April 24, 1928. 1,667,269

L. RANNEY

OIL MINING METHOD AND APPARATUS

Filed June 18. 1926 3 Sheets-Sheet 1

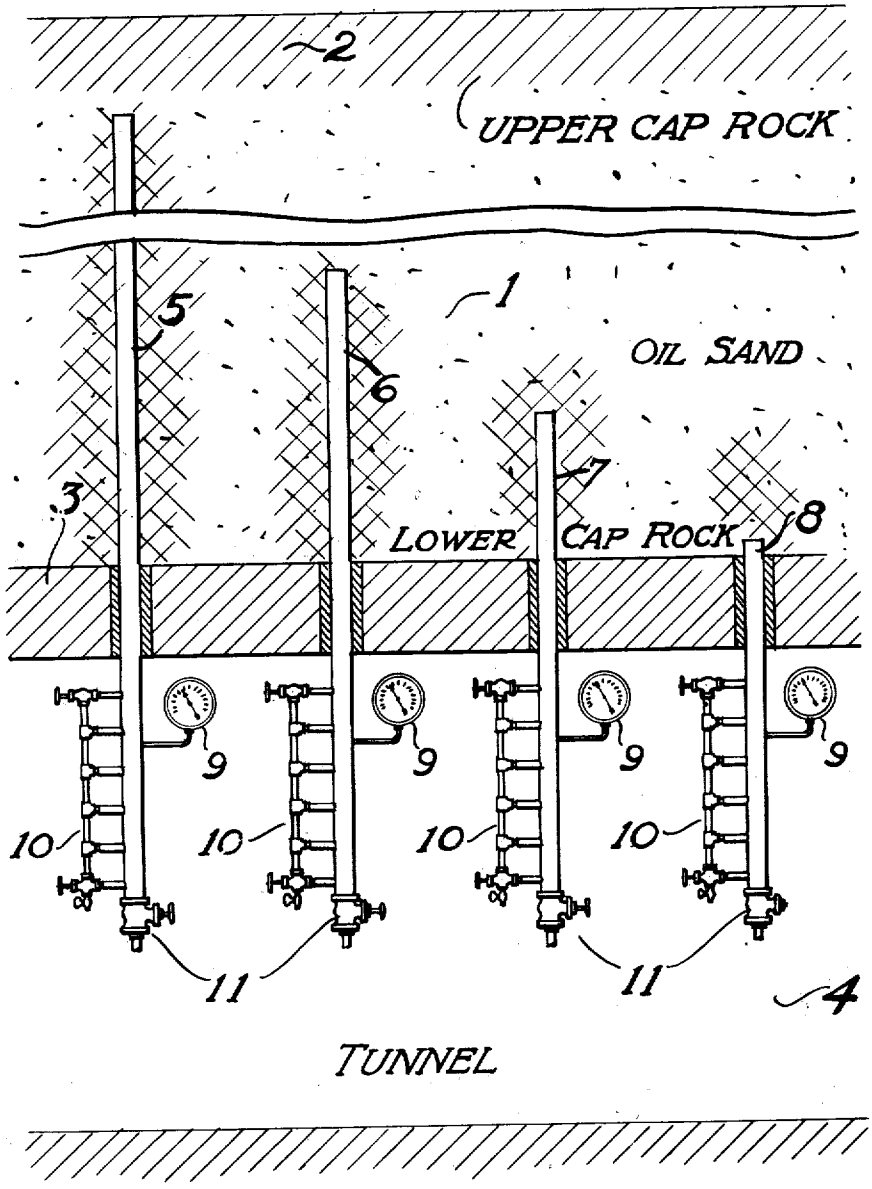


FIG.-1

Leo Ranney Inventor

By Attorney

April 24, 1928. 1,667,269

L. RANNEY

OIL MINING METHOD AND APPARATUS

Filed June 18, 1926 3 Sheets-Sheet 2

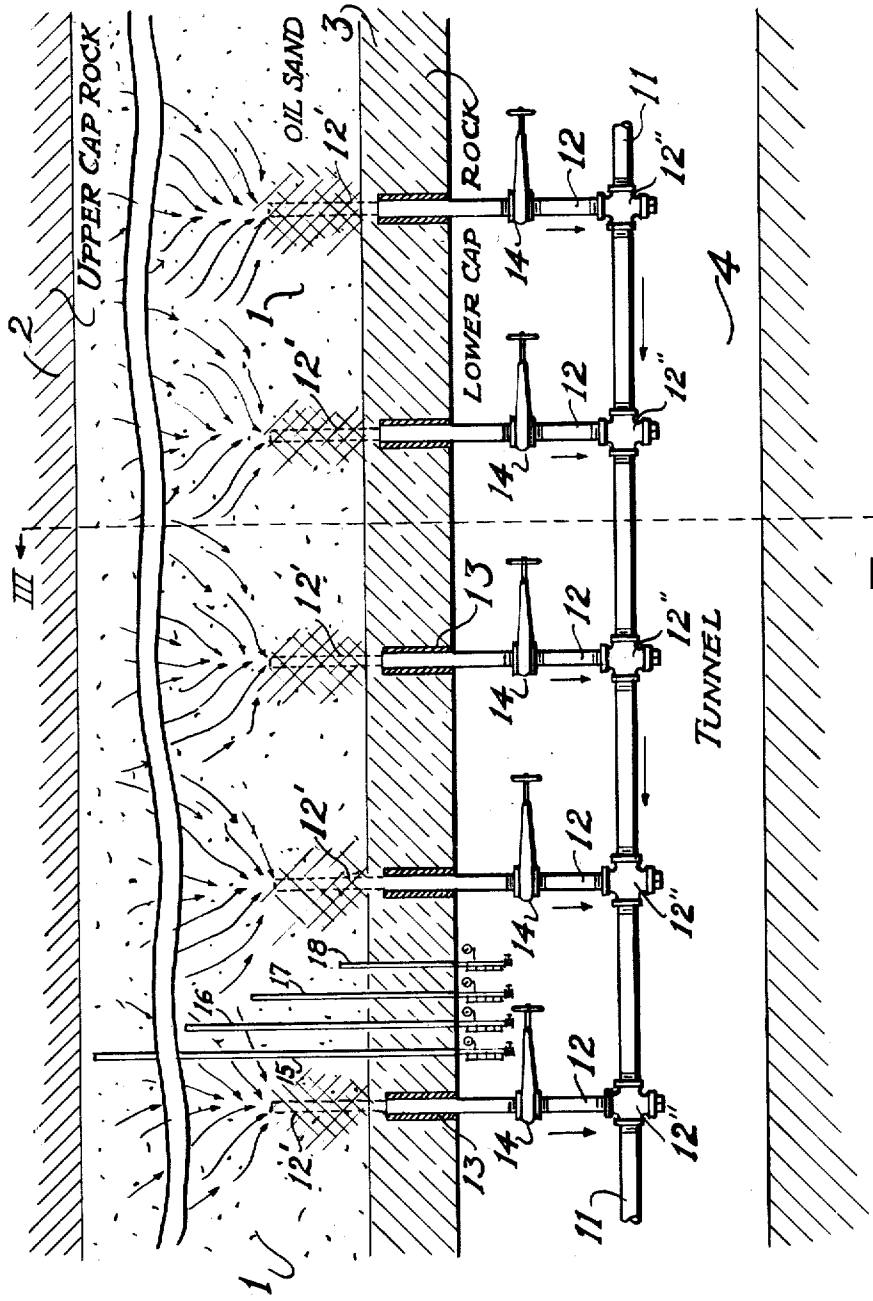


FIG-2

LEO RANNEY Inventor

By Attorney

April 24, 1928. 1,667,269

L. RANNEY

OIL MINING METHOD AND APPARATUS

Filed June 18, 1926 3 Sheets-Sheet 3

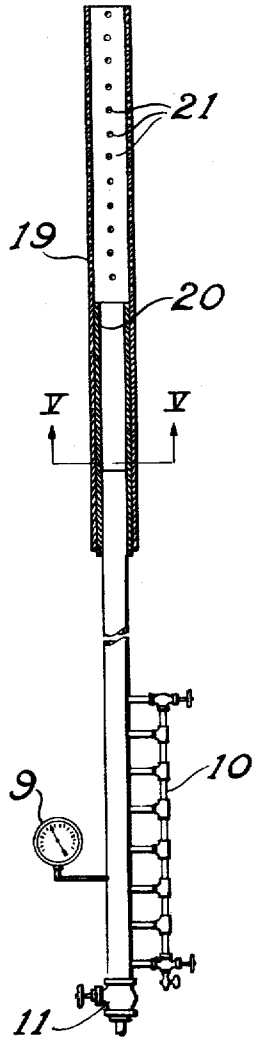


FIG.-4

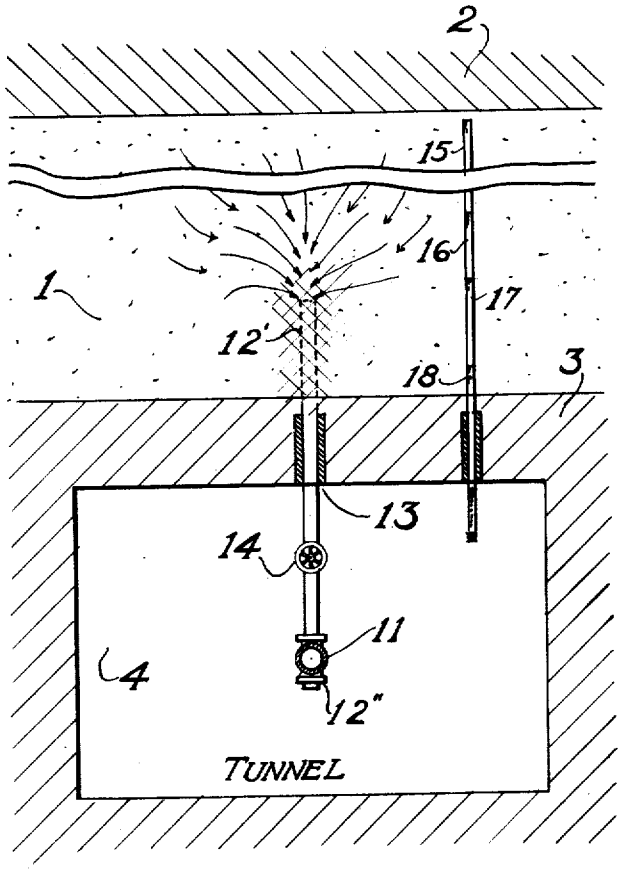


FIG.-3

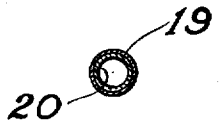


FIG.-5

LEO RANNEY Inventor

By Attorney

Patented Apr. 24, 1928. 1,667,269

UNITED STATES PATENT OFFICE.

LEO RANNEY, OF NEW YORK, N. Y., ASSIGNOR TO STANDARD OIL DEVELOPMENT CORPORATION, A CORPORATION OF DELAWARE.

OIL-MINING METHOD AND APPARATUS.

Application filed June 18, 1926. Serial No. 116,857.

This invention relates to improvements in the recovery of oil from the earth by a mining method of the type described in my copending patent applications Serial Nos. 683,703, filed December 31, 1923; 711,596, filed May 7, 1924; 14,448, filed March 10, 1925, and 100,531, filed April 8, 1926. The invention will be fully understood from the following description, taken in connection with the accompanying drawing, in which:

Fig. 1 is a vertical longitudinal section through a tunnel containing equipment for testing an oil sand lying adjacent to the tunnel;

Fig. 2 is a vertical longitudinal section through a tunnel, showing the oil-collecting system as well as the testing equipment;

Fig. 3 is a vertical transverse section on the line III—III of Fig. 2;

Fig. 4 is a vertical section through an alternative form of testing equipment; and

Fig. 5 is a transverse section on the line V—V of Fig. 4.

Referring first to Fig. 1 of the drawings, reference numeral 1 denotes an oil-bearing stratum or oil sand lying between an upper cap-rock 2 and a lower cap-rock 3. A tunnel or mine gallery 4 is driven adjacent the oil sand and generally parallel thereto. The tunnel is spaced from the oil sand by the lower cap-rock and is not open to the sand except through an oil-collecting system to be described later. I prefer to drive the tunnel below the level of the oil sand but it may be driven above the sand.

In accordance with the present invention, I provide equipment for testing the sand to determine the pressure prevailing in it; the presence of gas, oil, or water, and other conditions. This equipment comprises a series of conduits 5, 6, 7, and 8 set in openings drilled from the tunnel through the cap-rock and into the oil sand. The four conduits shown for illustration have a gradually decreasing length, but the number and arrangements of the conduits may be varied within considerable limits, depending on the thickness of the sand and the number of test points desired. The thickness of the sand may first be ascertained by drilling until the sand is completely traversed and the drill begins to enter the upper cap-rock. Then the opening for the first conduit, 5, is drilled to a point within the oil sand and just short of the upper cap-rock. The shortest conduit, 8, taps the lowest portion of the oil sand. The two intermediate conduits, 6 and 7, tap intermediate regions of the sand.

Each conduit has within the tunnel a pressure gauge 9, a liquid gauge 10, and a draw-off valve 11. Pressure and liquid gauges usually suffice to give all necessary information, but any other suitable testing devices may be used.

Knowledge concerning conditions in the sand being worked has been recognized to be desirable, but heretofore no means has been available for securing such knowledge. With the equipment provided according to the present invention, the operator can readily find out what he has to deal with and can act accordingly.

One particular advantageous use of testing equipment of the character described is in the regulation of "unexcavated drainage tunnels" in the oil sand. As described in my application 14,448 above referred to, unexcavated drainage tunnels or areas of facilitated flow in the oil sand are formed by withdrawing oil through a plurality of closely spaced openings, thus forming an evacuated area into which more oil flows from the surrounding sand.

As shown in Figs. 2 and 3 of the present application, a main collecting pipe 11 is arranged in the tunnel and has branch nipples 12 sealed in the cap-rock by packing 13. A drill is inserted through each nipple and is operated to form an opening or "mine well" 12′ in the oil sand, after which the drill is removed. Access is obtained through the lower branch of the cross connection 12″, which is provided with a suitable removable plug. Valves 14 (of the gate type to permit passage of the drill) are installed in the nipples 12, and the main collecting pipe 11 leads to a pump (not shown) which forwards to the earth surface the fluid conveyed by the pipe. Conduits 15, 16, 17, and 18, and testing devices of the kind previously referred to, are utilized in conjunction with the collecting system. The general direction of flow of fluids through the oil sand is shown by the curved lines traversing the sand in Figs. 2 and 3. Such area of flow constitutes the unexcavated drainage tunnel referred to above.

It is advantageous to control the oil level in the unexcavated drainage tunnels and

this may be conveniently done by the regulation of valves 14, with the aid of information obtained from the testing conduits 15, 16, 17, and 18. This information will include the exact pressure at various points between the top and the bottom of the sand and the fluid content, whether gas, air, oil, or water, at any or all of a plurality of points in the sand. The rate of fluid flow per square inch of exposed sand surface may also be found by measuring the amount of fluid withdrawn, say through the draw-off valve on conduit 15. Knowing the cross-sectional area of conduit 15, and the amount discharged through it per unit of time, the rate of flow for each square inch of exposed surface may be calculated.

In the light of knowledge obtained from the testing devices as to conditions in the sand, the operator may regulate the valves 14 in the nipples 12 so as to secure a steady and uniform fall or rise of level throughout the area of sand being operated upon. The valve regulation may be supplemented by varying suction on the main collecting pipe 11. If it is desired to raise the fluid level, some or all of the valves 14 are closed or partly closed; upon opening the valves the fluid level is caused to sink. The rate of fall can be controlled by regulating the amount of opening of the valves. The practice above referred to applies equally as well to "hot sand tunnels". These, as described in the application Serial No. 14,448, are unexcavated drainage tunnels formed when heat is used in connection with the draw-off nipples.

My invention is particularly useful in cases where a fluid (air, gas, water, etc., with or without heating) is to be put into the sand. For example, assuming that gas is being forced into an upper portion of the sand and oil is being withdrawn from a lower portion, it is of great importance to know the actual pressure within the sand. The pressure applied may be dissipated almost as soon as the gas enters the sand, by reason of porous streaks in the sand. Or the gas may meet a compact layer which prevents its reaching the main body of sand. By the use of the testing devices described, the operator can readily tell whether he is putting the right pressure on the desired area and can regulate his gas supply accordingly. The gauges are read periodically and furnish a continuous source of information, not only as to the fluid conditions in various sand levels, but also as to the travel of fluids horizontally through the sand.

When using compressed air as the expulsive medium, samples of the air-gas mixture in the sand are taken and the supply of air is regulated to prevent the formation of explosive mixtures. These are a serious danger under the former haphazard air-injection method. According to the present invention, also, the operator may readily determine the condition of surface-tension reducing solutions applied to the sand.

In Figs. 4 and 5 I have shown an alternative form of testing conduit. This comprises telescoping tubes 19 and 20. The outer tube 19 has perforations 21. The inner tube 20 is not perforated and fits closely in the outer tube so as to seal off all the perforations which it covers. The inner tube may be adjusted to expose any desired perforation. The telescoping tubes are inserted in openings in the oil sand in the same manner as the separate testing conduits above described. In general, separate testing conduits are preferable. In most fields the number of conduits required is not large; a group every 300 or 400 yards throughout the extent of the tunnel is adequate. The testing conduits may be advantageously used from a tunnel above the oil sand. In this case a small suction pump will be connected with the conduits to withdraw samples from the various levels.

Various changes and alternative arrangements may be made within the scope of the appended claims, in which it is my intention to claim all novelty inherent in the invention as broadly as the prior art permits.

I claim:

1. In securing hydrocarbons from a hydrocarbon-bearing stratum by means of a collecting system arranged in a mine gallery outside the stratum but adjacent thereto, the improvement which comprises establishing a plurality of test points within the stratum, each giving substantially immediate indicia of changing conditions therein, determining from said indicia the conditions existing in the stratum at such points, and regulating the operation accordingly.

2. In securing oil from an oil sand by means of a collecting system arranged in a mine gallery outside the sand, with the use of explosive force applied to the sand, the improvement which comprises establishing a series of test points beginning near the top of the sand and progressively increasing in distance therefrom to a point adjacent the bottom of the sand, determining conditions existing in the sand at a plurality of such test points, and regulating the collecting system and the expulsive force accordingly.

3. In securing oil from an oil sand by means of a collecting system arranged in a mine gallery outside the sand but adjacent thereto, said system comprising a main collecting pipe extending longitudinally of the gallery and having a large number of closely spaced nipples connected thereto and tapping the sand, whereby a drainage area is formed generally paralleling the main collecting pipe, the improvement which comprises establishing a plurality of test points

within the drainage area, each giving substantially immediate indicia of changing conditions therein, regulating the fluid level in the drainage area in accordance with conditions determined at said plurality of points therein.

4. In combination with a fluid-collecting system arranged in a mine gallery adjacent to an oil-bearing stratum, but spaced therefrom, a conduit tapping the stratum from the gallery and carrying testing devices for giving substantially immediate indicia of conditions in the stratum.

5. Apparatus according to claim 4, in which the conduit comprises a tube having spaced perforations throughout a substantial part of its length embedded in the stratum, and a sleeve telescoping in said tube and adapted to prevent flow from certain of said perforations while receiving fluids discharged from others thereof.

6. In combination with a fluid-collecting system arranged in a mine gallery adjacent to an oil-bearing stratum, but spaced therefrom, a series of conduits tapping the stratum at progressively decreasing distances from its top, and testing devices connected to each conduit for indicating conditions in the stratum.

7. In combination with a fluid connecting system arranged in a mine gallery adjacent to an oil bearing stratum, but spaced therefrom, a series of conduits formed from the gallery to progressively increasing distances into the stratum, indicating instruments on said conduits and within the gallery, whereby substantially immediate indicia of changing conditions in the stratum may be obtained, and control valves arranged in said fluid collecting system and adapted to be regulated in accordance with said indicia.

LEO RANNEY.

CERTIFICATE OF CORRECTION.

Patent No. 1,667,269. **Granted April 24, 1928, to**

LEO RANNEY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 111, claim 2, for the word "explosive" read "expulsive"; page 3, line 30, claim 7, for the word "connecting" read "collecting"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of July, A. D. 1928.

(Seal)

WM. A. Kinnan,
Acting Commissioner of Patents.

within the drainage area, each giving substantially immediate indicia of changing conditions therein, regulating the fluid level in the drainage area in accordance with conditions determined at said plurality of points therein.

4. In combination with a fluid-collecting system arranged in a mine gallery adjacent to an oil-bearing stratum, but spaced therefrom, a conduit tapping the stratum from the gallery and carrying testing devices for giving substantially immediate indicia of conditions in the stratum.

5. Apparatus according to claim 4, in which the conduit comprises a tube having spaced perforations throughout a substantial part of its length embedded in the stratum, and a sleeve telescoping in said tube and adapted to prevent flow from certain of said perforations while receiving fluids discharged from others thereof.

6. In combination with a fluid-collecting system arranged in a mine gallery adjacent to an oil-bearing stratum, but spaced therefrom, a series of conduits tapping the stratum at progressively decreasing distances from its top, and testing devices connected to each conduit for indicating conditions in the stratum.

7. In combination with a fluid connecting system arranged in a mine gallery adjacent to an oil bearing stratum, but spaced therefrom, a series of conduits formed from the gallery to progressively increasing distances into the stratum, indicating instruments on said conduits and within the gallery, whereby substantially immediate indicia of changing conditions in the stratum may be obtained, and control valves arranged in said fluid collecting system and adapted to be regulated in accordance with said indicia.

LEO RANNEY.

CERTIFICATE OF CORRECTION.

Patent No. 1,667,269. **Granted April 24, 1928, to**

LEO RANNEY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 111, claim 2, for the word "explosive" read "expulsive"; page 3, line 30, claim 7, for the word "connecting" read "collecting"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of July, A. D. 1928.

(Seal)

WM. A. Kinnan,
Acting Commissioner of Patents.