Oct. 25, 1932. L. RANNEY 1,884,858

APPARATUS FOR SIMULTANEOUSLY CONTROLLING OIL MINE WELLS

Filed March 22, 1929 4 Sheets-Sheet 1

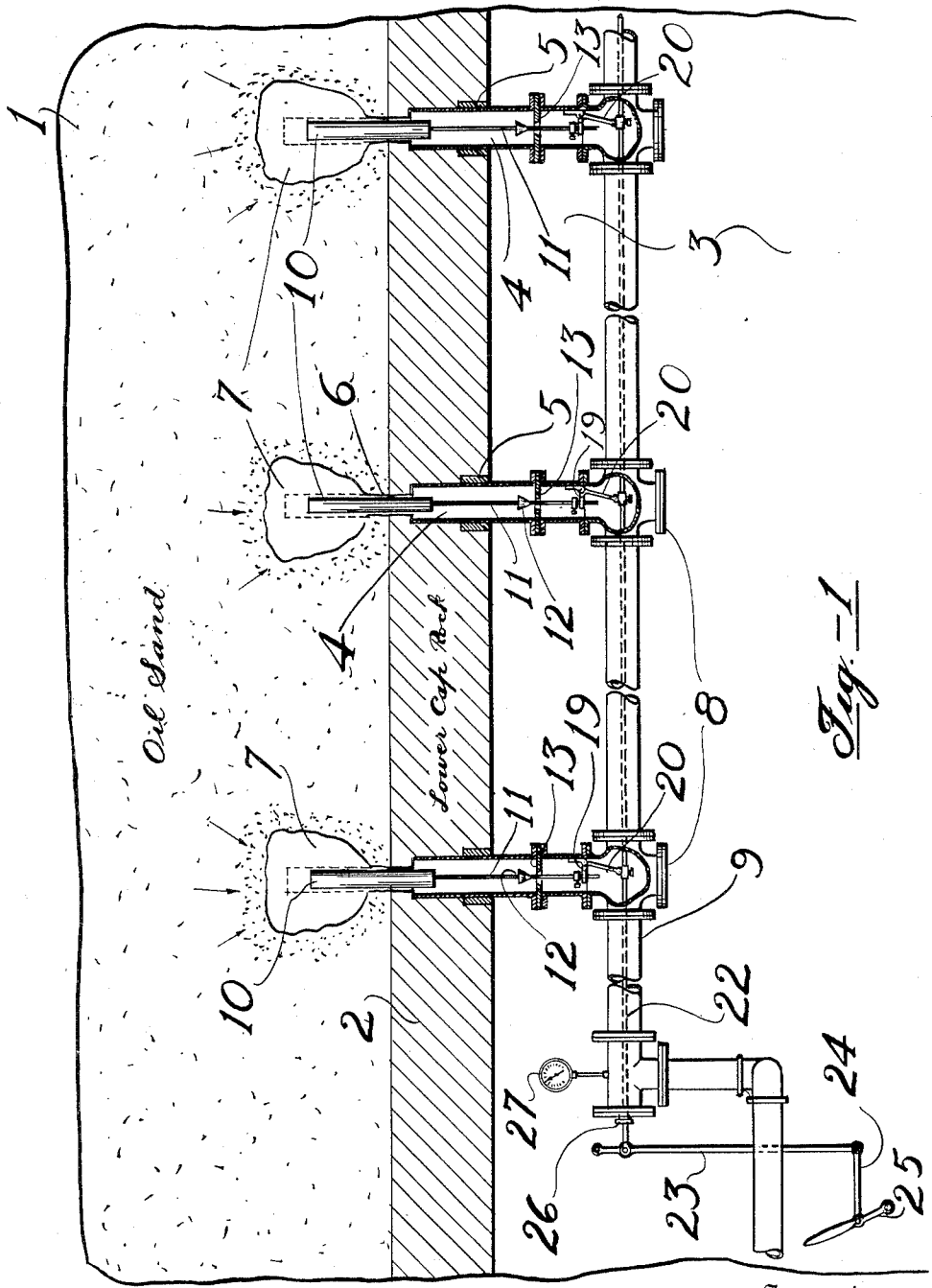


Fig. 1

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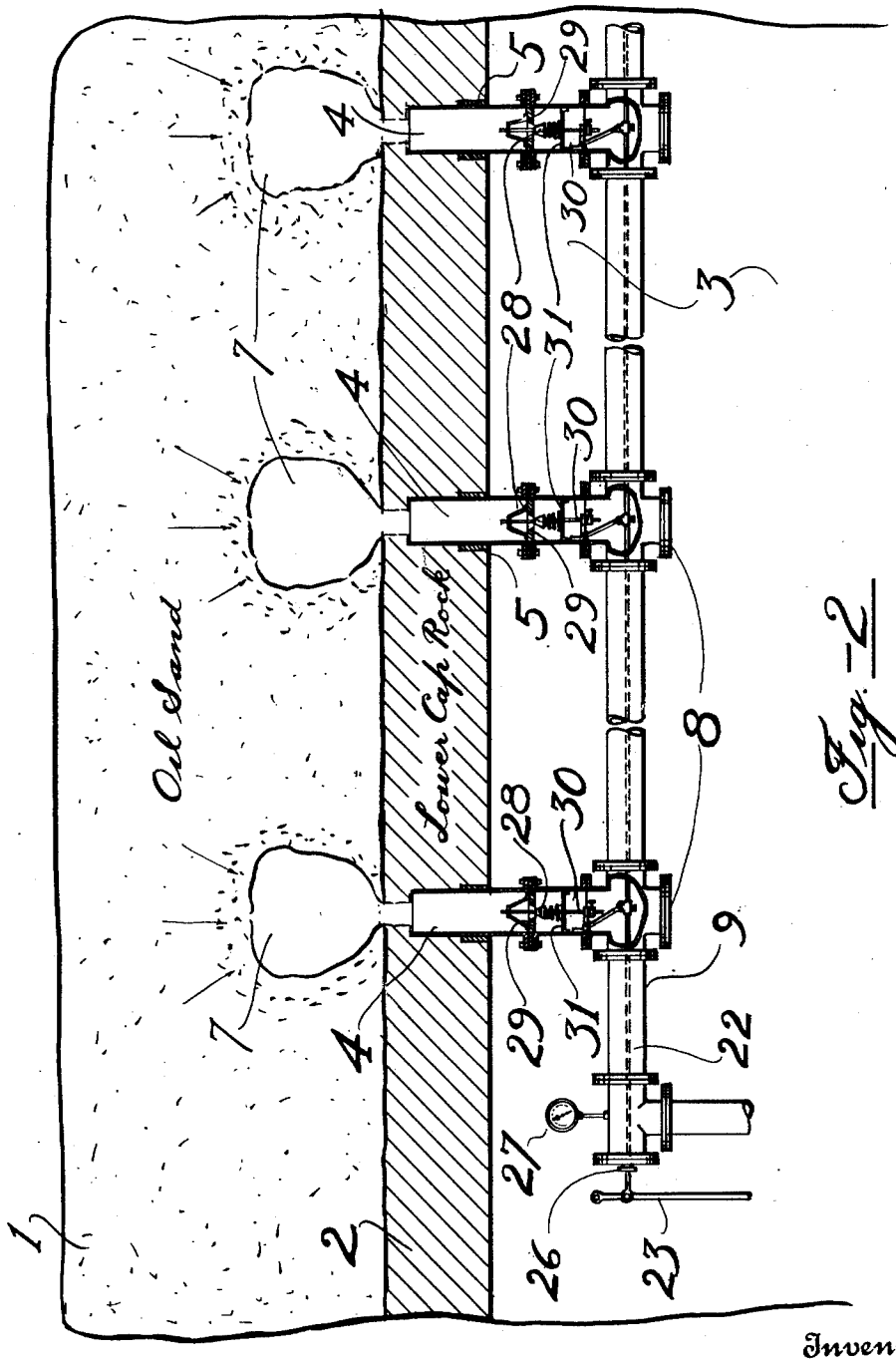


Fig. 2

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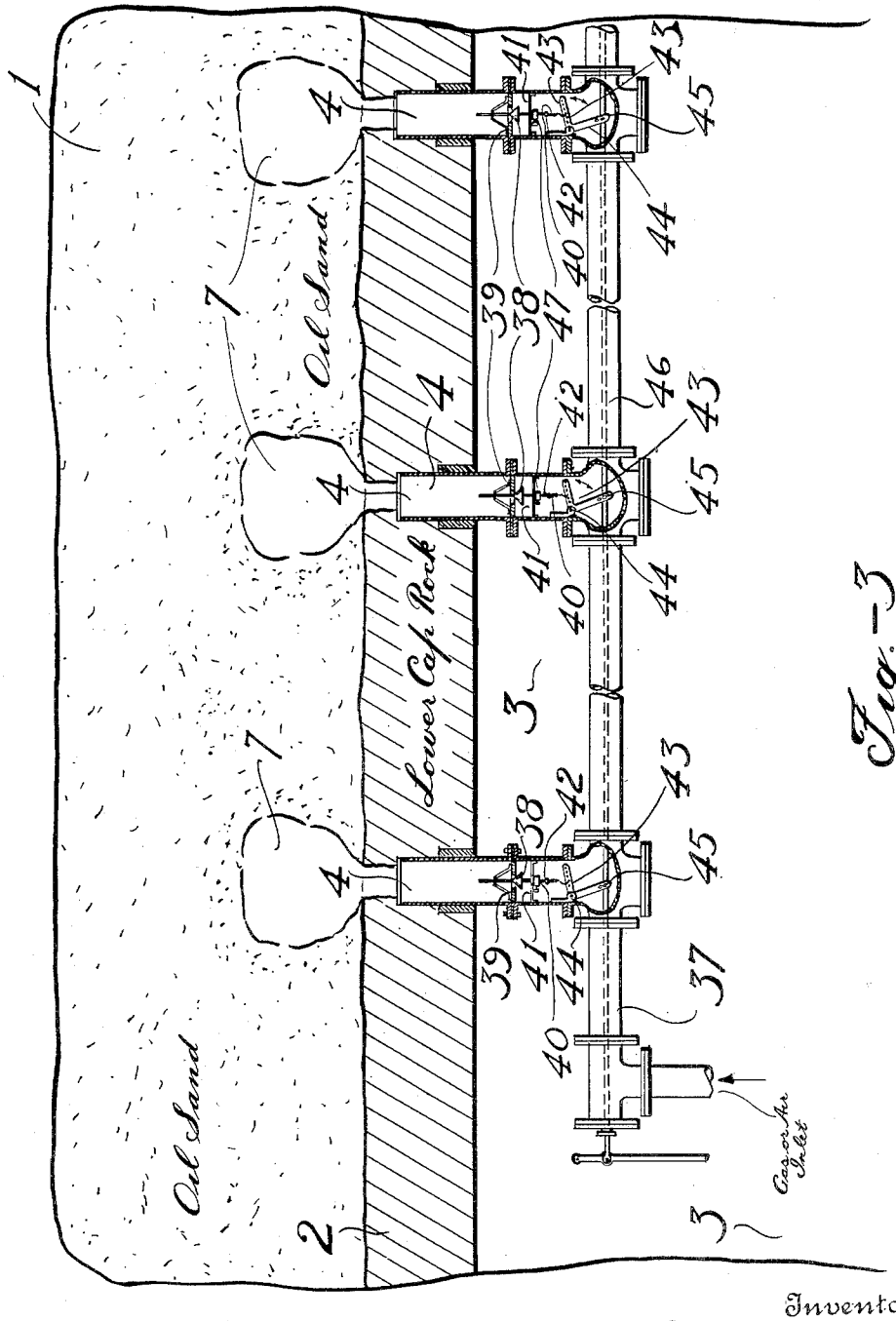


Fig. 3

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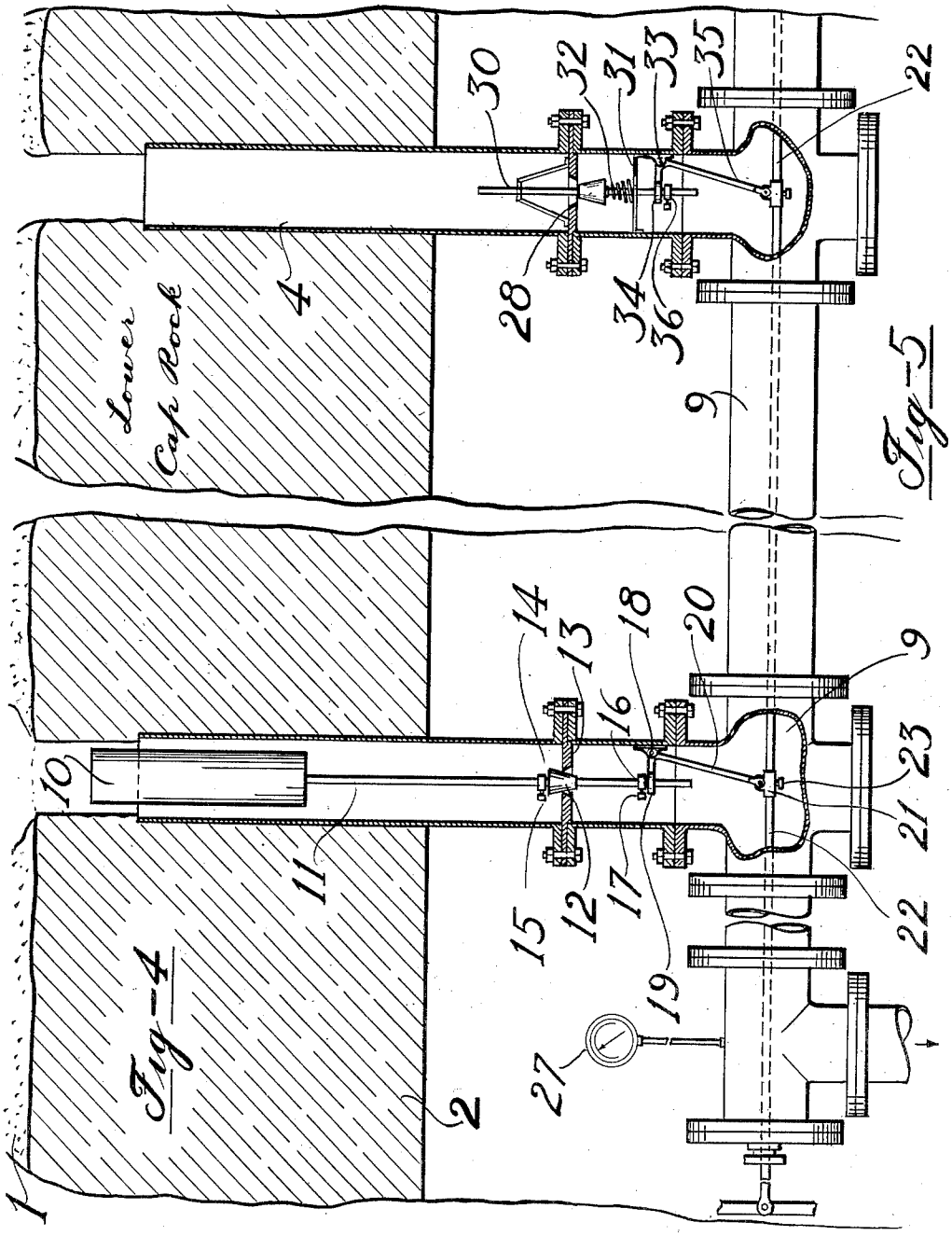


Fig-5

Fig-4

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UNITED STATES PATENT OFFICE

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APPARATUS FOR SIMULTANEOUSLY CONTROLLING OIL MINE WELLS

Application filed March 22, 1929. Serial No. 349,091.

This invention relates to improvements in the recovery of oil from the earth by mining methods of the general character described and claimed in my United States Patents Nos. 1,634,235 and 1,634,236 granted June 28, 1927; 1,660,818 granted February 28, 1928, and 1,667,269 granted April 24, 1928. A particular object of the present invention is to provide improved means for simultaneous valve control of a plurality of mine wells tapping an oil-sand. This control may be effected either as to the outflow of fluids from the wells or as to the intake of gas, air, or other fluid under pressure, or as to both intake and outflow. The intake is preferably regulated to secure the advance of the pressure fluid in a substantially straight line through the sand. Similarly, the outflow is regulated to cause a similar effect or to cooperate in causing it.

The invention will be fully understood from the following description read in connection with the accompanying drawings; in which

Fig. 1 is a diagrammatic vertical section through a portion of a mine gallery, showing means for controlling the outflow of oil and gas from the oil-sand;

Fig. 2 is a similar view showing means for controlling the outflow of gas from the sand;

Fig. 3 is a similar view showing means for controlling the intake of gas or other pressure fluid into the sand;

Fig. 4 is an enlarged vertical section through a mine well as illustrated in Fig. 1; and

Fig. 5 is a view similar to Fig. 4 showing a mine well of the kind embodied in the installation of Fig. 2.

Referring first to Fig. 1, reference numeral 1 denotes an oil-sand overlying a lower cap-rock 2, which is traversed by a mine gallery 3. This gallery is preferably run almost parallel to the plane of the sand and is everywhere spaced from it by a sufficient thickness of cap-rock to prevent access of fluids from the sand into the gallery. At numerous intervals along the gallery, bore holes directed toward the oil-sand are formed in the cap-rock. In these bore holes conduits 4 are seated and are preferably surrounded by sealing material 5 throughout at least a portion of their length. The conduits stop short of the oil-sand but after they are sealed in place, the bore hole is continued through them into the sand, as indicated at 6. It is desirable to ream out the opening about the point 6, to form an extended cavity 7. It will be understood that access is obtained to the sand through the lower arms of cross fittings 8 in the manner described in my patents referred to above.

Each of the conduits 4 is connected to an oil collecting line 9 which extends throughout the gallery. When the conduits are in place, valve control means is installed in each of them. This control means consists of a float 10 mounted on a stem 11 which carries a valve head 12. A valve seat 13 is set in the conduit.

As shown in more detail in Fig. 4, the valve head 12 is composed of a body part having a reduced neck 14. Both the valve and the neck are centrally perforated for slidable adjustment on the stem 11. A set screw 15 holds the valve in any desired position on the stem.

The opening in valve seat 13 is preferably beveled to present a rather sharp edge to the valve so as to prevent the retention of sand grains between the valve and its seat. The stem 11 extends downwardly through the valve seat and serves as a guide when the float is in the uppermost position. A collar 16 is mounted on the lower part of stem 11 by a set screw 17.

The means for positively actuating the valve comprises a hinge mounting 18 fastened to the wall of the conduit. Pivotally supported on this mounting is a bent arm having one branch 19 engaging the lower part of the valve stem and the other branch 20 extending downwardly into the collecting pipe 9. The branch 20 is pivotally mounted on the sleeve 21 secured to a rod 22 by a set screw 23.

As shown in Fig. 1, all the valve stems are similarly connected to the rod 22. This latter may be actuated by a lever connection 23, 24, 25 at a bend of the collecting pipe. Rod

22 passes through a stuffing box 26. A pressure gauge 27 is connected to the collecting line 9.

In the operation of this form of the invention the valve heads 12 are first set at the desired point on the stems 11. By this adjustment it is possible to cause the valve to open at any predetermined height of liquid in the conduits 4. When the liquid reaches this height the float rises, lifting the valve from its seat and the oil runs out until the float sinks and reseats the valve. Whenever it is desired to operate all the valves together the lever 25 is pulled to the left. This movement causes branch 19 to press against collar 16 and so lifts the whole valve and float assembly. Oil, gas or water may escape freely so long as the lever 25 is kept at the left hand position. In Fig. 1 the valves are shown open and the lever in its left hand position.

It will be understood that any selected number of mine wells may be operated simultaneously in the way described. In the operation of a square forty acre tract, for example, there will be about one hundred thirty-two mine wells in the gallery on each side of the tract. All the valves on one side may be easily actuated by a single rod 22 since there is ordinarily no excessive pressure holding the valves on their seats.

The valve head 12 may be adjusted in accordance with the character of the sand and the quantity of oil and gas present. In a porous streak in the sand the valve head will be set so as to obstruct the valve opening and permit no gas or only a small amount of gas to blow through normally with the oil. In tight sand the valve head will be set to allow the escape of more gas. Similarly when it is desirable to secure a differential effect in the outflow of oil in mine wells at various points in the gallery, the adjustment of the valve head 12 may be made to correspond with the conditions. If in any case there is a tendency of water to encroach upon mine wells which are permitted to flow too freely, the setting of the valve will be such as to permit only a slow drainage of oil from the sand.

The adjustment of the valve mechanism does not have to be made at frequent intervals and it is practical to disassemble the collecting pipe, which should be composed of easily assembled sections, in order to obtain access to the conduits 4.

One basic purpose of this method and apparatus is to create at all times the necessary differential of pressure between the sand adjacent to a mine well and the main body of sand to be worked. For example, it may be found in a particular case that the best flow of oil is secured when the pressure in a mine well is ten pounds less than at a distance of 50 feet from the mine well. In that case the mine well would be "blown" often enough to maintain approximately this differential.

In a porous sand of uniform texture substantially from top to bottom the controlled escape of oil from a mine well together with the force of gravity and the general field pressure may provide approximately enough pressure differential to cause oil to flow continuously through the sand towards the mine well. In that case mine wells would seldom be "blown". Pressure acts downwardly upon the body of oil in the sand as well as laterally in the region near the producing mine wells, but in cases where the sand is tight or where the sand is divided into more porous and less porous streaks, an air drive may be necessary to cause a satisfactory flow of oil. When an air drive is conducted the movement of the repressuring medium is substantially horizontal toward the producing mine wells.

To conduct such an air or gas drive, I allow the field pressure to be built up substantially, either by means of pressure wells drilled from the surface of the ground or by means of pressure mine wells drilled from a mine tunnel; then by simultaneously opening a series of valves along one side of a tract being worked I reduce the pressure along this side and cause a flow of oil and the pressure medium toward and through the producing mine wells. After this "blowing" has been stopped, in a few hours or days, depending upon sand conditions, the pressure differential which caused the flow of oil will disappear and that row of mine wells will have to be opened again to re-establish the necessary differential of pressure to cause a flow of oil.

By adjusting each float valve or spring valve to meet conditions in the immediate vicinity of any mine well, I am able to prevent a "fingering out" of the body of the repressure agent through a porous streak in the sand and thus prevent the by-passing of large bodies of oil in the sand. At the same time I am able to open a whole row of mine well valves simultaneously and cause the whole front of the bank of oil and pressure agent to move in a substantially straight line toward the row of producing mine wells. It will be understood that in "fingering out" a portion of the fluid advancing through the sand pervades an elongated area extending out from the main line of advance. Fluid may escape from such an area leaving large regions of the sand substantially unaffected; that is, it "by-passes" them through a porous streak.

Likewise, before injecting a pressure medium into the sand through a row of valve-controlled inlets, I adjust each individual valve according to the conditions in the sand at its mine well. Then when a series of inlet valves is opened in a tunnel along one side of

a tract being worked, the repressuring agent will move in a straight front toward a row of producing mine wells. The proper adjustment of each intake valve before a series of intake valves is opened prevents the "fingering out" of the advancing repressure agent and the consequent by-passing of oil.

Referring now to the form of installation shown in Figs. 2 and 5, the mine gallery 3 is as before formed in the cap-rock underlying the oil-sand and conduits 4 are set in the cap-rock. Here, however, the purpose is to secure control of the pressure prevailing in the sand by means of suitably adjusted spring-pressed valves. As shown, each of these comprises a head 28 cooperating with a valve seat 29. A stem 30 passes through the valve head and extends both above and below it. A spider or skeleton support 31 encircles the stem below the valve head and is rigidly mounted in the conduit. A coil spring 32 is fastened to support 31 and bears against the lower face of the valve head. By varying the position of the support with respect to the valve seat 28, the tension on the spring can be adjusted as desired.

As in Figs. 1 and 4, the means for actuating the valve comprises a hinged support 33 fastened to the wall of conduit 4, and arms 34 and 35 connected respectively to the valve stem and to the actuating rod 22 in collecting pipe 9. The arm 34 is slotted to permit it to move with respect to the valve stem.

In the operation of this form of the invention, the tension on the springs is adjusted in accordance with the pressure which is to be maintained in different areas of the oil-sand. For example, where there is a wide variation in the porosity of the sand it may be desirable to hold a high gas back-pressure on one region and a low gas back-pressure on another. This can be accomplished by adjusting the springs so that the valve will be unseated at the desired pressure.

When it is desired to freely vent the gas from all the mine wells or a considerable number of them at the same time, this can be done by moving the control rod 22 to the right in Fig. 5, to the left in Fig. 2. This causes the arm 34 to press downwardly upon a collar 36 secured by a set screw to the stem 30, and so depresses the valve head 28.

In the system shown in Fig. 3, means are provided for controlling the intake of gas or air into the oil-sand, when a repressuring operation is being carried on. In Fig. 3 a mine gallery 4 is run beneath the oil-sand as described above. A gas line 37 is laid in the gallery and connected to a suitable source of gas, air or other repressuring agent. In each of the conduits 4 there is a valve 38 cooperating with a valve seat 39. The valve has a stem 40 which is centered in the conduit by a spider 41. The lower end of the valve stem is connected by a chain and hook 42 to an arm 43 pivotally mounted at 44 on the wall of the conduit. An arm 45 integral with 43 is secured to a rod 46, by any suitable means cooperating with perforations in the arm. This has a suitable outside lever connection (not shown) similar to that illustrated in Fig. 1.

The arm 43, as well as arm 45, is perforated. This is done to provide means for adjusting the valve. The hook 42 may be engaged in any of the perforations on 43 and the rod 46 may be connected to any of the perforations in the arm 45.

An adjustable sleeve 47 is mounted on the stem 40. This sleeve may be set in the desired position to control the normal amount of gas admitted to the oil-sand. Whenever it is desired to introduce the full amount of repressuring agent into all the mine wells or a considerable number of them at the same time the control rod 46 is actuated to open all the valves wide.

It will be understood that the foregoing methods are applicable in general to oil mining methods and are not to be restricted to the particular operations referred to herein. 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 equipment for recovering oil from the earth by a mining method, the improvement which comprises a plurality of conduits affording access to the oil sand, a common line into which said conduits discharge, a float operated valve in each conduit adapted to vent oil when the oil level in the conduit reaches a predetermined height, and means having a common connection to all of the valves for simultaneously unseating the valves in a single operation.

2. In equipment for recovering oil from the earth by a mining method, the improvement which comprises a plurality of conduits opening into the oil sand, a common line into which said conduits discharge, flow operated valves in each conduit adapted to vent oil through the conduit when the oil level in the conduit reaches a predetermined height and means having a common connection to all of the valves for simultaneously opening the valves and closing the valves to their initial position.

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