Sept. 2, 1924. 1,506,920

P. DE CHAMBRIER

OIL MINING AND DRAINAGE SYSTEM

Filed Oct. 19, 1921

Fig. 1.

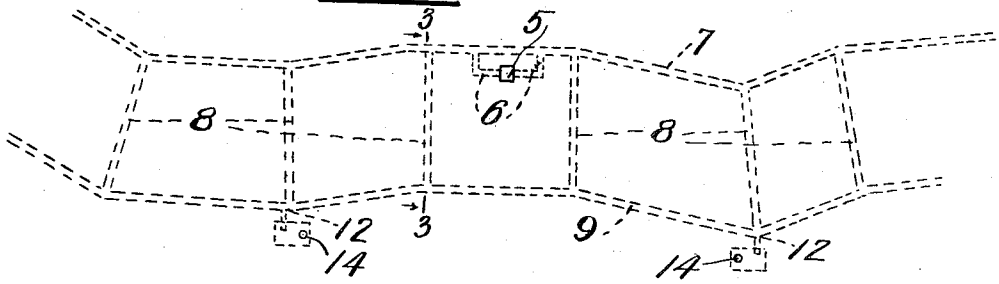


Fig. 3.

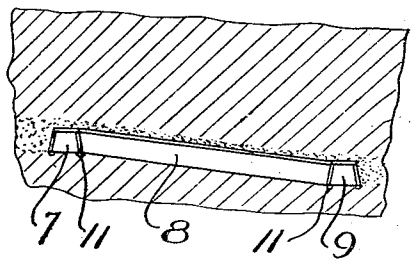
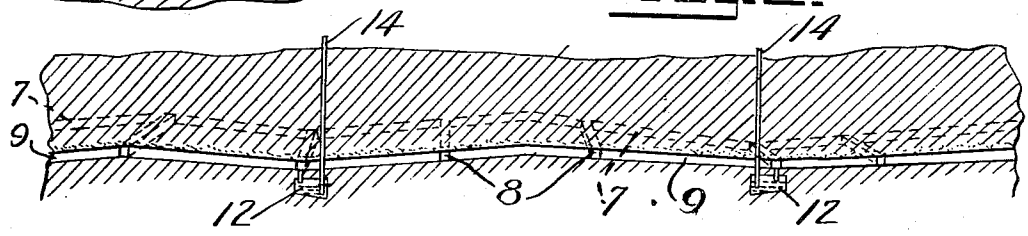


Fig. 4.

Fig. 2.



Inventor

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By his Attorney

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UNITED STATES PATENT OFFICE.

PAUL DE CHAMBRIER, OF BEVAIX, SWITZERLAND.

OIL MINING AND DRAINAGE SYSTEM.

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To all whom it may concern:

Be it known that I, PAUL DE CHAMBRIER, engineer, citizen of the Republic of Switzerland, residing at Bevaix, in the county of Neuchatel and State of Switzerland, have invented certain new and useful Improvements in Oil Mining and Drainage Systems, of which the following is a specification.

This invention relates to a system of recovery of crude petroleum that may be specially applied to the recovery of petroleum from oil bearing sands after extraction of that part of the oil which can be beneficially removed from bituminous sands by natural flow or direct pumping.

Long investigations have enabled me to determine that there remains a considerable quantity of crude oil in the petroleum bearing sands when the extraction by usual means ceases to give appreciable results. For instance, sands having been pumped dry still contain up to 20 per cent in volume of their original oil contents.

Moreover I am in a position to explain why and how it happens that such important quantities of oil still adhere to the sands. My invention enables me to apply commercially a new method of extraction whose description follows.

After an oil bearing stratum has been worked by drilled wells and pumping, until the extraction does not pay, there remains adherent to the sands not only large quantities of crude oil, but also a very important proportion of gas. The gas, however, having lost the greatest part of its pressure, can not drive the oil through the resistance opposed to its free outflow by the sands. Moreover, and that is the most important point, the oil drops are surrounded by adhering small gas bubbles which so increase their volume as to prevent the oil from flowing through the sands by gravity.

The state of equilibrium established under these conditions is of such a nature that the oil containing medium ceases yielding by ordinary means. The layer will only reassume its yieldings if this state of equilibrium can be destroyed. Different means have been proposed and tried to remove this part of the oil, but these methods gave only partial or unsatisfactory results.

I have succeeded in finding a method by which this state of equilibrium can be destroyed and which allows the gas to escape freely and completely securing, under these conditions, an outflow for the oil by its own weight, as soon as it is no more held back by gas bubbles that prevented the oils' outflow through the pores of the bituminous sands.

My invention which may be termed an oil mining and draining system consists in extracting the residual oil from an oil sand by expelling its gas contents which produces the separation of the oil by gravity and natural drainage. For the better carrying out of the process I propose that this natural flow or drainage shall occur at a number of points and that the accumulations at these points shall be conducted by natural or forced flow to a reservoir or reservoirs, whence the oil may be lifted as by pumping to the surface of the earth.

A further object of the invention is to accomplish the object referred to in an economical manner, and which does not involve any operations that are not already familiar in the petroleum industry and in general mining practice.

Other objects of the invention, more or less broad than those stated above, will be in part obvious and in part specifically referred to, and in the course of the following description of the elements, combinations, arrangements of parts and applications of principles constituting the invention; and the scope of protection contemplated will appear in the claims.

In the accompanying drawings, which are to be taken as a part of this specification, and in which I have shown more or less diagrammatically an arrangement of shafts, galleries, etc., which may be utilized in the practice of my method, Fig. 1 is a view as it would appear in plan of a system adapted for my process. Fig. 2 is a sectional view on a plane vertical to the earth's surface and including the subject matter of Fig. 1. Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1, slightly enlarged, and Fig. 4 is an enlarged sectional view illustrating the relation between the shaft, the upper-level gallery and lower-level gallery, the connecting galleries being shown in dotted lines.

Referring to the numerals of the drawings, there is shown at 5, an ordinary shaft which will be sunk either through the bed or near it. It is even preferable in order to obtain complete expulsion of the gas and for the sake of security to sink at once two shafts connected by airing galleries.

To simplify the drawings, there has been

shown but one shaft; the second one, with its galleries being constructed similarly to the first. The description refers only to one part of the mine, the second connected to the first by airing galleries will be identical to the first.

At its lower end the shaft opens into a gallery or galleries 6, communicating with a main upper-level gallery 7, this upper-level gallery 7 being connected at suitable intervals, by means of connecting galleries 8, with a lower-level main gallery 9. All of these galleries may be suitably shored up, as indicated by Fig. 4, and provision can be made for the drainage into them through their walls of oil which may drain or exude from the surrounding sands. Thus there may be shields 10 on the side walls to direct the oil into suitably located gutters 11 along the bottom and at the sides of each gallery. Since these galleries, both main galleries and connecting galleries are all inclined, and the gutters partake of the inclinations of their respective galleries, the oil will naturally flow to the low point or points of the system, two of such low points being indicated by the numeral 12. It will be understood that the main galleries 7 and 9, besides being on different general levels, are divided into sections, each section terminating at one of the connecting galleries, and the connecting galleries inclining downwardly from the main gallery 7 thus towards main gallery 9. The oil flowing from the main gallery 7 thus finds its way through the connecting galleries 8 into the lower main gallery 9 and to the low points 12 of main gallery 9, where suitable reservoirs may be provided whence the oil may be pumped through suitable pipes 14 to the surface.

To obtain these differences of level, the workings should be established in the direction of the layers using the dip of the strata for the connecting galleries. If the strata were not inclined but of sufficient thickness, the main gallery 7 should be driven into the upper part of the layer and the main gallery 9 on a lower level.

It will be understood of course that the sand when removed in excavating the various galleries etc. must be taken to the surface as the excavations proceed, and that as the drainage and removal of oil goes on the galleries and the cross-connections thereof may be extended as may be necessary or feasible.

My method depends upon the principle of drainage of the oil and upon the principle of expulsion of the gases. A small boring hole does not allow the emulsion or mixture of gas and oil to separate but the mixture remains enclosed in the minute pores of the porous bed. A single drainage gallery dug bodily into the petroleum carrying bed would up to a certain point facilitate the flow of oil but this method is impracticable for two reasons: The gas which might escape would render such work impossibe and further the incomplete evacuation of the gas would leave the emulsion intact in the interior of the bed and the yield of oil would be very slight. If, however, two galleries were located at different levels and connected with each other by transverse galleries, they would set up a double circulation in the petroleum carrying bed, the gas would rise up into the upper gallery and the oil flow into the lower gallery. Furthermore this arrangement alone permits of ventilating the mine. Owing to the powerful ventilators which must be provided in any mine where minerals, which are apt to liberate gas, are worked a powerful current of air will be produced in such net work of galleries. The object of this current is not alone to permit the workman to gain access to the galleries but also has for its effect to produce a suction of the gas lighter than itself and which is enclosed in the bed. This suction breaks up the emulsion or mixture formed by the two fluids. The gas is really expelled and the oil will flow off by gravity. The movement thus produced will gradually be communicated to the interior of the bed, the more so because the gas is still under a certain pressure at that point. To recapitulate, this process produces an effective expulsion of the gas by compelling it to move. This is a new application of previously known means, such as galleries at different levels, suction and expulsion of the gas by means of suitable ventilation and draining off of the oil.

An important feature of my method is in the fact that the stratum from which the oil is to be recovered is pierced by a network of galleries at sufficiently close intervals to insure at the same time the most effective drainage and ventilation; and of course the operation of the system depends fundamentally upon the proposition that the main galleries are on different general levels, that the main galleries consist of sections, adjacent sections inclining towards a common low point, and the low points of the upper main gallery being connected by inclined connecting galleries with the low points of the lower main gallery.

It will be evident that many variations and modifications are possible in the construction and development of the system described, without departing from the spirit of the invention, but the essentials are set forth in the appended claims. It will be apparent also that the sectional character of the system lends itself to the requirements of ventilation, fire protection etc.

I have not described how the system will be ventilated or guarded against fire. Any

usual or preferred means or methods may be employed for the safety and convenience of the persons employed in the work, and the excavations and other labor may be assisted by machinery as desired. Of course the greatest precautions must be taken against fire or explosions in the case of this system, because of the readily inflammable character of the petroleum.

I claim:

1. The method of recovering the residual oil contents of sands which no longer give up quantities of oil great enough to be worked advantageously by natural flow or direct pumping, which consists in expelling completely the gas and in draining the oil by driving drainage and ventilating galleries in the sand stratum on different general levels, with inclined connecting galleries between them, each upper level drainage gallery comprising an inclined section opening at its low point into a connecting gallery.

2. The method of recovering the residual oil contents of sands by expulsion of its gas contents which consists in providing a main upper drainage and ventilating gallery, a main lower drainage gallery, connecting galleries between the two main galleries and inclining from the one towards the other, and reservoirs supplied from the lower main drainage gallery, substantially as and for the purpose set forth.

3. A method of gas expulsion and oil drainage of the character set forth including the provision of an upper drainage gallery which comprises relatively inclined sections, inclined connecting galleries opening out of the sections of the upper main gallery at low points thereof, and a lower main gallery also composed of relatively inclined sections whose low points are in communication with the low points of the connecting galleries.

4. The method of recovering the residual oil contents of sands which no longer give up oil enough by natural flow or direct pumping, which consists in liberating the gas from the oil bearing sand and in draining the sand in situ into inclined drainage and ventilating channels piercing the sand.

5. The method of recovering the residual oil contents of sands which no longer give up oil enough by natural flow or direct pumping, which consists in liberating the gas from the oil bearing sand, draining the sand and taking the oil from the drainage channels into reservoirs located below the low points of the drainage channels.

6. The method of recovering the residual oil contents of sands which no longer give up oil enough by natural flow or direct pumping, which consists in liberating the gas from the oil bearing sand and in draining the sand in situ.

7. The method of recovering the residual oil contents of sands which no longer give up quantities of oil great enough to be worked advantageously by natural flow or direct pumping, which consists in expelling completely the gas and in draining the oil by driving drainage and ventilating galleries in the sand stratum on different general levels.

8. The method of recovering the residual oil contents of sands by expulsion of its gas contents which consists in providing a main upper drainage and ventilating gallery, a main lower drainage gallery, connecting galleries between the two main galleries, and reservoirs supplied from the lower main drainage gallery, substantially as and for the purpose set forth.

9. The method of recovering the residual oil contents of sands by expulsion of its gas contents which consists in providing a main upper drainage and ventilating gallery, a main lower drainage gallery and connecting galleries between the two main galleries.

In testimony whereof I affix my signature in presence of two witnesses.

PAUL DE CHAMBRIER.

Witnesses:

EDGAR FALLER,

CHARLES JEANNES.