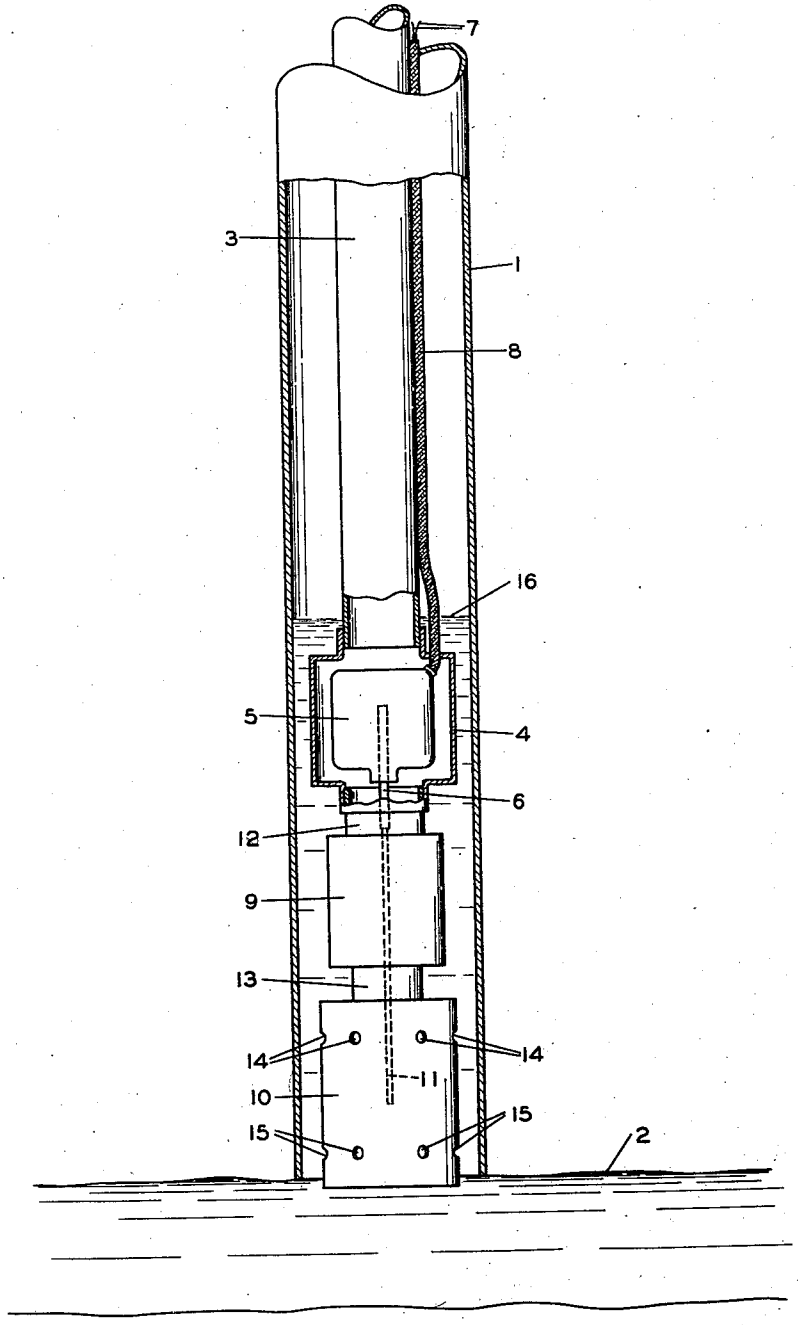
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APPARATUS FOR PUMPING FLUIDS

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APPARATUS FOR PUMPING FLUIDS

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3 Claims. (Cl. 103—204)

This invention relates to the pumping of fluids from underground reservoirs, and more particularly to apparatus for pumping fluids employing positive displacement means.

In the production of fluid from underground reservoirs, such as a hydrocarbon oil reservoir, the piston displacement type or centrifugal type of pumps are generally employed. Both types have their own inherent mechanical drawbacks which increase the cost of pumping fluids. It has long been recognized by the petroleum industry that a positive displacement pump of the rotary type could be utilized advantageously for the production of fluid from underground reservoirs and that this type pump would involve fewer mechanical problems of operation were it not for the fact that practically all fluids contain solid particles in suspension which are abrasive in character, and which soon tend to render the pump inefficient and oftentimes inoperative due to excessive wear on the impellers and the pump casing.

My invention proposes to utilize the positive displacement rotary pump for pumping fluids from underground reservoirs by connecting a centrifugal separator or centrifuge in series with the rotary pump, and driving both devices from the same prime mover. The fluid with the entrained abrasive materials is first admitted into the centrifugal separator where the solids are removed, and the fluid is then transmitted to the pump, thereby overcoming the difficulties experienced in the past.

This invention has for its primary object, the provision of apparatus using a positive displacement rotary means for the production of fluid from underground reservoirs.

Another object of this invention is to provide apparatus for removing abrasive solids from underground fluids and for subsequently producing the fluid by means of a positive displacement rotary pump.

These and other objects and advantages will be apparent to persons skilled in the art by reference to the following description and annexed drawing which is an elevation view, partly in cross section, of a preferred embodiment of my invention.

Referring to the drawing, I have denoted therein a well casing 1 that extends downwardly from the surface of the ground (not shown) and communicates with a hydrocarbon oil-bearing reservoir 2. A string of flow tubing 3 within the casing, is removably connected at its lower extremity to a chamber 4 that contains a submersible electric motor 5 having a drive shaft 6. The motor is connected to a pair of electric leads 7 that are disposed in a suitable insulating sheath 8. A positive displacement rotary pump 9 of conventional design is mechanically connected to motor 5 and a centrifuge 10 by means of a common shaft 11 that is coupled to motor drive shaft 6. The pump also communicates with chamber 4 and centrifuge 10 through conduits 12 and 13, respectively, so that fluid admitted into the centrifuge is transmitted upwardly by the pump, into the chamber and thence through tubing string 3 to the surface of the ground. Centrifuge 10 is provided with one or more intake ports 14 for the admission of hydrocarbon fluid with entrained abrasive materials, such as sand, into the interior thereof and one or more discharge ports 15 for the emission of the abrasive materials after they are separated from the fluid within the centrifuge. Motor 5, pump 9 and centrifuge 10 are all preferably suspended below liquid level 16 in the well casing. It is to be understood, however, that the electric motor and the pump may be disposed at any desired practical depth in the casing, it being sufficient for the purposes of this invention if intake ports 14 of the centrifuge are maintained below the liquid level of the reservoir fluid.

For the purpose of outlining the mode of operation of the instant invention, let us assume that the apparatus is assembled and suspended in the well casing, as illustrated in the drawing, and that the electric circuit is completed, thereby energizing electric motor 5 which rotates pump 9 and centrifuge 10 through the cooperation of motor drive shaft 6 and shaft 11. Hydrocarbon oil with the entrained solid materials is admitted through intake ports 14 into centrifuge 10 where the solid abrasive materials are separated from the liquid by centrifugal action. The solid materials are emitted from the centrifuge through discharge ports 15 after separation and the cleansed fluid passes upwardly through conduit 13. Rotary pump 9 receives the fluid from conduit 13 and transmits the same through conduit 12, chamber 4, and thence through flow tubing 3 to the surface of the ground.

From the foregoing it is believed that the apparatus for practicing my instant invention will be readily comprehended by persons skilled in the art. It is to be clearly understood, however, that various changes in the apparatus herewith shown and described may be resorted to without departing from the spirit of the invention as defined by the appended claims.

I claim:

1. In apparatus for recovering oil from a hydrocarbon oil-bearing formation through a well bore communicating therewith, the combination comprising a centrifuge for cleansing the oil below the surface of the ground by removing solid material entrained therein, a rotary pump having an inlet and an outlet with the centrifuge directly connected to the inlet of the pump, the centrifuge delivering the cleansed oil to the inlet of the pump, pump actuating means connected to the pump within the well bore, and flow tubing communicating with the outlet of the pump for transmitting the cleansed oil to the surface of the ground.

2. In apparatus for recovering oil from a hydrocarbon oil-bearing formation through a well bore communicating therewith, the combination comprising flow tubing in the well bore, a rotary pump having an inlet and an outlet suspended from the lower extremity of the flow tubing and having the outlet communicating with the lower extremity of the flow tubing, pump actuating means intermediate the tubing and the pump and a centrifuge connected to the inlet end of the pump and delivering cleansed oil to the pump.

3. In apparatus for recovering oil from a hydrocarbon oil-bearing formation through a well bore communicating therewith, the combination comprising flow tubing in the well bore, a chamber suspended from and communicating with the lower extremity of the tubing, an electric motor including a drive shaft in the chamber, a rotary pump having an inlet and an outlet, said pump outlet communicating with the chamber, a centrifuge for cleansing the oil below the surface of the ground by removing solid material entrained therein, the centrifuge delivering the cleansed oil to the inlet of the pump, and means connected to the motor drive shaft for imparting rotary motion to both the pump and the centrifuge.

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