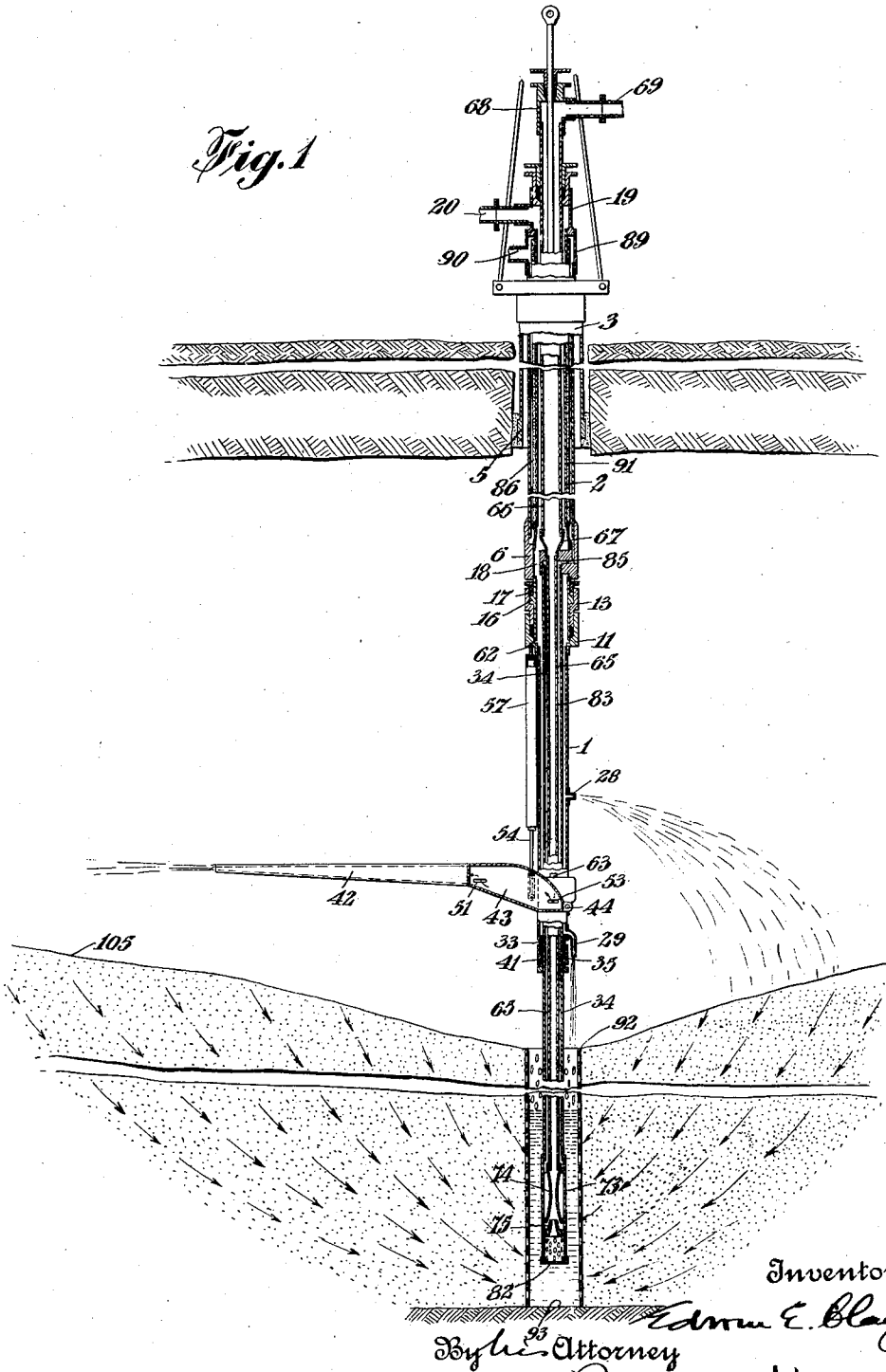
Dec. 28, 1926. 1,612,611

E. E. CLAYTOR

METHOD AND APPARATUS FOR RECOVERING OIL FROM LOOSE OIL BEARING STRATA

Original Filed Dec. 22, 1924 3 Sheets-Sheet 1

Fig. 1



Inventor
Edwin E. Claytor
By his Attorney
Ramsay Hoguet

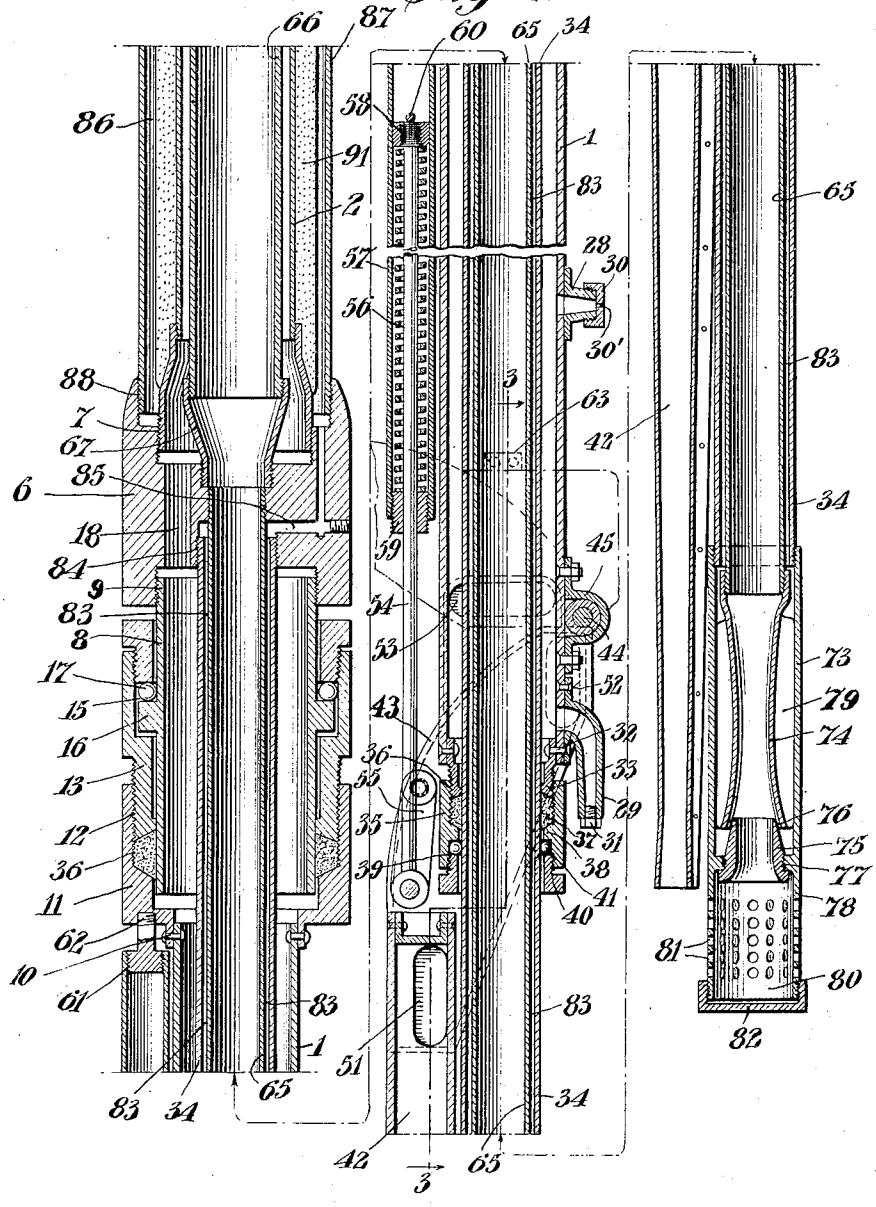
Dec. 28, 1926. 1,612,611

E. E. CLAYTOR

METHOD AND APPARATUS FOR RECOVERING OIL FROM LOOSE OIL BEARING STRATA

Original Filed Dec. 22, 1924 3 Sheets-Sheet 2

Fig. 2.



Inventor

Edwin E. Claytor

By his Attorney Ramsay, Hoguet.

Dec. 28, 1926. 1,612,611

E. E. CLAYTOR

METHOD AND APPARATUS FOR RECOVERING OIL FROM LOOSE OIL BEARING STRATA

Original Filed Dec. 22, 1924 3 Sheets-Sheet 3

Fig. 3.

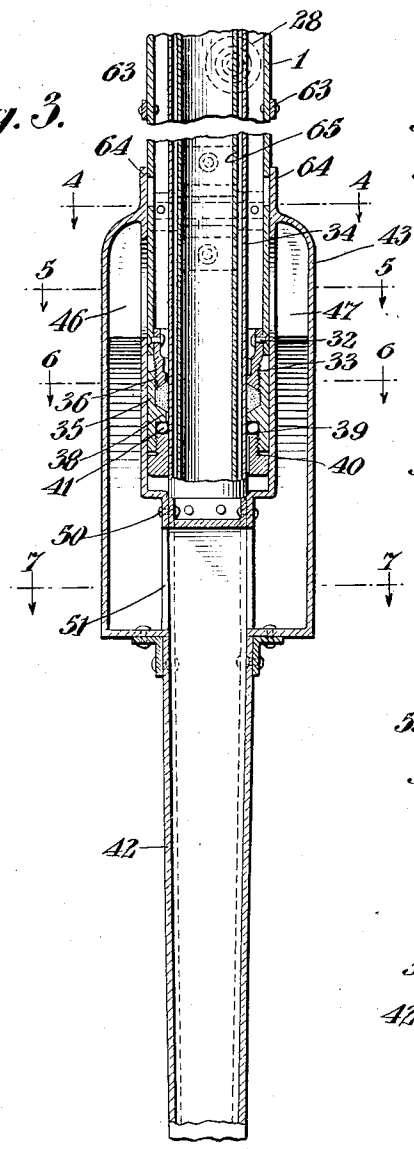


Fig. 4.

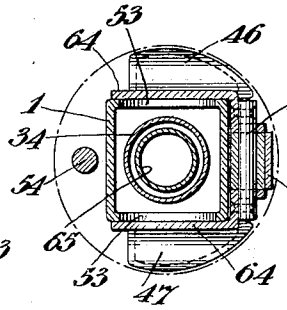


Fig. 5.

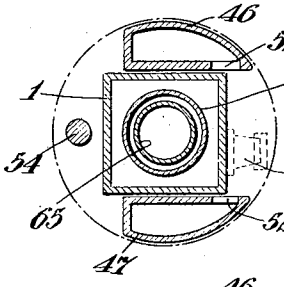


Fig. 6.

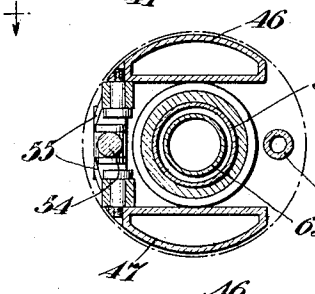
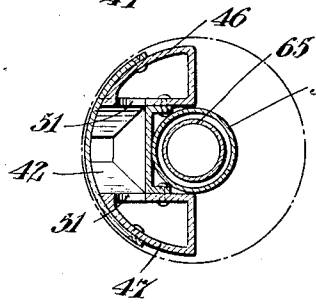


Fig. 7.



Inventor

Edwin E. Claytor

By his Attorney Ramsay Hoguet

Patented Dec. 28, 1926. 1,612,611

UNITED STATES PATENT OFFICE.

EDWIN E. CLAYTOR, OF NEW YORK, N. Y., ASSIGNOR TO CHARLES PAUL MACKIE, OF NEWARK, NEW JERSEY.

METHOD AND APPARATUS FOR RECOVERING OIL FROM LOOSE OIL-BEARING STRATA.

Application filed December 22, 1924, Serial No. 757,433. Renewed October 21, 1926.

This invention relates to the mining and treatment of minerals and particularly to the recovery of oil from loose oil bearing underground sands.

In the drawings, which illustrate a mechanism for carrying out the method of mining the underground oil,

Fig. 1 is a sectional view showing the disposition of the giant in the well and in the housing,

Fig. 2 is an enlarged detail sectional view of the giant,

Fig. 3 is a view on line 3—3 of Fig. 2,

Fig. 4 is a section on line 4—4 of Fig. 3,

Fig. 5 is a section on line 5—5 on Fig. 3,

Fig. 6 is a section on line 6—6 of Fig. 3, and

Fig. 7 is a section on line 7—7 of Fig. 3.

The apparatus in the form illustrated includes what I term a giant. This giant includes a tube 1 which is preferably, although not necessarily, quadrangular in cross section and which communicates with a tube 2 extending through the casing 3 which is placed in the ground to line the wall and sealed therein by casing shoe 5.

The tube 1 communicates with the tube 2 in the following manner:

The adapter 6 is attached to the tube 2 by a suitable means such as screw threads 7. This adapter carries at its lower end a sleeve 8 which forms in effect an extension of the tube 1 and is attached to the adapter by means such as screw threads 9. Attached to the tube 1 at 10 is a packing ring 11 which in turn is adjustably attached as at 12 to a second packing ring 13. The packing ring 13 at its upper end carries an adjustable raceway 15 between which, and an annular shoulder 16 on the sleeve 8, anti-friction bearings 17 are located, which shoulder 16 acts as an opposing raceway for the anti-friction bearings. Thus the tube 1 is supported on the sleeve 8 which depends from the adapter 6 so that it is free to revolve upon the tube for a purpose which will later appear.

The adapter 6 is provided with a series of ports 18 so designed that the pressure of the mining agent after passing therethrough will not exceed the desired working head for the nozzles 42, 29 and 31 when the tube 2 is filled with the mining agent completely to the surface of the ground, which establish communication between the interior of the tube 2 and the interior of the tube 1 so that the mining agent (later to be described) may be conveyed through the former into the latter.

The tube 2 is attached at its upper end to a tubing head 19 to which is attached a flexible pipe 20 extending to the source of supply of the mining agent, which source of supply is not shown, but which may be similar to that illustrated and described in my co-pending application filed on October 1, 1924, Serial No. 704,911.

In order that the mining agent may be projected against the walls of the well, I have located nozzles 28 and 29 adjacent the lower end of the tube 1, the former extending outwardly from the tube and the latter, located below the former, extending downwardly. These nozzles are adapted to be closed by suitable closures 30 and 31, closure 30 of the nozzle 28 having a central opening 30′ therein. The nozzle 28 is offset or tangential with respect to the longitudinal axis of the tube 1 so that when the mining agent is projected from the nozzle the tube will be given a rotative movement by the reactive force of the agent leaving the nozzle, so that the agent will be automatically projected against the wall of the well in a progressive circle.

The lower end of the tube 1 is closed and supported on anti-friction bearings in the following manner: Secured to the tube 1 at 32 is a packing ring 33 which fits within the tube 1 and is, at its upper end, of a cross section similar to that of the tube. At its lower end, however, it is of a circular cross section so as to snugly fit the tube 34 which is likewise circular in cross section and extends upwardly through the tube 1. A second ring 35 is attached adjustably at 36 to the ring 33 and disposed between these packing rings is suitable packing material 37. The packing ring 35 is provided with an annular shoulder 38 between which and a raceway 39 which is adjustably attached at 40 to the packing ring 35, anti-friction bearings 41 are disposed. Thus it will be seen that the tube 1 is supported at its upper and at its lower ends by anti-friction bearings and is packed so as to prevent the escape of the mining agent except through the ejection nozzles.

This tube 1 is provided with a relatively larger nozzle 42. This nozzle 42 is provided

with a head 43 which head is mounted for pivotal movement at 44 on a bracket 45 carried by the tube 1.

It will be seen that the head 43 is formed of two chambers, 46 and 47. These chambers 46 and 47 are disposed upon the opposite sides of the tube 1 and are attached at 50 to the nozzle 42 having permanent communication with the same through the openings 51.

In order that communication may be established between the chambers 46 and 47 of the nozzle when the latter is in its raised position, I have provided each of the chambers with openings 52, which openings are adapted to register with openings 53 in the tube 1.

In order that the nozzle 42 may be automatically raised into its operative position as shown in Fig. 1, I have provided a lifting rod 54 which is attached pivotally to the chambers 46 and 47 by means of a yoke 55 and is normally urged upwardly by a spring 56 mounted within a housing 57 and disposed between an abutment 58 on the end of the rod 54 and a permanent abutment 59 on the lower end of the housing. A spring 56 is, when desired, maintained under compression and in an inoperative position, that is to say, inoperative to raise the nozzle 42, by a removable pin 60 which extends from the housing 57. This housing 57 is carried by the packing ring 11 as at 62.

In order that the nozzle 42 may be limited in its upward movement under the action of the spring 56, so as to be arrested in the proper position to project the mining agent, I have provided a pair of stops 63 which stops are disposed on opposite sides of the tube 1 and adapted to engage the upper surfaces of wings 64 which project from the chambers 46 and 47 of the head 43 of the nozzle 42 and which, when the nozzle is in its lowered or inoperative position, cover the openings 53 in the tube 1.

A tube 65 is mounted in the adapter 6 which tube at its upper end communicates with a tube 66 having a reducing nipple 67 at its lower end above the end of the tube 65 and which tube 66 is, at its upper end, provided with a tubing head 68 having connection to a flexible pipe 69 which extends to a heat exchanger, not shown. The tube 65 extends downwardly to a point beyond the lower end of the tube 1 and to the extent desired, and is provided at its lower end with a steam injector 73 including a Venturi tube 74, and a nozzle 75 which latter extends into the Venturi tube and is relatively smaller than the same to provide the steam space 76 and is carried at 77 by a housing 78 which is attached at its upper end to the lower end of the tube 34. This housing 78 carries the Venturi tube 74, the latter being mounted therein by means of suitable vanes 79 in the usual manner. The lower end of the housing 78 is provided with a chamber 80 having perforations 81 therein, which chamber is closed by a cap 82 at its lower end and through which perforations the material to be raised passes to the nozzle 75.

In order that steam (from a source not shown) may be supplied to the injector, the tube 34 is provided. This tube has a slightly greater diameter than the tube 66 and provides the steam space 83. This tube 34 is carried by the adapter 6, as hereinbefore stated, being attached thereto at 84 and having communication with a series of steam ports 85 in the adapter which ports establish communication with the steam space 86 between the tube 2 and an outer tube 87 which is attached at 88 to the adapter and at its upper end is provided with a tubing head 89 having a steam inlet 90 from the source of steam.

It will be noted that the tube 2 is provided with heat insulation 91 to prevent the communication of heat from the steam passing through the steam space 86 to the mining agent passing through the tube 2.

I have provided a perforated pipe 92 which preferably is of the well-known Button type. This pipe should be of a diameter as large as is possible to place loosely within the well casing and of a length somewhat less than the thickness of the productive strata. The perforated pipe 92 is adapted to house the lower end of the giant in one of the operations of the latter, and is provided with an open upper end for the reception of the giant and an open lower end 93 to permit the inflow of material during the sinking of the pipe through the productive strata of sand.

The operation, when it is desired to obtain oil from the loose oil bearing sand strata, is as follows: The large radially extending nozzle 42 is rendered inoperative by the insertion of the locking pin 60, that is to say, the nozzle is held in its lowered position. The two smaller nozzles, 28 and 29, are left open and with the three nozzles in this condition the giant is lowered into the well until the nozzle 28 is adjacent the top of the productive strata which is indicated at 105 on the drawing just below the cap rock or the over-lying strata.

The steam and the mining solution which may be an alkaline liquid and preferably carbonate of soda either in a hot or cold condition as the circumstances warrant, are turned into the giant through the pipes 20 and 69 from the source of supply. The ejection of the mining solution from the nozzles 28 and 29 frees the loose sand from the walls of the well in the oil bearing strata and this freed sand and mining solution flow downwardly into the well. This opera-

tion is continued until a space or chamber has been formed in the oil bearing strata, which chamber takes the shape of an inverted cone, the apex of which is some distance, (in actual practice from five to ten feet,) below the top of the productive strata, the cone shaped chamber being formed by the sand coming to rest at its natural angle of repose. After this chamber has thus been formed, the giant is removed from the well and the perforated pipe 92 is lowered into the well, preferably on a string of tubing which is connected loosely to the pipe. Upon reaching the bottom of the chamber which has been previously formed, the string of tubing is detached from the pipe, as by unscrewing, for instance, and the tubing hoisted from the well, leaving the perforated pipe resting on the productive strata on the bottom of the cone shaped chamber which, as hereinbefore stated, is formed adjacent the top of the productive strata. Then the giant, with the large nozzle 42 locked in its lowered or inoperative position, and the nozzle 28 closed by the closure 30 and the nozzle 29 open, is again lowered into the well until it enters the perforated pipe 92 and rests upon the oil bearing sand at the lower end of the pipe. The steam and mining solution are again turned into the tubing heads and into the giant. The solution is ejected from the nozzle 29 in a downward direction and agitates the sand and oil at the bottom of the perforated pipe which latter sinks by its own weight until it reaches the bottom of the oil bearing sands and rests upon the unproductive strata below. The sand and oil which is thus agitated by the ejection of the mining solution from the nozzle 29 is continuously removed by the action of the injector 73 and elevated to the surface of the ground by the elevating effect of the steam, which may be supplemented by compressed air, as described in my co-pending application hereinbefore referred to.

The perforated pipe 92, having been landed, that is to say, definitely placed in position, the giant is again hoisted from the well and the nozzle 42 unlocked by the withdrawal of the pin 60. If it is desired to prevent the bottom water and sand from entering the lower end of the perforated pipe, this may be done by placing a packer in the pipe in the usual manner.

The giant, with the nozzle 42 unlocked, is again lowered into the well and if desired the length of the steam tubing 34 and of the discharge tubing 65 is increased to the length of the perforated pipe 92, or to the distance from the top of the pipe to the packer, in case the latter is used.

When the nozzle 42 reaches the cavity which has previously been excavated, it will unfold automatically and assume a horizontal position and when the steam and mining solution are caused to flow through the giant, the streams of the solution ejected from the nozzles 42 and 28 will excavate the sands adjacent the top of the productive strata and cause them to flow, with some of the solution and oil, toward the perforated pipe 92, some of the solution and oil and sand flowing over the top of the pipe and into the same. However, the greater portion of the solution will flow through the sands on the outside of the perforated pipe and toward the latter. This solution being hot, will wash or free practically all of the oil from the interstices between the grains of sand and will carry the oil downwardly toward the perforated pipe, entering the latter, with the oil, through its numerous perforations. The solution and oil are continuously removed from the pipe 92 by the steam injector 73, together with the sand, solution and oil that flows over the top of the perforated pipe. The downward projection of the mining solution from the nozzle 29 agitates the oil, sand and solution within the pipe 92 so that the entire removal is insured.

After the oil, sand and mining solution are elevated to the surface of the ground, they may be separated in any desirable manner such as permitting them to arrange themselves according to their specific gravities, as for instance, in the manner described in the before mentioned co-pending application, and the hot mining solution may be returned to the nozzles to be used repeatedly.

While I have described a particular embodiment of the method and apparatus of this invention, it is to be understood that I do not wish to be limited to that embodiment, as numerous changes may be made in the details thereof within the scope of the claims.

What I claim is:

1. A method of recovering oil from loose underground strata in a well which includes sinking a perforated housing into the strata, sinking a giant into the housing, projecting a mining agent from the giant directly against the strata to free the oil from the inert material thereof and to cause the oil to flow into said perforated housing, and raising the oil from the housing by means of the giant.

2. The method of recovering oil from loose underground strata in a well which includes projecting a mining agent directly against the strata to free the oil and the inert material from the strata and the oil from the inert material and to cause the oil and the inert material to flow downwardly into the well, creating a liquid receiving chamber in the accumulated inert material, sinking a giant into said chamber, and raising the oil by means of the giant.

3. An apparatus for recovering oil from loose underground strata which includes a perforated housing adapted to be sunk into the strata, a giant having liquid raising means including a suction device removably and adjustably mounted in the housing and liquid projecting means located above the suction device and operable directly against the strata independently of the housing.

4. The method of recovering oil from loose underground strata in a well which includes sinking a perforated housing into the strata, sinking a giant into the housing, projecting a mining agent directly against the strata to free the oil from the inert material and to cause the oil to flow into the perforated housing, raising the oil from the housing by means of the giant, and agitating the oil in the housing during the raising operation.

5. The method of recovering oil from loose underground strata in a well by means of a giant, a housing, means for projecting a mining solution against the strata, means for projecting a mining solution into the housing and means for raising the oil from the housing, which includes projecting the mining solution against the strata forming the wall of the well and projecting the mining solution downwardly, whereby a chamber is formed in the oil bearing strata and the loose material flows to the bottom of the well, removing the projecting means from the well, sinking the housing into said loose material, then projecting the mining solution against the strata and into the housing, and simultaneously removing the oil from the housing.

In testimony whereof, I have signed my name to this specification this 11th day of December, 1924.

EDWIN E. CLAYTOR.