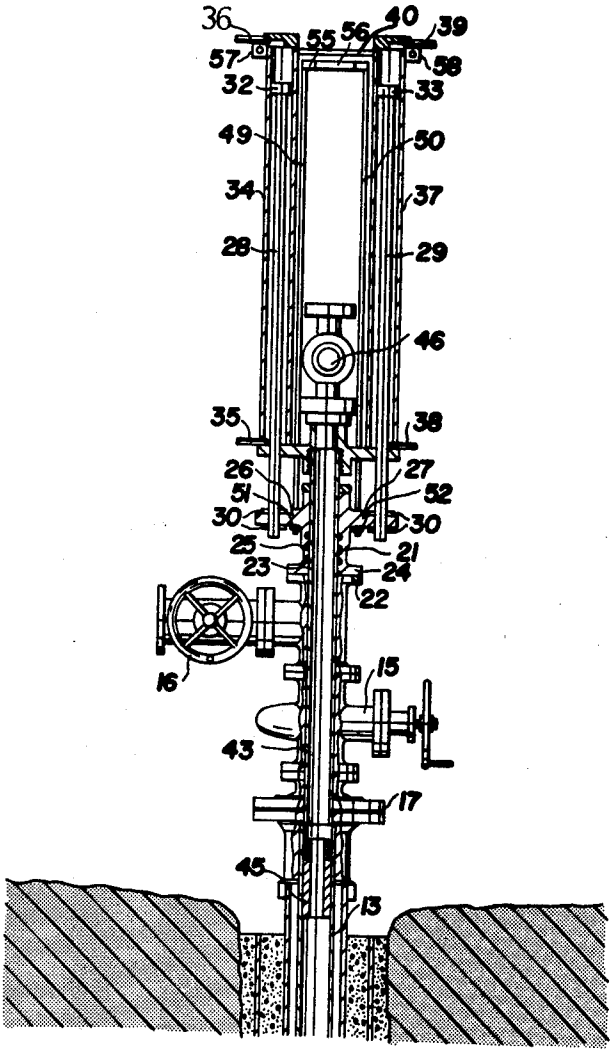


FIG. 3

WELL TREE SAVER

This invention relates to well-head equipment for oil and gas wells and the like. More particularly, the invention relates to a high-pressure bypass for well-head valves.

BACKGROUND OF THE INVENTION

The well-head of a production oil or gas well commonly is provided with a number of valves. Some of these valves are present for safety purposes, to block off the flow of oil or gas from the well as and when required. Others are present to permit selection of one or more different passages through which oil or gas can leave the well, or through which various additives can be passed down the well. Commonly, from two to six or more such valves are present at the well-head. The group of valves at the well-head is known colloquially as the "well tree" or "Christmas tree".

During the course of production in the well, it is sometimes necessary to stimulate the well by means of a fracturing technique to yield increased productivity. Fracturing involves the injection into the well of a pressurized fluid, such as water ,brine, foam or the like, which fluid breaks or fractures the oil or gas producing strata down the well.

During the fracturing process, pressures must be elevated in order to cause the rock formations down the well to fracture. Pressures in excess of 7,500 psi are not uncommon during fracturing processes. Pressures of the magnitude found in fracturing processes can usually be tolerated by the well tubing or casing, which extends downwardly from ground level into the well. However, in many cases, the valves which are placed at the well head to form the well tree are not capable of tolerating such pressures and there is a severe risk of rupture if they are subjected to such pressures. Of course, valves which can tolerate such pressures are available, but they are relatively costly, and are not widely used on wells. High pressures are not normally encountered during operations of wells except during fracturing processes, so the provision of valves which would tolerate high pressure is generally considered as an unnecessary expense, particularly since it is usually not known when the valves are installed whether or not the well will eventually be subjected to a fracturing process.

It has been suggested that the danger of a rupture of the well tree valves could be reduced during fracturing processes, and other processes involving high pressure, by inserting a high-pressure tube through the bores of the open valves of the well tree, with the high-pressure tube engaging, at its bottom end, the well tubing in a pressure-tight relationship. At its upper end, the tube would extend beyond the uppermost valve of the well tree, and would be topped by a high-pressure valve. Thus, the high pressure pumping equipment used in fracturing could be connected to the high-pressure valve on the tube, and the high-pressure fluid would then pass through the tube directly into the tubing of the well. This would prevent the contact of the high-pressure fluid with the low-pressure valves of the well-head, thus reducing the chances of rupture.

Although the use of a high-pressure tube in this way has been generally successful, and has resulted in lessened danger in the field, it is still not completely satisfactory. For one thing, the tube and associated high-pressure valve must be guided straight down into the well tree through some sort of cradle. Additionally, hydraulic means are usually necessary to force the high-pressure tube down through the open valves of the well tree. The hydraulic means and the cradle together form a very heavy, cumbersome piece of equipment, and frequently take up so much space that the high-pressure valve at the end of the tubing must be very far away from the ground, where it cannot be reached easily in case of an emergency.

OBJECT OF THE INVENTION

It is an object of the invention to provide an apparatus for inserting a high-pressure tube through a well tree to meet with the well tubing, so that fluid under high pressure can be inserted into the well tubing without damaging the valves of the well tree.

It is a further object of the invention to provide such an apparatus which can be disassembled for carrying from place to place, and which can be assembled relatively easily on site. It is a further object to provide such apparatus having a high-pressure valve which is relatively accessible when the high-pressure tubing has been inserted into the well.

BRIEF DESCRIPTION OF THE INVENTION

The invention comprises an apparatus for inserting high-pressure fluid through a well tree having a vertical passage therethrough including at least one valve and into a well having well tubing aligned with said vertical passage, which apparatus comprises:

a piston rod removably mounted in a position secured to the well tree and offset from the vertical passage, and having a piston fixed to the end of the piston rod,

a cylinder moveable on the piston,

a piece of high-pressure tubing mounted for movement with the cylinder and aligned axially with said vertical passage when said piston rod is mounted in said position,

a high-pressure valve to selectively stop fluid flow through said high-pressure tubing, and,

sealing means to prevent passage of fluid between the exterior of the high-pressure tubing and the interior of the vertical passage, when said high pressure tubing is inserted through said vertical passage into said well tubing.

DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. **1** shows a partially cutaway view of a conventional prior art well-head and well tree.

FIG. **2** shows a partially cutaway side view of the apparatus according to one embodiment of the invention, when such embodiment has been mounted on the well tree of FIG. **1**, but when the high-pressure tube has not as yet been inserted into the well tree.

FIG. **3** shows a partially cut-away side view of the same embodiment as shown in FIG. **2**, in which the high-pressure tibe has been placed in its final position and the well-head is ready for the carrying out of a fracture process.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, the well-head of a producing oil or gas well is indicated generally at **1**. The ground surface is shown schematically at **2**. The well itself (only a small portion of which is shown) comprises a hole **3** aligned with an outer, or surface, casing **10** and a pro-

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