

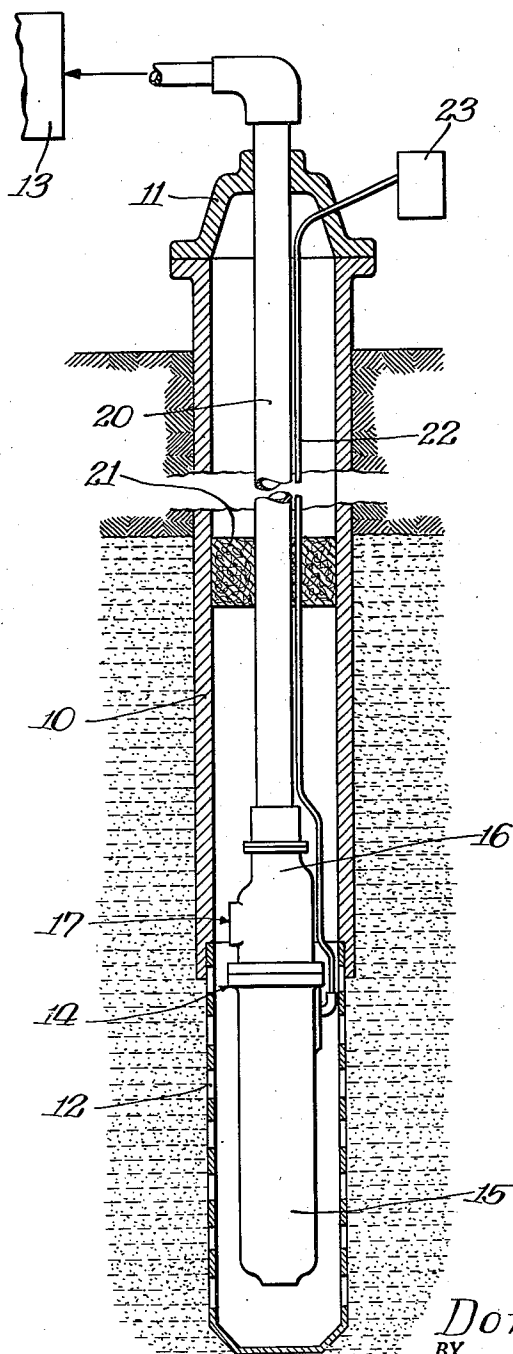
Dec. 25, 1951

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**2,580,332**

## PUMPING APPARATUS

Original Filed Nov. 22, 1946



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## UNITED STATES PATENT OFFICE

2,580,332

## PUMPING APPARATUS

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Original application November 22, 1946, Serial No. 711,582. Divided and this application February 16, 1951, Serial No. 211,366

3 Claims. (Cl. 103-3)

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The invention relates generally to pumping apparatus for use in wells and more particularly to such apparatus used in connection with oil wells.

This application is a division of my copending application Serial No. 711,582 filed November 22, 1946.

In small oil wells where the oil has to be removed by pumping, a type of pumping apparatus frequently employed comprises a casing extending to the bottom of the well and having an intake at its lower end which may comprise a slotted or perforated pipe or a screen to prevent solid material from being drawn into the apparatus or which may be open in case the adjacent earth formation is sufficiently tight. Located in the lower end of the casing is a reciprocating pump operated by a sucker rod extending upwardly through the casing and mechanically actuated above ground. Such mode of operation is obviously inefficient.

With wells of this character, the sand or other earth formations at the bottom of the well may become clogged, through age, to such an extent that the yield is too low to warrant further continued operation. The well must therefore either be abandoned or cleaned. Cleaning may be effected by forcing water, acids, or other fluid into the sand formation to remove the obstructing material in the vicinity of the lower end of the casing thus permitting the oil to flow freely.

Heretofore, in so cleaning a well, the pump with its sucker rod is removed since no provision is made for carrying fluid reversely through the reciprocating pump, and a temporary pipe is inserted in the casing to carry the cleaning fluid under pressure to the lower end thereof. After the cleaning has been completed, the temporary pipe is removed and the pump with its sucker rod is reinserted. Obviously such a mode of cleaning involves considerable expense, and in many cases it is questionable whether, when the production of the well at best is small, the expense is warranted.

The general object of the invention is therefore to provide novel pumping apparatus for a well, with which the well may be readily maintained in a clean, free-flowing condition at relatively small expense.

Another object is to provide novel pumping apparatus for a well, through which fluid may be reversely conducted to effect cleaning of the intake of the apparatus as well as the sand formations in the vicinity of the intake.

A further object is to provide novel pumping

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apparatus for a well, which includes a timer for automatically reversing the flow in the apparatus at predetermined intervals to remove obstructions to flow to and through the intake of the apparatus.

Still another object is to provide novel pumping apparatus for an oil well, which may be reversely operated to produce a flow from or to the well, the apparatus normally being operated to pump oil from the well but being operable at predetermined intervals to pump oil to the well under pressure to effect cleaning of the intake and the sand formations in the vicinity thereof.

A still further object is to provide a novel method of maintaining an oil well in a clean free-flowing condition.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings, in which the single figure is a vertical sectional view, partially diagrammatic, of a pumping apparatus embodying the features of the invention.

In the usual form of apparatus utilized for pumping oil, an elongated tubular casing is provided, extending from the ground level to the bottom of the well, such a casing being shown at 10 in the drawing. The upper end of the casing may be closed by a casing head or cover 11 while the lower end constitutes an intake 12 embedded in the sand or other earth formation from which the oil is obtained and which may be open if the adjacent earth formation is sufficiently tight, or which may comprise a slotted or perforated pipe or screen. In the drawings, the intake 12 is shown in the form of a screen. The oil is drawn inwardly through the intake 12 and forced upwardly to the ground level by a pumping unit located in the casing 10, where it may be collected as in a tank 13.

In the mode of operation heretofore commonly employed, such pumping continues indefinitely, and as a result obstructions to flow will occur in the formation adjacent the intake and, if the intake is in the form of a pipe or screen, material will collect on the exterior thereof to such an extent that the production of the well will be lowered below the point where its operation is warranted. At such time, if the well is thought to be capable of continued production, the well is cleaned as described above and operation is thereafter continued. The cost of such cleaning is relatively large, however, and if the maximum production of the well is small, such cleaning is not undertaken and the well is abandoned.

The present invention provides apparatus

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which maintains the intake and the surrounding formation in a clean free-flowing condition. This result is attained by periodic interruption of the normal flow which causes the collection of obstructions, and effecting a reverse flow, preferably of the oil itself, through the apparatus so that obstructions to flow inwardly through the formation are cleared away and normal flow can thereafter be resumed. While other liquids than oil could, of course, be employed for the reverse flow, oil from the well itself is preferred since no problem of separation is hereby involved. The periodic reversal occurs at sufficiently short intervals to prevent a large accumulation or solidifying of obstructing material and the reverse flow may therefore be maintained for a relatively short period of time, leaving the major portion of time available for productive pumping.

In the form of apparatus shown in the drawing, I provide a pumping unit indicated generally at 14 and comprising a motor 15 and a pump 16. Both of these are of a reversible type. Thus, the motor may be of a well known type adapted to be reversely operated by reversal of the connections therefor, and the pump may be of the gear type which is operable in opposite directions to produce opposite directions of flow. The motor and pump in the present instance are constructed with proper dimension to permit their insertion into the casing 10, the unit being located adjacent the lower end thereof with space between the unit and the casing and intake to provide an intake reservoir. The pump is provided with an opening indicated at 17, which normally serves as an intake through which oil is drawn from the reservoir. The oil delivered by the pump during normal flow is carried upwardly through a delivery pipe 20 which may extend through the casing head or cover 11 and to the tank 13. A packer 21 may be placed in the lower part of the casing 10 a short distance above the pump unit, segregating the intake reservoir from the upper portion of the casing so that a decreased pressure may be induced in the reservoir by the pump to draw oil from the surrounding earth formation inwardly through the intake 12. The wiring connections for the motor 15, indicated at 22, may extend upwardly to the ground level in the space between the delivery pipe 20 and the wall of the casing for connection with a source of current (not shown).

Obviously, continued operation of the pumping unit in a direction to draw oil inwardly through the intake 12 will result in clogging of the earth formation in the vicinity thereof and of the openings in the screen, if that form of intake is employed, by material from the surrounding area. However, reversal of flow, particularly if the reverse flow is under pressure, will clear away such obstructions and reestablish conditions suitable for free inward flow. Thus, by operating the motor 15 and pump 16 in the reverse direction from that required to produce the normal flow, oil from the tank 13 may be drawn downwardly through the pipe 20 and forced under pressure into the reservoir space below the packer 21. Such packer being adjacent the lower end of the casing permits a rapid building up of pressure in the reservoir, depending upon the extent of clogging, and the oil will be forced outwardly through the intake to remove the obstructions therefrom. The reversal of the motor and pump may be easily effected by suitable switching means in the wiring connections 22 at the ground level.

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The maintenance of a free-flowing condition for the well is better attained if the reversal of flow is effected periodically and at relatively short intervals of time. While the apparatus may of course be controlled manually to attain this result, it is preferably controlled by an automatic timing device indicated diagrammatically at 23. The timing device 23 includes switch means for effecting a current reversal at predetermined intervals, the reversal being maintained for the desired period of time. The time of reverse operation may be considerably less than the time during which normal operation occurs so that the major portion of time is spent in productive operation, the flow during such period being maintained at a high rate because of the riddance of any substantial clogging.

I claim:

1. Pumping apparatus for an oil well comprising a casing adapted to extend from the ground level downwardly to the producing strata of the well and having an intake at its lower end in said producing strata, a pump unit comprising a reversible motor and reversible pump mounted in said casing adjacent the lower end thereof and normally adapted to draw oil inwardly through said intake and deliver it to the ground level through said casing, means for effecting reverse operation of said motor and pump for effecting reverse flow therethrough to draw fluid from the ground level and force it outwardly through said intake to remove obstructions therefrom, and pressure sustaining means comprising a packer mounted in said casing and capable of resisting upward pressure for confining the reverse flow from the pump unit to the lower end of said casing, said packer being located closely adjacent the top of the pump and above said intake whereby the volume of the space below said packer and between said casing and pump is held to a minimum to permit a rapid build-up of the pressure within said intake on the reverse flow with a minimum volume of fluid.

2. Pumping apparatus for an oil well comprising a casing adapted to extend from the ground level to the bottom of the well and having an intake at its lower end, a pump unit comprising a reversible motor and reversible pump mounted in said casing adjacent the lower end thereof and having an inlet adjacent said intake, a delivery pipe extending upwardly within said casing from said pump unit, said pump unit being normally adapted to draw oil inwardly through said intake and deliver it upwardly through said delivery pipe, means for effecting reverse operation of said motor and pump for effecting reverse flow therethrough to draw fluid downwardly through said delivery pipe and force it outwardly through said intake to remove obstructions therefrom, and means for confining the fluid pumped during said reverse flow to the lower portion of said casing comprising a packer mounted in said casing and located above but adjacent the inlet of said pump and said intake whereby the volume of the space below said packer and between said casing and said pump is held to a minimum to enable the pump to rapidly build up pressure within said space on the reverse flow, said packer being in operative sealing engagement with the casing to withstand upward pressure whereby the pump may increase the pressure of the fluid within said space above that due to the depth of the well to force the fluid outwardly from the intake under high pressure to remove obstructions therefrom.

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3. Pumping apparatus for an oil well comprising a casing adapted to extend from the ground level to the bottom of the well and having an intake at its lower end, a pump unit comprising a motor and a pump mounted in said casing in the lower end thereof and having means providing communication between the pump and space within the casing between the pump and the intake, a delivery pipe extending upwardly from the pump unit within the casing, said pump unit being normally adapted to draw oil from said intake through said means and deliver it upwardly through said delivery pipe, control means for the pump unit operable to cause the pump unit to draw fluid downwardly through said delivery pipe and to discharge such fluid through said first-mentioned means to the space between the pump unit and the casing, and a packer mounted in said casing above but adjacent said first-mentioned means and said intake to confine the fluid pumped into said space to the lower portion of said casing adjacent the intake, said packer

operatively engaging the casing and constituting a seal against upward pressure, whereby a high pressure may be rapidly built up within said space with a minimum volume of fluid, with the pressure tending to force the fluid outwardly from the intake to remove obstructions therefrom.

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