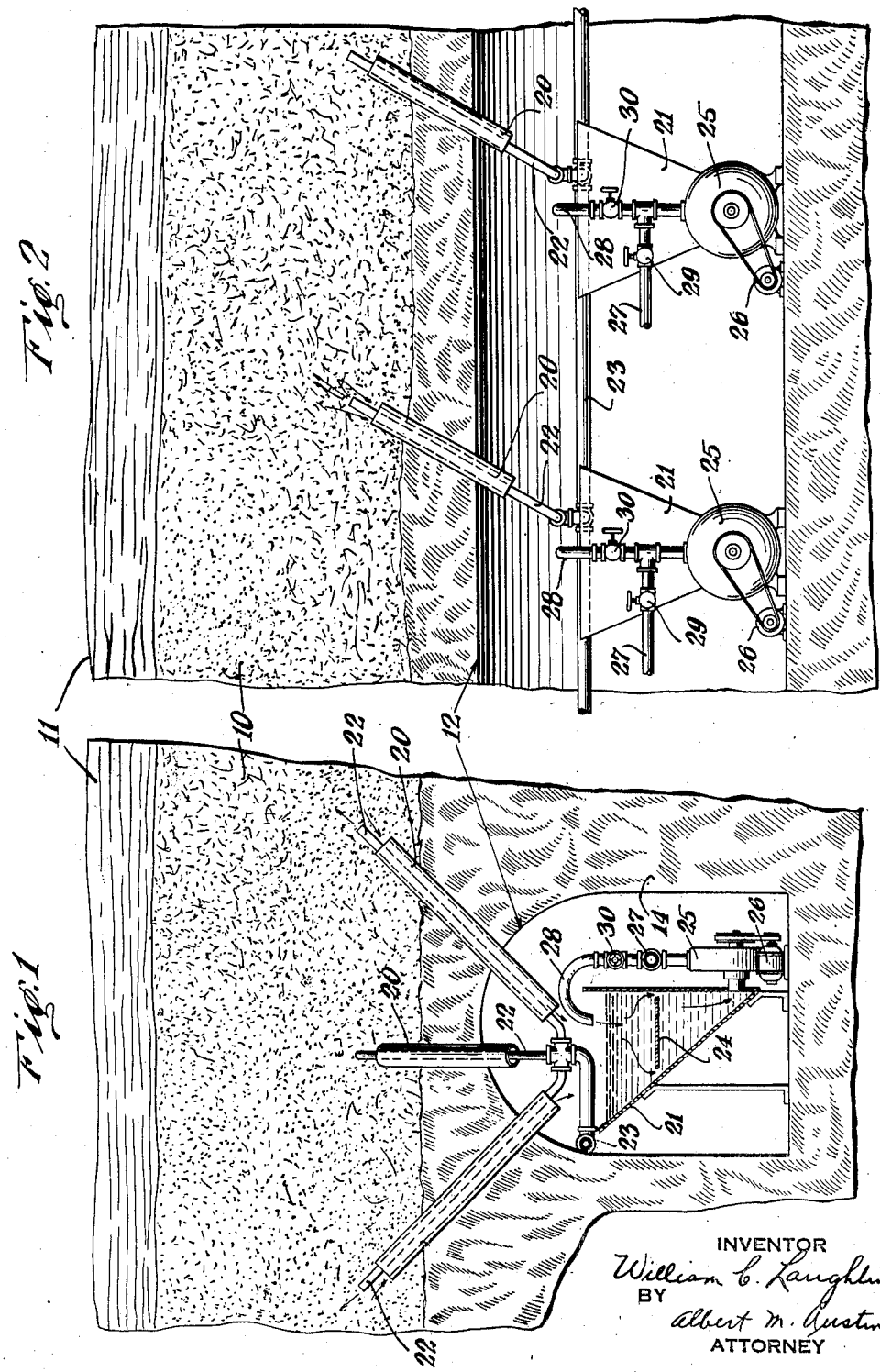
Nov. 21, 1933. W. C. LAUGHLIN 1,935,643

PROCESS FOR TREATING OIL BEARING SANDS

Filed Feb. 5, 1930 2 Sheets-Sheet 1

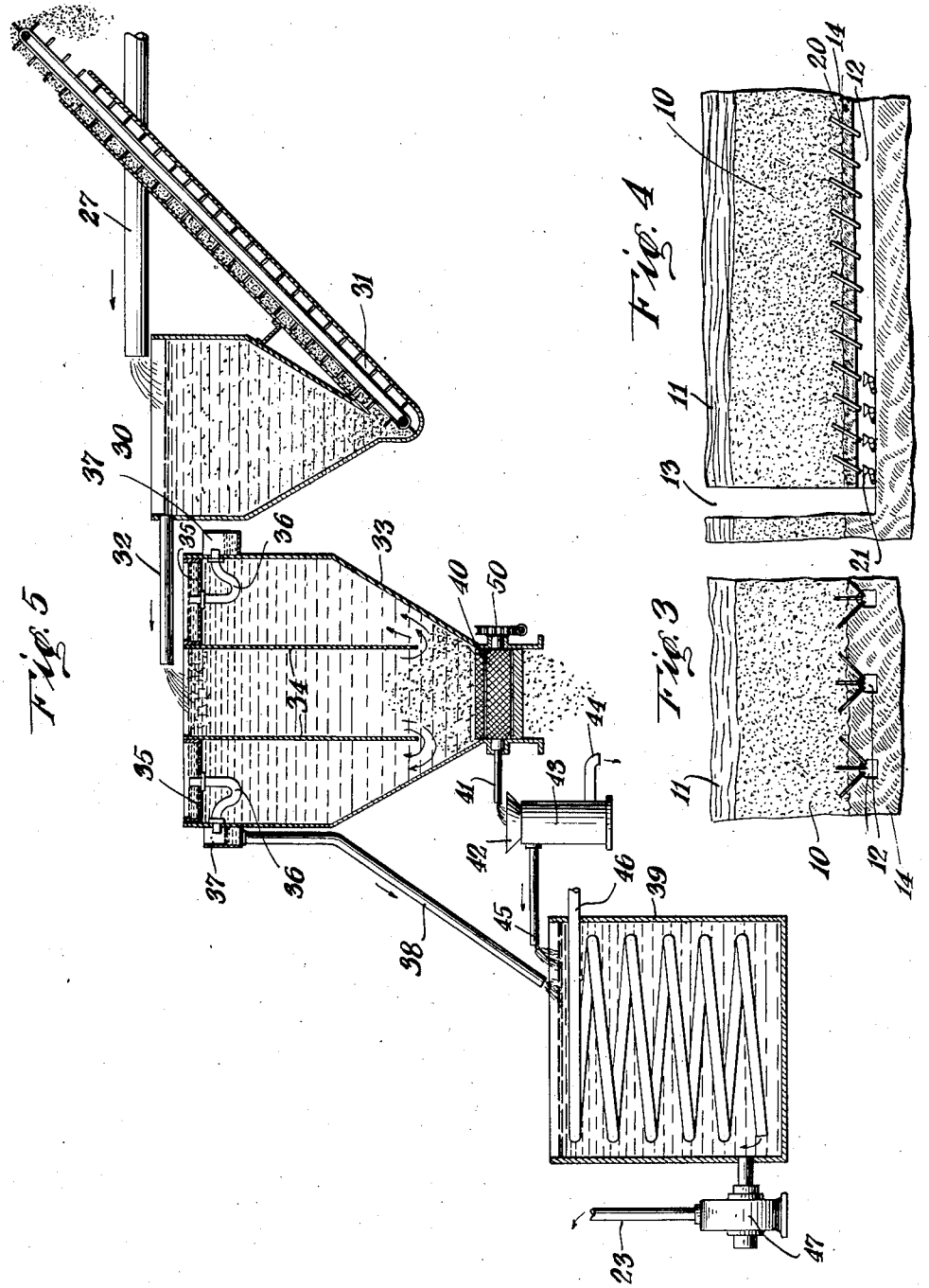


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PROCESS FOR TREATING OIL BEARING SANDS

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PROCESS FOR TREATING OIL BEARING SANDS

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4 Claims. (Cl. 262—1)

This invention relates to a process and apparatus for mining oil bearing sands and provides for the recovery of the oil content in natural deposits of surface or sub-surface sands.

Oil sands are commonly covered by a layer of barren sand, dirt and vegetation which must be removed if the sands are to be worked at their face or from above. Furthermore, the sands are difficult to work by means of steam shovels and other similar devices, because of their viscous (sticky) nature.

The present invention overcomes this difficulty by mining the sand from below and utilizes the natural tendency of the sand to cave to assist the mining operation. By operating in this manner the extent and nature of the barren covering is immaterial as it is not necessary to remove the same.

In accordance with the present invention heated water under pressure is applied to the sands from below and causes the sands together with their oil content to readily flow into a centrifugal pump which disintegrates the oil sand and discharges the mixture to a suitable oil recovery apparatus which is located outside the mine.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, the mode of its operation and the manner of its organization may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which

Fig. 1 is a sectional view of a mine tunnel or adit showing the mining apparatus incorporated therein;

Fig. 2 is a longitudinal section of a tunnel showing the arrangement of the mechanism:

Fig. 3 is a transverse sectional view of a typical deposit showing a plurality of tunnels or adits;

Fig. 4 is a similar view showing arrangement as applied where shaft is necessary; and

Fig. 5 is a diagrammatic showing of a typical oil recovery apparatus.

Like reference characters denote like parts in the several figures of the drawings.

In the following description and in the claims parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Referring in particular to Fig. 3 the arrangement for mining the oil bearing sands 10 which are covered by a layer of barren material 11, is disclosed as comprising a plurality of tunnels or adits 12 which are extended horizontally below the deposit. These tunnels are preferably extended from a cliff which exposes the various layers of material and are formed in a hard layer 14 such as limestone below the deposit of oil bearing sands. The limestone is rigid and may be easily tunneled. If necessary the tunnel may be lined or supported in a manner well known in mining. If the face of a deposit is not exposed, as by a cliff, a shaft 13 may be sunk through the oil bearing sands and into the hard layer 14 and the tunnels may be dug from the shaft as shown in Fig. 4.

A plurality of pipes 20 are extended at convenient intervals through the roof of tunnel 12 and through the intervening layer of limestone into the sand deposit. These pipes preferably extend in a direction transverse to the axis of the tunnel and are adapted to receive the oil bearing sands and discharge them into a hopper 21 which is mounted within the tunnel adjacent the ends of each group of pipes. A smaller pipe 22 carrying hot water is extended through pipes 20 in a position to discharge the hot water into the sand adjacent the mouths of pipes 20. Said pipes 22 are connected with a supply pipe 23 which extends to any suitable source of hot water which is located outside the mine.

Each hopper 21 is provided with a baffle 24 which is mounted free from the sides of the hopper whereby an opening suitable for the discharge of sand is provided around the entire periphery thereof. Hopper 21 discharges into a centrifugal pump 25 which is driven by any suitable means such as an electric motor 26. Said pump discharges into a pipe 27 which extends to the oil recovery apparatus outside of the mine and also connects with a return pipe 28 by which a circulation of sand and water in the hopper 21 may be obtained. The proportion of material discharged through pipes 27 and 28 is controlled by valves 29 and 30 respectively.

Referring to Fig. 5 the discharge pipe 27 is shown as applying the mixture of oil, water and sand to a receiving tank 30 in which the bulk of the sand is removed by settling. This sand is picked up by a traveling conveyor 31 and discarded.

The liquid from tank 30 is tapped by pipe 32 into a clarifier tank 33 which contains a pair

of longitudinally extending baffles 34. Clarifier baskets 35 are mounted in said tank between baffles 34 and the edge of the tank and contain any suitable clarifier material which is capable of passing water and separating the unsettled solid particles therefrom. The water which is passed through baskets 35 is tapped by flexible pipe 36 into weir 37 and may be applied by pipe 38 into the hot water supply tank 39 to be described.

The mixture from pipe 32 is applied to the clarifier tank between baffles 34 and flows downwardly underneath said baffles and thence upwardly through the clarifier baskets 35. The sand and heavy oils, if any settle to the bottom of the tank and are filtered through screen 40 which may be formed of any suitable material such as membrane or cloth, the oil and water being discharged through pipe 41 into hopper 42 of a centrifuge 43. The sand and other particles may be removed from the screen and discarded in any suitable manner. Suction may be applied to screen 40 if desired to assist in the filtration of the oil and water and the separation thereof from the remaining sand.

The oil and water are separated in centrifuge 43, the oil being discharged through pipe 44 and the water through pipe 45 to a hot water tank 39. Tank 39 is heated by a steam coil 46 which receives steam from any convenient source. The hot water from said tank is pumped by a centrifugal pump 47 through pipe 23 which extends into the mine tunnels.

The particular construction of screen 40 is not involved in the present invention. The screen, however, is shown in the form of a roller which may be suitably rotated by gears 50. The sand is removed from the surface thereof by gravity as the roller is rotated, whereas the oil and water are caused to pass therethrough and may be discharged through pipe 41. The covering of semi-solid material or sludge in the bottom of tank 33 prevents the bulk of the water from passing through screen 40 and causes the same to flow through clarifier baskets 35 whence it is discharged to weirs 37.

In carrying on the mining operation the hot water is forced under high pressure through pipe 22 into the oil bearing sands. This causes the sand and oil to flow into the mouth of pipes 20 and to be discharged into hoppers 21. As the action is continued the sand above caves in and may be further withdrawn in a similar manner. The process may be continued until the entire oil bearing layer has been removed and the barren layer above is reached.

The mixture of sand, oil and water in hoppers 21 is prevented from immediately falling to the bottom of said hoppers and clogging the entrance of pump 25 by means of baffle 24. It has been found that a baffle of this type causes the material to flow evenly and eliminates the tendency of the material to form a hard compact mass at the bottom of the hopper. The mixture recirculated through pipe 28 assits in disintegrating the oil sand mixture.

Centrifugal pump 26 causes disintegration of the sand and oil mixture and liberation of the oil content thereof. This mixture is then pumped into the receiving tank 30 from which the sand is settled out and removed by conveyor 31, while the oil bearing liquid is applied to clarifier tank 34. The remainder of the sand and the bulk of the water is removed in this tank and the final separation of oil and water takes place in centrifuge 43.

It will be noted that the above operation is substantially continuous and is carried on in an apparatus involving few moving parts and requiring little attention. The water which is applied to the oil bearing sands is largely recovered and recirculated. The application of heat to the sands tends to increase the fluidity of the oil and materially assists in securing the desired separation thereof. It is obvious that the number and position of the pipes 20 and 22 may be varied as desired to meet the requirements of a particular deposit.

By mining the sands from tunnels, or shafts and drifts, underneath the deposit, it is not necessary to remove the valueless material with which the sand deposit may be covered. It is accordingly possible to economically mine the sand and recover the oil at a profit even with deep lying sands, with a depth of barren material which would prevent or prohibit mechanical removal thereof. As the mining operation is carried on under cover it is not affected by climatic changes or conditions, making operation continuous regardless of weather condition. This matter is of particular importance in northern latitudes and high altitudes where the major deposits of oil sands occur.

The application of hot water to the sands from below renders the oil less viscous and permits the oil and sands to be carried down the inclined pipes 20 to the receiving hopper. This eliminates manual or machine handling of the sands which in their natural condition tend to stick or adhere to any plate, shovel or mechanical excavating appliance.

It is evident that as the sand is removed the remaining sands above tend to fall due to the natural pressure from above. By removing the sands evenly from various points along the tunnels the entire section of bed under treatment can be caused to fall evenly with minor disturbance to the surface material. The separation of the oil and sands is greatly assisted by the centrifugal pump which acts not only as a disintegrator but also as a means for conveying the sand, oil and water to the separation plant without the mine.

In the above process the mining and disintegration require a minimum amount of labor and mechanical handling. No heavy or expensive machinery is required and the power requirements are small. Furthermore, by recirculating water the maximum amount of heat is conserved therein.

While certain novel features of the invention have been shown and described and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes in the forms and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. The process of mining oil sands which comprises forming a tunnel below a bed of said sands, applying heat and water to the sands from various points in said tunnel, and causing the sands and oil to flow into said tunnel, then disintegrating said material and pumping the same to a separation plant at a distant point.

2. The process of mining oil bearing sands which comprises applying hot water under pressure to said sands from below, withdrawing a mixture of said sands, oil and water and pump-

ing said mixture to a separation plant, in which the oil is removed therefrom.

3. The process of mining a bed of oil bearing sands which comprises forming a plurality of tunnels below said bed, applying hot water under pressure to said sands at various points in said tunnels, removing a mixture of water, oil and sand at said points, pumping said mixture to an oil recovery plant, carrying on said process so that as sand is removed the remainder of the sand falls due to the pressure from above, and so regulating the removal of sand that a substantially even surface of the bed is obtained.

4. A system for mining oil bearing sands which comprises forming a plurality of tunnels below a bed of said sands and applying hot water under pressure to the sand and various points of said tunnels, removing a mixture of water, sand and oil, whereby the sands settle as said removal takes place and regulating the removal from various tunnels to cause an even settling over substantially the entire bed under treatment.

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