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SIGNALING DEVICE FOR OIL WELLS

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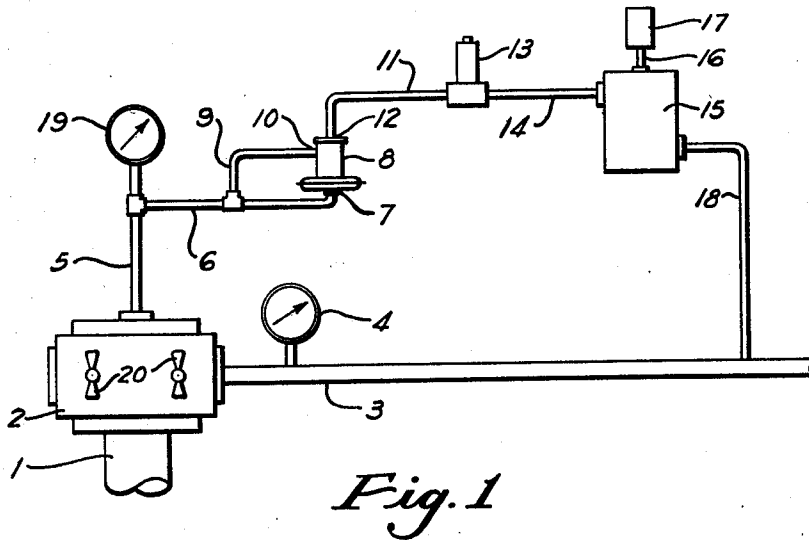


Fig. 1

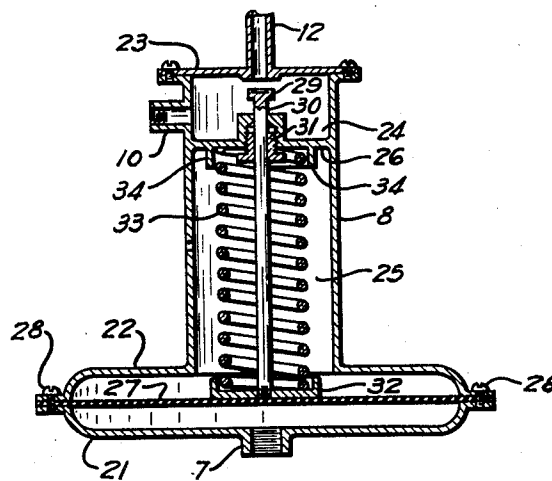


Fig. 2

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SIGNALING DEVICE FOR OIL WELLS

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4 Claims. (Cl. 116—70)

This invention relates to a signaling device for oil wells, and more particularly to a device which automatically comes into operation when the pressure at a well head falls below a preselected degree and by means of which the well fluids are utilized to actuate an alarm and so call attention to the changing condition.

In the production of petroleum oil from wells, the pressure under which the oil flows into the well from the surrounding formation varies over a wide range. The oil may barely trickle into the well or it may enter under a pressure measured in thousands of pounds per square inch. The oil so produced may or may not be accompanied by salt water and gas or either of these two. This invention relates to the production of oil from wells in which the well fluids are under a sufficient pressure at the bottom of the well to carry the entire production to the well head and beyond so long as the various well fluids, oil, water, and gas, are in their initial proportions, but in which the pressure at the bottom of the well is less than the hydrostatic head of a well full of water.

In producing oil under present day limitations on the quantity produced, it is ordinarily necessary to restrict the output of each well by means of mechanical devices known as chokes. This restriction upon the output sometimes reduces the velocity of the stream rising in the well tubing to a point at which the salt water accompanying the oil partially separates out in the tubing and, if not attended to, gradually builds up a column of salt water in the tubing which has a hydrostatic head equal to the formation pressure of the well fluids at the bottom of the hole. Sometimes the formation pressure is so slightly in excess of the hydrostatic head of the column of well fluids that a relatively minor degree of separation and consequent increase in the proportion of water in the tubing will overcome the formation pressure. When the hydrostatic head of the column of fluid in the tubing equals the formation pressure at the bottom of the well it of course shuts off all flow from the well and the well is said to die.

When a well is dying, the falling off of pressure at the well head continues over a period of hours and the condition can be corrected at this stage by temporarily increasing the rate at which the well is permitted to flow. This increased flow rate is maintained until the accumulated water in the well has been carried out and replaced by a column of the various well fluids in their normal proportion, whereupon the well is shut in again to its allowed producing rate.

Should the well die completely before it receives attention, it is then necessary to reestablish production by

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the use of gas under pressure or by swabbing, both of which are expensive operations. For this reason it becomes desirable to fit wells that are flowing under moderate pressure with some sort of a device to bring any such falling pressure to the attention of an attendant. Except for the need of prompt attention when a well is losing head and in danger of dying, it is possible to assign one pumper to a very large number of wells, spread over a large area, in which case the pumper may not have opportunity to attend each individual well more often than once a day. To permit this efficient use of scarce labor it is necessary to have some automatic device such as the signal device of my invention. This device will summon the pumper in emergencies to the place where his services are most immediately required.

The signal device of my invention is shown in the accompanying drawings, which consist of Figures 1 and 2.

Referring to Figure 1, numeral 1 indicates the tubing at the top of a well, and numeral 2 indicates a valve-controlled manifold positioned at the top of the tubing, fitted with valves and choke for controlling the discharge of well fluids therefrom. Control handles 20 are indicated on the manifold. The produced oil leaves manifold 2 through flow line 3 fitted with pressure indicating gauge 4. A conduit 5, fitted with pressure indicating gauge 19, leads from manifold 2 to conduit 6, which latter leads to the base 7 of a diaphragm-controlled valve indicated overall by numeral 8. The details of diaphragm-controlled valve 8 are shown in Figure 2. Conduit 9 leads from conduit 6 to connection 10 in the upper part of diaphragm-controlled valve 8, and conduit 11 leads from connection 12 of diaphragm-controlled valve 8 to a pressure reducing valve 13. Pressure-reducing valve 13 is a conventional pressure reducing valve which receives gas at a high pressure and discharges it therefrom through conduit 14 at a uniformly controlled lower pressure. Conduit 14 in turn leads to a conventional fluid motor 15. A typical fluid motor suitable for use in this invention is described in Patent No. 565,123 issued August 4, 1896 to G. J. Scott. Shaft 16 of fluid motor 15 extends outwardly through the casing of motor 15 and carries a siren 17 or other signaling device. Conduit 18 extends from the discharge side of fluid motor 15 into flow line 3.

Referring to Figure 2, this is a sectional view of diaphragm-controlled valve 8, previously mentioned in connection with Figure 1. Valve 8 comprises a lower body casing 21, an upper body casing 22, and cap 23. Upper body casing 22 is separated into an upper chamber 24 and a lower chamber 25 by means of partition 26. A flexible diaphragm 27 is held between lower body casing 21 and upper body casing 22, and these elements are fastened together by screws, bolts, or equivalent means 28. A valve stem 30, carrying valve closure element 29 on its upper extremity passes through partition 26 and the passageway is closed against leakage of fluid by packing held in place by gland 31. The lower end of valve stem 30 is fastened to a cup 32 positioned on the upper surface of flexible diaphragm 27. Surrounding valve stem 30 and extending upward from cup 32 to the underside of partition 26 is a coiled spring 33. An upstanding flange on cup 32 holds the spring in place at its lower extremity, and annular flange 34 maintains it in position at its upper extremity. Spring 33 is maintained under

such a degree of compression as will permit flexible diaphragm 27 to force closure element 29 tight against its seat, thereby closing the valve when the pressure on the underside of diaphragm 27 is in excess of some preselected degree, e.g. 250 pounds per square inch above atmospheric, and which will open the valve when the pressure on the underside of diaphragm 27 falls substantially below the preselected pressure.

Pressure reducing valves designed to receive a fluid under a high pressure and to discharge it under a uniform lower pressure are very common and simple mechanical devices and require no detailed description here. The same is true of fluid motors and sirens such as shown at 15 and 17.

The operation of my device is as follows:

Well fluids issuing from the well through tubing 1 are discharged therefrom through control means 2 such as the well-known Gray composite manifold shown in Figure 1. Before discharging from manifold 2 into flow line 3 the well fluids are passed through a choke, built integral with the manifold, to restrict the production of oil from the well. The effect of the choke in manifold 2 is not alone to restrict the flow of well fluids, but there is consequent upon this restriction a substantial difference of pressure between the two sides of the choke, and the pressure in flow line 3 as indicated by pressure gauge 4 is much lower than that in tubing 1. For instance it may be about 75 pounds per square inch while the pressure in tubing 1, as indicated by pressure indicator 19, may be 500 pounds or more per square inch. In my apparatus well fluid from tubing 1 also flows successively through manifold 2, conduit 5, conduit 6, conduit 9, the controlled upper portion 24 of valve 8, conduit 11, pressure reducing valve 13, conduit 14, fluid motor 15, and conduit 18 to flow line 3. Flow through this system results from the very substantial difference in pressure between tubing 1 and conduit 5 on the one hand, indicated by pressure gauge 19, and the pressure in flow line 3 on the other hand. The latter pressure is indicated by pressure gauge 4. Pressure of the well fluids in tubing 1, in communication through conduits 5 and 6, operates on the underside of diaphragm 27 of valve 8, and when the pressure of that fluid is in excess of some preselected value, e.g. 250 pounds per square inch, the diaphragm is forced upward and the closure element 29 is forced against its seat in the upper section 24 of valve 8. The high pressure fluid is at the same time in open communication with the upper chamber of diaphragm valve 8 and its flow is controlled by the opening or closing of closure element 29. When the pressure in tubing 1 and conduits 5 and 6 and 9 falls below the aforementioned preselected pressure, closure element 29 is pulled away from its seat by spring 33, thereby opening the valve to pass well fluid to fluid operated motor 15 and so cause the energizing of a signal, for instance the sounding of direct connected siren 17. Pressure reducing valve 13 is placed in the system just ahead of the fluid motor to maintain the pressure of the fluid entering motor 15 at a safe level. By setting pressure reducing valve 13 to discharge fluid into line 14 at the lowest pressure suitable for operation of fluid motor 15 and signal 17 it is possible to maintain the available fluid energy for the longest possible time.

While Figure 1 indicates a siren 17 as being energized by the fluid motor 15, the motor may energize any other type of signal such as a semaphore, the control switch on an electrically powered device, etc.

In a specific embodiment of my invention the apparatus is constructed precisely as shown in Figures 1 and 2, including pressure-reducing valve 13 and a sonic signal 17 which in this instance is a low speed siren. The pressure at the well head, as indicated by gauge 19 was 525 pounds per square inch. The pressure-reducing valve 13 was set to reduce the pressure of the well fluids from 525 pounds to 250 pounds per square inch. The pressure

of the well fluids in flow line 3, as indicated on gauge 4, was 78 pounds per square inch.

My invention is shown and has been described with pressure-reducing valve 13 interposed in the conduit leading from upper part 24 of valve 8, through connection 12, to fluid motor 15. This valve could equally well be positioned in conduit 9. An additional pressure reducing valve such as 13 may be interposed in conduit 6, between the branch of conduit 9 and connection 7 if the pressure indicated by gauge 19 is unduly high for safe and satisfactory operation of diaphragm-controlled valve 8. Under some conditions of pressure, and assuming that the preselected actuating pressure for valve 8 is not too high for safe and satisfactory operation of fluid motor 15, a single pressure reducing valve in conduit 5 or 6 somewhere between manifold 2 and the connection of conduit 9 is effective.

I claim:

1. In combination with an oil well having tubing for delivery of oil under pressure from the well, apparatus for signaling a drop in pressure in fluids in the tubing of the well comprising a fluid motor, a signaling device actuated by the fluid motor, a conduit extending from the tubing of the well to the fluid motor, a pressure responsive valve in the conduit to control flow of fluids through the conduit to the fluid motor, said pressure responsive valve having a pressure chamber and a valve closure element, pressure responsive means actuated by pressure in the pressure chamber, means linking the pressure responsive means and the valve closure element to open the pressure responsive valve when pressure in the pressure chamber is low, and a pressure supply line connected with the tubing and opening into the pressure chamber for transmitting pressure in the tubing to the pressure chamber.

2. In combination with an oil well having a tubing for delivery of well fluids to the well head, a flow line communicating with the tubing to conduct fluids from the well, and a choke between the tubing and flow line, apparatus for signaling a drop in pressure in fluids in the tubing of the well comprising a fluid motor, a signaling device actuated by the fluid motor, a first conduit extending from the tubing of the well to the fluid motor for delivery of well fluids under pressure to the fluid motor, a second conduit extending from the fluid motor to the flow line, a pressure responsive valve in the first conduit to control flow of fluids through the conduit to the fluid motor, said pressure responsive valve having a pressure chamber and a valve closure element, pressure responsive means actuated by pressure in the pressure chamber, means linking the pressure responsive means and the valve closure element to open the pressure responsive valve when pressure in the pressure chamber is low, and a pressure supply line connected with the tubing and opening into the pressure chamber for transmitting pressure in the tubing to the pressure chamber.

3. In combination with an oil well having a tubing for delivery of oil under pressure, apparatus for signaling a drop in pressure in fluids in the tubing of a well comprising a fluid motor, a signaling device actuated by the fluid motor, a conduit extending from the tubing of the well to the fluid motor, a pressure responsive valve in the conduit adapted to control flow of fluids through the conduit to the fluid motor, a pressure reducing valve in the conduit, said pressure responsive valve having a pressure chamber and a valve closure element, pressure responsive means actuated by pressure in the pressure chamber, means linking the pressure responsive means and the valve closure element to open the pressure responsive valve when pressure in the pressure chamber is low, and a pressure supply line connected with the tubing and opening into the pressure chamber for transmitting pressure in the tubing to the pressure chamber.

4. In combination with an oil well having tubing for delivery of oil under pressure from the well, apparatus

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for signaling a drop in pressure in fluids in the tubing of a well comprising a fluid motor, a signaling device actuated by the fluid motor, a conduit extending from the tubing of the well to the fluid motor, a pressure responsive valve in the conduit adapted to control flow of fluids through the conduit to the fluid motor, said pressure responsive valve having a pressure chamber and a valve closure element, pressure responsive means actuated by pressure in the pressure chamber, means linking the pressure responsive means and the valve closure element to

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open the pressure responsive valve when pressure in the pressure chamber is low, and a pressure supply line opening into the pressure chamber and into the conduit between the pressure responsive valve and the tubing for transmitting the tubing pressure to the pressure chamber.

References Cited in the file of this patent**UNITED STATES PATENTS**

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