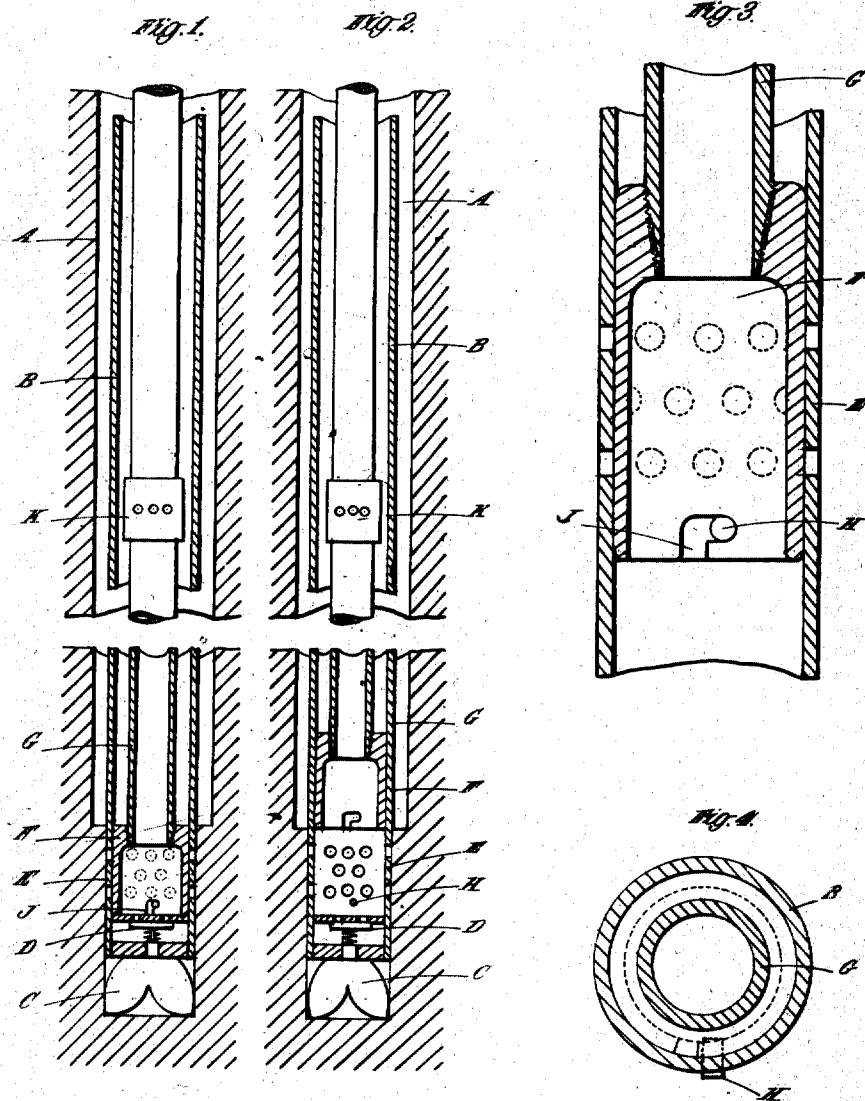


R. STIRLING.
 METHOD AND APPARATUS FOR CONTROLLING AND PUMPING OIL WELLS.
 APPLICATION FILED MAR. 5, 1918.

1,279,783.

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INVENTOR:
Robert Stirling
 By Attys
 Fraser, Dunk & Myers

UNITED STATES PATENT OFFICE.

ROBERT STIRLING, OF DORMANS PARK, ENGLAND.

METHOD AND APPARATUS FOR CONTROLLING AND PUMPING OIL-WELLS.

1,279,783.

Specification of Letters Patent. Patented Sept. 24, 1918.

Application filed March 5, 1918. Serial No. 220,446.

To all whom it may concern:

Be it known that I, ROBERT STIRLING, of The Anchorage, Dormans Park, in the county of Surrey, England, have invented certain new and useful Improvements in or Relating to Methods and Apparatus for Controlling and Pumping Oil-Wells, of which the following is a specification.

This invention relates to a method and apparatus for controlling and raising the production from oil wells and particularly wells in which the oil is found in loose sand formations with much gas under pressure, which forces the sand into the well and up the casing, forming a plug of sand therein, which stops the flow of oil. The method at present employed consists in encouraging the flow of oil and gas in the casing and cleaning out the plug of sand as often as it may be formed in the casing, with the object of getting rid of the loose sand and obtaining a flow of more or less pure oil. This method entails serious risk of damage to the casing, either when cleaning out the sand plug, or by the violence of the eruptions of oil, gas and sand, and encourages disturbances of the strata, which may have equally serious results. Attempts have been made to control the flow by restricting the discharge orifice at the surface, but the gas acts in the casing as in a badly proportioned air lift pump, the gas passing through the liquid which is lifted and falls back as the casing not being proportioned to the quantity of liquid the flow is necessarily irregular, and the sand is brought in at times in quantity sufficient to form a plug in the casing and stop the flow. The quantity of gas present with the oil may cease to be sufficient to maintain a flow, and production will cease.

The method of my invention overcomes all these difficulties. By controlling the ingress of liquid to the drilling tube the quantity of sand carried in by the liquid is reduced and the disturbance of the strata at the bottom of the well is reduced to the minimum, while the maintenance of the flow in the discharge pipe by the addition of compressed air to supplement the gas present with the oil maintains a steady flow and prevents the sand settling in and choking the discharge pipe.

In carrying out this invention I lower inside the well casing a drilling tube closed at

the bottom by a valve or closing piece as hereinafter described, which prevents the oil, gas and sand from entering the said drilling tube until a suitably proportioned discharge pipe has been inserted, which when the valve is suitably opened admits of a steady flow of liquid which will bring in little sand and does not cause disturbance of the strata. At the same time when the gas is deficient in quantity to maintain a steady flow of liquid, compressed air is applied to supplement the gas. If the quantity of liquid yielded be insufficient to maintain a steady flow in the discharge pipe, the perforations can be closed and another discharge pipe inserted of a size proportioned to the yield of liquid.

Referring to the drawings filed herewith:

Figures 1 and 2 are part diagrammatic sections of an apparatus made in accordance with this invention.

Figs. 3 and 4 are a part sectional elevation and cross section of the closing piece to a larger scale.

Figs. 1 and 2 show the apparatus, in so far as concerns this invention, placed in a well. A is the ordinary protecting casing of the well, B is the drilling tube penetrating into the oil sand. It is fitted with a drilling bit C as used in the jetting or rotary system of drilling, to penetrate the sand, and has a back pressure valve D. The part of the casing above this E is perforated with holes of suitable size, which in Fig. 1 are shown closed by the cylindrical closing piece or valve F, and in Fig. 2 are shown free, the piece or valve F being shown raised. This movement is effected by means of the discharge pipe G screwed into the piece F. In the act of screwing in, the slot J is turned so that the pin H passes through the vertical part of the slot, and the piece F is free to be raised to uncover the perforations. When lowered to close the perforations the action of unscrewing the pipe G causes the pin H to enter the horizontal part of the slot, and so it holds the piece F from being raised. Two such pins and slots will generally be used, one on either side.

The construction of the piece or valve F covering the perforations and attached to the discharge pipe G, the same lettering being used, is shown in Figs. 3 and 4. Although I consider this the most suitable form for the purpose, any other suitable

form of covering piece or valve may be used, and opened or closed by other means than by the discharge pipe.

5 The covering piece or valve may be rotated in place of being raised to uncover and cover wholly or partly the perforations, and connection may be made with the discharge pipe by other means than by the screwed joint, as for instance by a bayonet connection.

10 The apparatus is placed in the well and operated in the following manner:—

The drilling tube B fitted with the drill bit C and the back pressure valve D and with the perforations covered by the piece F, is lowered to the sand plug or to the ground to be drilled and connected to the rotary drilling plant, and further progress is made in the usual way by rotating the drilling tube and forcing a stream of water or other liquid through it to clear the sand loosened by the drilling bit. When the desired depth is reached, the pipe G with the air nozzle K of any suitable form, at the proper point in the length is lowered and screwed into or otherwise connected to the covering piece F. The air and discharge connections for the air lift having been made, the pipe is raised sufficiently to lift the covering piece F above all or a proportion of the perforations sufficient to admit the required quantity of liquid. Compressed air is then applied in sufficient quantity to maintain a steady flow of liquid with the aid of such gas as may be present with the oil. The air is supplied to the annular space between the drilling tube B and the discharge pipe G and enters the nozzle K through perforations and so mixes with the liquid in the discharge pipe G.

If it be only necessary to penetrate soft sand, the operation may be carried through without the use of the rotary drilling plant, by the use of the air lift alone. In this case the drilling tube B fitted with drilling bit C and with or without the valve D is lowered to rest on the sand; the discharge pipe G with an air nozzle K is inserted and screwed into or otherwise attached to the piece or valve F. The air and discharge connections being made with suitable flexible hose, the covering piece is raised, air is applied and a discharge of liquid maintained, the drilling tube B being allowed to sink as the sand is removed by the discharging liquid. When

necessary the drilling tube B with drilling bit C attached is moved up and down or rotated by hand to loosen the sand and mix it with the liquid to be discharged. Other lengths of pipe are added and the operation repeated until the desired depth is attained, after which the constant discharge is maintained.

I am aware that it has been proposed to use a covering sleeve outside the drilling tube to protect the suction piece during the process of drilling, also that it has been proposed to cover the perforations in the drilling tube by an inner tube to exclude sand and water during the process of drilling, which covering is afterward wholly removed from the drilling tube.

What I claim as my invention and desire to secure by Letters Patent is:—

1. The method of controlling and raising liquid in wells characterized in that a drilling tube provided with inlets near its lower end is inserted in the well, said inlets being closed until a suitable discharge pipe has been inserted within the drilling tube when the inlets in the drilling tube are opened and liquid thereby admitted to the discharge pipe.

2. In oil wells a drilling tube provided with inlets near its lower end, means for opening and closing said inlets, and a discharge pipe disposed within the drilling tube.

3. In oil wells, a drilling tube provided with inlets near its lower end, a sleeve slidable inside said tube, to cover and uncover said inlets, and a discharge pipe within said drilling tube.

4. In oil wells, a drilling tube provided with inlets near its lower end, a sleeve inside said tube, a discharge pipe attached to said sleeve, for raising and lowering said sleeve so that the sleeve covers and uncovers said inlets, and means for locking the sleeve in its lowered position.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

ROBERT STIRLING.

Witnesses:

REGINALD EATON ELLIS,
ROBERT MILTON SPEARPOINT.