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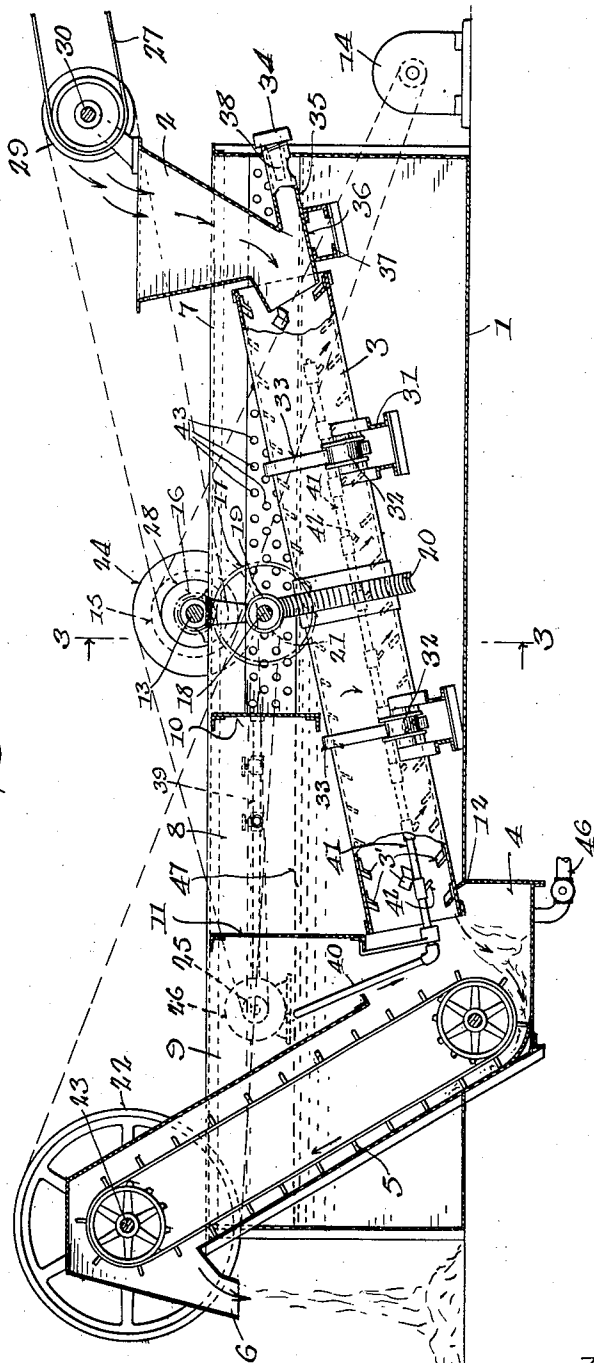
J. COOGAN

APPARATUS AND METHOD OF EXTRACTING THE PETROLEUM CONTENT FROM
PETROLEUM BEARING SAND OR SHALE

Filed April 16, 1920

2 Sheets-Sheet 1

Fig. 1.



Inventor
Jesse Coogan
By Erwin Wheeler & Woodland
Attorneys.

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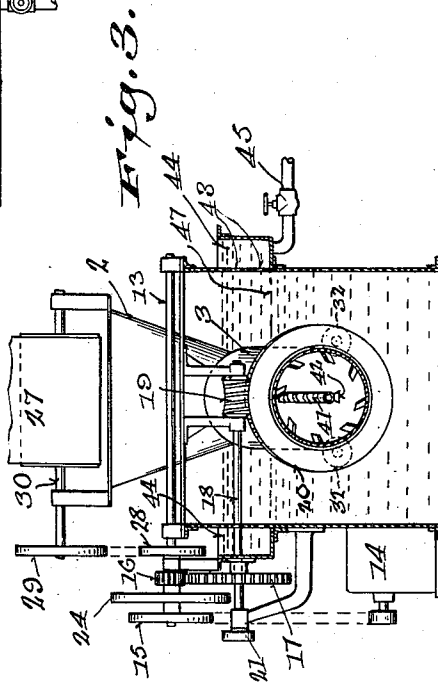
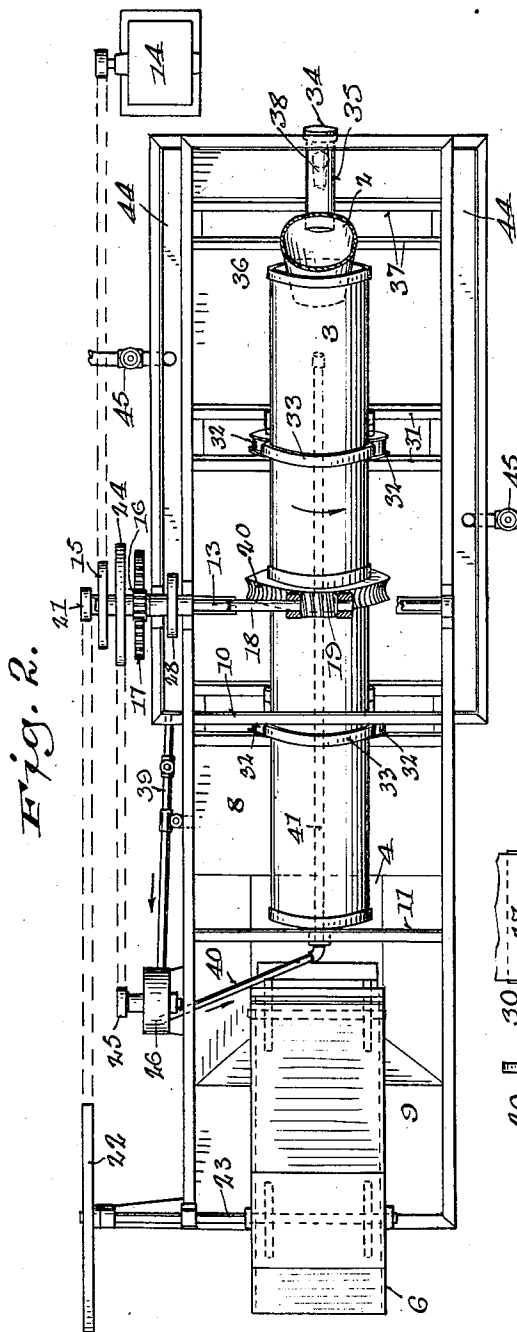
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Inventor
Jesse Coogan
By Edwin Miller & Woodard
Attorneys.

UNITED STATES PATENT OFFICE.

JESSE COOGAN, OF SALT LAKE CITY, UTAH.

APPARATUS AND METHOD OF EXTRACTING THE PETROLEUM CONTENT FROM
PETROLEUM-BEARING SAND OR SHALE.

Application filed April 16, 1920. Serial No. 374,323.

To all whom it may concern:

Be it known that I, JESSE COOGAN, a citizen of the United States, residing at Salt Lake City, county of Salt Lake, and State of Utah, have invented new and useful Improvements in Apparatus and Methods of Extracting the Petroleum Content from Petroleum-Bearing Sand or Shale, of which the following is a specification.

This invention relates to an apparatus and a method of extracting the petroleum or oil content from oil bearing sand or shale.

Objects of this invention are to provide an apparatus for continuously extracting petroleum from petroleum bearing sand; to provide an apparatus which will conserve the water used by such apparatus by continuously using the same over and over; to provide an apparatus in which the independent functions of the parts work synchronously, or in step, with each other; and to provide an apparatus constructed so that the parts are inter-dependent in their operation so as to avoid congestion of any part under operating conditions.

Other objects are to provide an apparatus of the above described class which is adapted to use water, the parts being so arranged that the muddy or soiled water is kept substantially separate from the remaining water; to provide means for segregating the oil in a compartment from which it may be drawn continuously during the operation of the machine either automatically or otherwise; to provide an apparatus wherein the addition of gasoline or other substances to aid in the extraction of the petroleum is not required in the normal operation of the machine; to provide a self-contained apparatus which may or may not be portable; to provide an apparatus which may be easily cleaned; and to provide an apparatus which may be readily and cheaply constructed.

Other objects are to provide a method of extracting the petroleum content from petroleum bearing sand or shale which is continuous in its operation; to provide a method in which the water used in the extraction of the petroleum is conserved; and to provide a method which is direct, simple and practical.

In the drawings:

Fig. 1 is a longitudinal sectional view of the apparatus.

Fig. 2 is a plan view thereof, and

Fig. 3 is a section on the line 3—3 of Fig. 1.

The method which I contemplate in my invention is to continuously agitate and mix petroleum bearing sand or shale with a solvent and with water to effect the separation of the petroleum from the sand and to continuously withdraw and separate the petroleum and sand.

The apparatus comprises a tank or container 1 which may, in portable installations, be made of sheet metal and in larger or fixed installation of concrete. A hopper 2 projects into this container and has its lower end extending into a rotary agitator 3 which is provided with angularly arranged blades 3' to pass the sand or shale there-through. From the rotary agitator, the sand or shale, which has been treated therein, is deposited in a sump 4 and is drawn therefrom by a conveyor 5 and discharged thru a chute 6. The tank is divided into three compartments 7, 8 and 9 by means of a relatively short partition 10 and a longer partition 11, the partition 11 conveniently extending downwardly to the bottom part of the tank and may be joined thereto at 12. An opening is provided in the partition 11 thru which the rotary agitator 3 projects.

The apparatus may conveniently be made with a main power shaft 13, driven by an electric motor 14 which may be belted to a pulley 15 mounted upon such shaft 13. The reduction gearings 16 and 17 operatively connect the shaft 13 with a worm shaft 18 upon which is mounted a worm 19. A worm wheel 20, in mesh with the worm 19, is rigidly fastened to the rotary agitator 3 and serves to rotate such agitator. A pulley 21 carried by the worm shaft 18 is belted to a larger pulley 22 mounted upon the driving shaft of the conveyor 5 and serves to impart a relatively slow rotary motion to the shaft 23 thereby causing a slow motion to be given the conveyor. A pulley 24 of relatively large size is mounted upon the shaft 13 and is belted to a smaller pulley 25 mounted upon the shaft of a centrifugal pump 26. The feeding conveyor 27 is operated by means of a pulley 28 mounted upon the shaft 13 and belted to a pulley 29 mounted upon the conveyor shaft 30. In this manner a single motor 14 may be used to drive the entire mechanism and the cessation of

the functioning of any of the parts cannot occur without a cessation of the functioning of all of the parts, whereby clogging of any individual part is avoided.

5 The centrifugal pump 26 is arranged to draw crude petroleum from the compartment 7 of the tank thru the pipe 39 and to force sufficient petroleum thru a pipe 40 and up a pipe 41 which latter pipe extends longitudinally of the rotary agitator and is provided at intervals with nozzles 42 which project the petroleum downwardly and cause an intimate commingling of this petroleum with the water and with the agitated sand. These nozzles 42 all extend towards the upper end of the rotary agitator 3 and project streams of petroleum outwardly and forwardly through the agitator, thereby causing a circulation of the mixture of water and petroleum upwardly thru the agitator towards its forward end. This circulation aids the petroleum separated from the sand in its outward travel towards the front end of the rotary agitator 3 and causes the separated petroleum to be discharged outwardly thru the forward end of the rotary agitator so that such petroleum will collect in the compartment 7 as indicated in the drawings.

30 The separated petroleum passes thru openings 43 adjacent the upper side edges of the compartment 7 and into longitudinally extending channels 44 from which it may be withdrawn continuously thru pipes 45 controlled by suitable valves.

The rotary agitator is conveniently supported upon channel irons 31 which extend across the entire tank and are secured at each side thereof. These channel irons 30 support rollers 32 which in turn rotatably support the rotary agitator 3. The rollers 32 are provided with flanges between which a projecting bearing surface 33, which is mounted upon the rotary agitator 3, is adapted to work. In this manner, the rotary agitator is freely supported so that it may revolve about its axis but is prevented from axial shifting.

In order to clean the device, particularly the rotary agitator, a removable cap 34 is mounted upon the outside of the end of the tank or container 1 and in approximate line with the lower inner surface of the rotary agitator. If desired, this cap may close simply an opening thru the end of the tank. However, it may be found desirable to have this cap close a tube or pipe 35 which projects into such tank and is carried upon a plate 36 which in turn is carried upon channel irons 37 extending across the tank. In this manner, a guide may be provided for a clean-out brush or rod or if so desired an injector nozzle 38 may be formed in the pipe 35 whereby water may be forced thru the nozzle 38 thereby entraining additional

water and causing a stream of considerable volume to pass axially along the agitator adjacent its lower inner periphery thereby effectively washing down any sediment into the sump 4.

The sump 4 may conveniently be drained by means of a pipe 46 under the control of a suitable valve. In this manner where water is available a ready flushing out of the apparatus may be accomplished by forcing a stream of water thru the nozzle 38 and finally draining the water thru the pipe 46. Even during such flushing the water need not be wasted as after settling it may be used again.

The operation of the apparatus is as follows:

The tank 1 is filled with water to the level 47 and a quantity of gasoline or crude petroleum is poured into compartment 7 to start the operation. Thereafter the motor 14 is started and sand or shale is dumped into the hopper 2 by the action of the conveyor 27 and discharged thru the layer of gasoline or crude petroleum in the compartment 7 and into the agitator 3. The rotary agitator 3 breaks the sand or shale up into finer particles by the action of the plates or baffles 3' and such baffles lift the sand or shale upwardly and allow it to fall downwardly thru the water and thru the petroleum which is being supplied such agitator thru the nozzles 42. In this manner, the sand is thoroughly and intimately mixed with the solvent petroleum and with the water and is washed and separated from the petroleum which it carried. The arrangement of the plates 3' is such that the sand is given an axial motion downwardly along the agitator. The petroleum which has become separated from the sand floats upwardly and outwardly, such upward and outward motion of the petroleum being aided by the current set up by the nozzles 42. It is to be understood that while the agitator is shown as inclined, it may be mounted horizontally if so desired, as the arrangement of the plates 3' and the nozzles 42 is such that a counterdirectional travel of the sand and separated petroleum is secured.

It will be noted that this process is continuous and that the water is used over and over again, the only loss of water being such as is caused by evaporation and such small quantity of water as is carried away by the moist sand, the motion of the conveyor 5 being sufficiently slow to allow any excess water to drain back into the compartment 9. If desired, the centrifugal pump may draw water from compartment 8 together with oil from compartment 7 or may draw either water or oil.

In the foregoing description of the embodiment of my invention illustrated in the

drawings, it is not my intention to limit the scope of my invention to the structure illustrated, the terms herein used being employed as words of description and not of limitation.

I claim:

1. The method of extracting petroleum from petroleum bearing sand or shale, which method comprises mixing the sand or shale with a solvent, feeding the mixture into a fluid of greater density than the solvent, agitating the mixture in such fluid, supplying additional solvent to the sand or shale while in the fluid, and allowing the petroleum to pass upwardly through the fluid during such agitation.

2. The method of extracting bituminous material from sand and the like, which method comprises the agitation of such sand in water, the injection into said water during such agitation of a petroleum solvent, whereby the petroleum in said sand will be floated to the surface of the water, and the re-circulation of a portion of the petroleum so floated through the sand in the course of its continued agitation.

3. The method of extracting petroleum from petroleum bearing sand or the like, which method comprises the delivery of such sand into a body of water, advancing such sand through such water, subjecting such sand to agitation in the course of its advance through the water, and the sub-surface injection into such sand of a petroleum solvent, whereby the petroleum in such sand will be freed and permitted to float to the surface of said water.

4. The method of extracting petroleum from petroleum bearing sand or shale, which method comprises the delivery of the sand or shale to a body of liquid in which petroleum is insoluble, the advance of said sand or shale through said liquid, the agitation of said sand or shale beneath the surface of said liquid, the sub-surface injection into said sand or shale of petroleum solvent, whereby the petroleum in said sand or shale is controlled and permitted to rise to the surface of said liquid, and the re-circulation of a portion of the petroleum so freed to a position for sub-surface contact with said sand or shale.

5. An apparatus, for extracting petroleum from petroleum bearing sand or shale, comprising a container for liquids, said container being divided into a plurality of compartments; an agitator and conveyor mounted within said container and below the liquid level, and having its forward end opening into one of said compartments, its body portion extending through an intermediate compartment, and its rear portion opening into a rear compartment; means for subjecting the submerged sand or shale to the action of a solvent for the petroleum

while said sand or shale is being agitated and conveyed through the liquid; said first mentioned compartment being adapted to receive the extracted petroleum; and means for removing the treated sand or shale from the rear compartment.

6. An apparatus, for extracting petroleum from petroleum bearing sand or shale, comprising a container for liquids, said container being divided into a forward and a rear compartment, an agitator mounted within said container below the liquid level, means for passing sand or shale into said agitator thru the forward compartment, means for operating said agitator to cause the sand or shale to travel longitudinally thereof into the rear compartment, means for subjecting the sand or shale while it is being agitated to the action of a solvent for the petroleum, means for removing the treated sand or shale from the rear compartment and means for re-circulating a portion of the petroleum freed by said solvent into contact with sand or shale in said agitator, whereby to use said portion as a solvent during the continued operation of said apparatus.

7. An apparatus, for extracting petroleum from petroleum bearing sand or shale, comprising a container, partitions extending across said container to divide it into a forward compartment to receive the separated petroleum, an intermediate compartment and a rear compartment, an agitator mounted beneath the level of a liquid within said container and arranged to convey sand or shale from the forward compartment thru the intermediate compartment, and to the rear compartment, means for drawing petroleum from the forward compartment and conveying said petroleum to the agitator while the agitator is in operation, and means for withdrawing the treated sand or shale from the rear compartment and allowing the liquids mixed therewith to drain into said container.

8. An apparatus for extracting petroleum from petroleum bearing sand or shale, said apparatus comprising a unitary agitator and conveyor for agitating the sand or shale in and conveying the same through water, liquid injecting means for injecting a solvent for the petroleum into the agitator and subjecting the sand or shale to the solvent while it is being agitated in the water, whereby the separated petroleum will rise upwardly through the water to the surface thereof and the sand or shale be conveyed toward the rear end of the agitator.

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

JESSE COOGAN.

Witnesses:

JOHN SANTORA,
ALICE T. SULLIVAN.