

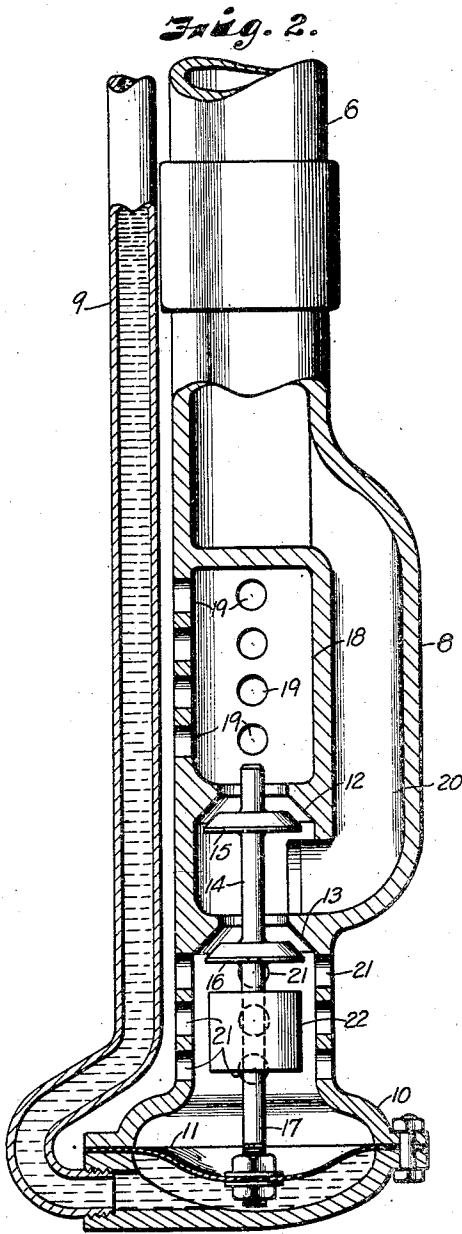
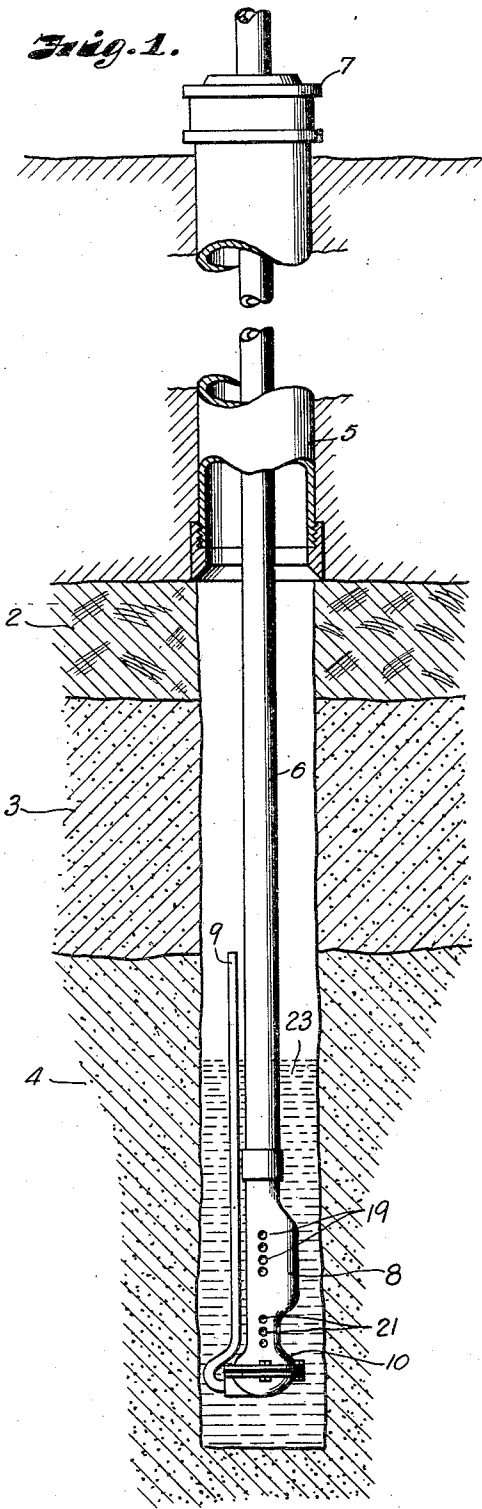
Nov. 1, 1932.

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1,886,009

DEVICE FOR PRESERVING NATURAL GAS PRESSURE IN OIL WELLS

Filed Nov. 23, 1931



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DEVICE FOR PRESERVING NATURAL GAS PRESSURE IN OIL WELLS

Application filed November 23, 1931. Serial No. 576,703.

My invention relates to a device for maintaining a natural gas pressure in an oil well and for permitting the removal of oil from a well without the loss of any natural gas pressure.

Oil is found with gas under an imprisoning layer of cap rock or a salt dome. Under the impervious layer there is usually a stratum of gas producing sand superposed over a stratum of oil producing sand. When the oil producing sand is reached, the natural gas pressure will force the oil out of the oil sands and into the oil well. If the gas pressure is dissipated this process is stopped. It is estimated that frequently as high as 80% of the original oil content is unrecoverable from oil wells because of a reduction in the gas pressure. This fact has long been recognized and operators have attempted to retain the natural gas pressure existing in an oil well by means of chokes, properly sized flow tubing and flow devices. These devices, however, have failed to vary the proportion of the gas to the oil produced except within narrow limits.

One object of my invention is to provide a device which will preclude the escape of any natural gas from the well and yet permit the removal of the oil.

Another object of my invention is to provide a device which will stop the flow of oil temporarily when the oil pressure in the well drops below a predetermined level in order to prevent the escape of gas.

A further object of my invention is to provide a device which will automatically allow the oil flow to resume when a further supply of oil is forced into the well by the natural gas pressure.

In the accompanying drawing, which forms part of the specifications:

Fig. 1 is a section of an oil well equipped with one embodiment of the device of my invention.

Fig. 2 is a sectional view of a device embodying my invention.

In general, my invention contemplates the provision of a flow pipe within the well through which all products leaving the well must flow. The lower end of this flow pipe extends to a point near the bottom of the well and is provided with a valve adapted to control the passage of products into the flow pipe. The valve is of the balance type and provided with a weight to prevent chattering. The valve stem is connected to a flexible diaphragm, the movement of which opens and closes the valve. The diaphragm extends across a chamber and divides it into two parts. The hydrostatic pressure of the oil in the well is permitted to act on the upper surface of the diaphragm to tend to hold the valve in open position. A standpipe is connected to the lower portion of the chamber and filled with oil, water, mercury or any suitable liquid, so that the hydrostatic head developed by the liquid in the standpipe will act upon the under side of the diaphragm opposing the hydrostatic pressure exercised by the oil in the well and tend to close the valve. When the hydrostatic pressure of the oil drops below that exercised by the liquid in the standpipe, the valve will close and allow the oil level to build up within the well.

More particularly, referring now to the accompanying drawing, the oil well 1 extends through an impervious layer 2 under which are gas producing sand 3 and oil producing sand 4. The oil well is provided with the usual well casing 5 which extends from the surface. Disposed within the oil well 1 is a flow tube 6, through which the oil flows out of the well. The annular space between the casing 5 and the flow tube 6 is sealed in any suitable manner as by a stuffing box 7, to prevent escape of gas at the upper end of the well between the casing and the flow tube.

The end of the flow tube 6 is provided with a differential hydrostatically operated valve

assembly 8. Connected to the valve assembly 8 and forming part thereof, is a standpipe 9 which extends approximately to the upper level of the oil producing sand. The valve assembly 8 comprises a casing 9 terminating in an enlarged chamber 10 across which is stretched a flexible diaphragm 11. A pair of valve seats 12 and 13 are provided for a balanced valve 14, provided with a pair of valve discs 15 and 16 adapted to seat upon the valve seats 12 and 13.

The valve stem 17 is connected to the diaphragm 11. Oil in the well enters chamber 18 through inlet openings 19 whence it may flow past the valve seat 12 into conduit 20 and up through flow tube 6. Oil in the well also enters the upper portion of chamber 10 through openings 21 where it may flow past the valve seat 13 and into conduit 20 and out through flow tube 6. It is to be noted that hydrostatic pressure in the well acts upon valve discs 15 and 16 to balance the pressure upon the valve. The hydrostatic pressure of the well also acts upon the upper surface of the flexible diaphragm 11 through the inlet openings 21. This pressure as can be readily appreciated from the drawing will tend to hold the valve in its open position, permitting the oil to flow out of the well.

The hydrostatic head of the pressure within the standpipe 9 acts upon the lower portion of the diaphragm 11 to oppose the hydrostatic pressure of the oil in the well. If this liquid is oil, the upper portion of the standpipe should be approximately level with the upper surface of the oil producing sand stratum. If the liquid used be water, the standpipe 9 will be somewhat shorter, and if a heavier liquid, as for example mercury, be used the standpipe, of course, will be quite shorter, due to the heavier specific gravity of mercury. In order to give a compact device, mercury may be employed.

If there were no friction and the liquid within the standpipe 9 had the same specific gravity as that of the oil, the instant the oil level dropped below the top of the standpipe 9 the valve would close. When it again reached the height of the standpipe the valve would open. This ready response would cause chattering of the valve. In order to provide a time lag and prevent chattering, a weight 22 is secured to the valve stem 17. In addition to preventing chattering, the weight 22 also controls the pressure differential which must be reached before the valve will close. It will readily be appreciated that the pressure differential may be controlled according to the requirements desired by changing the weight 22, by changing the height of the standpipe 9, or by changing the specific gravity of the liquid within the standpipe. In any event, however, the design should be such that the valve will close before the oil level drops so as to uncover the uppermost

of inlets 19, so that no gas can escape from the well.

In operation, when the oil level of the oil 23 in the well drops so that its hydrostatic pressure is lessened the hydrostatic head existing in the standpipe 9 will operate to close the valve 14, and prevent any further decrease of the oil level as the natural gas pressure forces more oil into the oil well 1. As the oil level rises the increased oil will exert a higher hydrostatic pressure which will operate upon the upper surface of diaphragm 11 to open the valve and permit the flow of oil out of the well to be resumed.

It will be readily appreciated that I have accomplished the objects of my invention, and that I have provided a device which will permit the removal of oil from an oil well without the loss of any natural gas present in the well. My device will stop the flow of oil from the well when the oil present in the well drops below a predetermined level in order to prevent the escape of gas. My device will automatically permit the oil flow to resume when the natural gas pressure has forced more oil into the well.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of the invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention what I claim is:

1. A device for preventing the escape of natural gas pressure from an oil well, comprising a flow pipe having an opening disposed within the well, a balanced valve adapted to control the flow of oil out through said opening, a valve stem for said valve connected to a hydrostatic piston, openings for placing one side of said piston in communication with the oil in said well, a standpipe containing liquid adapted to produce a hydrostatic head, said head being in communication with the other side of said piston, whereby said valve will be moved to closed position when the hydrostatic head in said standpipe exceeds the hydrostatic pressure of the oil present in the well.

2. A device as in claim 1 wherein the valve stem is provided with a weight to determine the pressure differential necessary to close the valve and to prevent said valve from chattering.

3. A device for preventing the escape of natural gas pressure from an oil well, comprising a flow pipe having an opening disposed within the well, a balanced valve adapted

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5 along one side of the flow pipe and contain-
ing liquid adapted to produce a hydrostatic
head, said head being in communication with
the other side of said piston, whereby said
valve will be moved to closed position when
10 the hydrostatic head in said standpipe ex-
ceeds the hydrostatic pressure of the oil pres-
ent in the well.

In testimony whereof I affix my signature.

EDWARD H. GRISWOLD.