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APPARATUS FOR SEPARATING OIL FROM OIL SHALE, ETC

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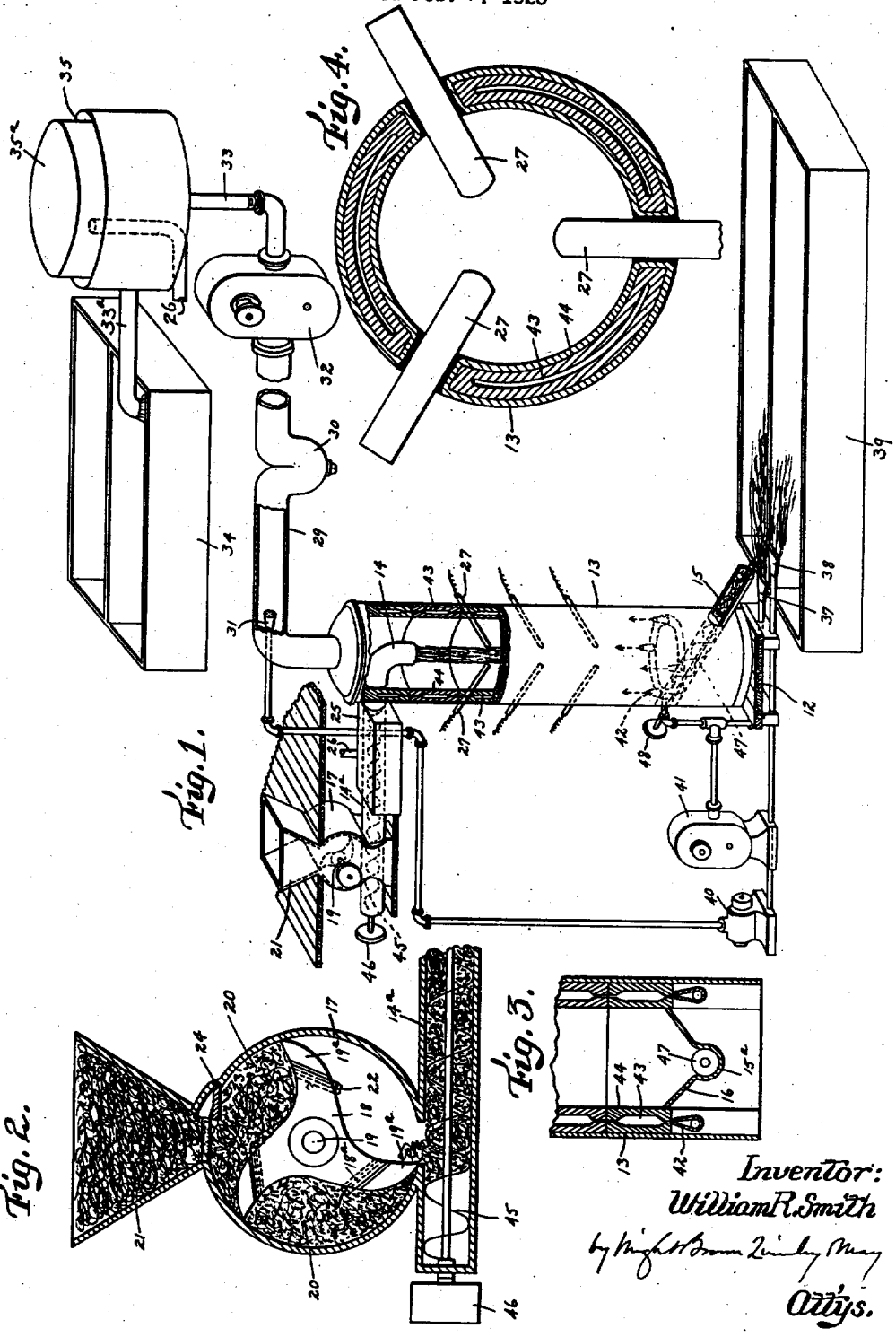


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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APPARATUS FOR SEPARATING OIL FROM OIL SHALE, ETC.

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To all whom it may concern:

Be it known that I, WILLIAM R. SMITH, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Apparatus for Separating Oil from Oil Shale, Etc., of which the following is a specification.

The object of this invention is to provide an efficient and economical apparatus for separating liquid hydrocarbons including oil from so called bituminous shale, and for separately collecting the hydrocarbons and the residual matter, which includes asphalt and mineral matter such as crushed shale, sand, etc.

It will be understood that the term "shale" as used herein, includes not only artificially crushed or pulverized shale rock, but also sand, which may be the product of the natural disintegration of such rock.

I accomplish the objects of the invention by the improvements hereinafter described and claimed.

Of the accompanying drawings forming a part of this specification,—

Figure 1 is a perspective view, showing an apparatus embodying the invention, a portion of the retort being shown in section.

Figure 2 is a sectional view, showing the air-excluding, shale-feeding means shown in perspective by Figure 1.

Figure 3 is a fragmentary vertical section, showing the lower portion of the retort.

Figure 4 is a cross section of the retort on a larger scale, showing the preferred arrangement of the electrodes.

The same reference characters indicate the same parts in all the figures.

Mounted on a suitable base or support 12 is a vertically elongated retort 13, preferably cylindrical in cross section. At the upper portion of the retort is a shale inlet 14, which is preferably the downwardly bent inner end of a conduit 14^a. At the lower end is an outlet 15, for residual matter, such as a mixture of asphalt and crushed mineral remaining after the volatilization of the liquid matter originally contained in the shale, said outlet being preferably one end of a semicircular spout 15^a formed in a bottom 16 (Figure 3), closing the lower end of the retort, as shown by Figure 3.

Shale prepared for treatment by the apparatus is introduced through the inlet 14 by air-excluding feeding means, organized to prevent the entrance into the retort through said inlet of sufficient air to support combustion in the retort, said means being preferably embodied in a substantially cylindrical chute 17, communicating with the conduit 14^a, and a rotary air-excluding gate 18 mounted on a shaft 19, and extending across the chute, said gate having curved wings 19^a and forming pockets 20 adapted to deliver charges of shale from the chute to the conduit. A hopper 21 provides an entrance to the chute. The outer ends of the wings are in close rubbing contact with the cylindrical internal surface of the chute, and their arrangement is such that shale cannot pass from the hopper to the conduit 14^a when the gate is at rest, and air cannot pass from the hopper to the conduit when the gate is rotating, the charges of material in the pockets 20 forming moving air-excluding plugs.

To minimize and compensate for wear, I form the wings 19^a separately from the body of the gate, and preferably make the wings of hardened steel, or other material harder than the body. I also make the wings radially adjustable, so that they may be adjusted outward as occasion may require, each wing having a flat base, movable on a tangential seat 18^a on the body and adjustable thereon by a tangentially arranged adjusting screw 22, so engaged with the body and the wing that rotation of the screw adjusts the wing, either inward or outward. The chute 17 is preferably provided with a scraper 23, pivoted at 24, and adapted to bear yieldingly on the wings 19^a and prevent the accumulation of material thereon.

The conduit 14^a may be externally heated by heating means embodied in a casing 25, surrounding a portion of the conduit and burners within the casing supplied with gas by a pipe 26.

The retort is provided with heating means, located in the path of material falling from the inlet 14, and preferably embodied in carbon electrodes 27, connected with a source of electrical energy, and adapted to form arcs whereby a temperature of approximately 800° F. may be produced within the retort.

The oil contained in the falling shale is thus subjected to destructive distillation, and volatilized before reaching the bottom 16. 29 represents a horizontally elongated condensing conduit, connected with the up-

per end of the retort, and preferably provided with a series of water-sealed traps 30. A water-delivering nozzle 31 entering the condensing conduit at a point adjacent to the retort delivers a jet or jets of water, whereby the volatilized oil is condensed.

32 represents a pump connected with the outer end of the condensing conduit, and adapted to continuously exert suction in the retort and in said conduit, and thus draw the volatilized oil into the conduit and the condensed oil therefrom, the discharge port of the pump being provided with a conduit 33, adapted to discharge the oil.

A gasometer indicated as a whole at 35, may be interposed between a pump 32 and the collecting tank 34. The oil passes from the fixed element of the gasometer to the tank 34, through a conduit 33ª. Any uncondensed gas passing through the pump may be collected by the floating bell 35ª of the gasometer, and conveyed therefrom by a pipe 26 to supply the burners in the casing 25, or for other purposes.

The residual matter forms a moving plug in the outlet 15, preventing the admission of air to the retort through said outlet.

It will now be seen that distillation takes place in the retort without liability of combustion, or partial combustion of the volatilized matter.

The residual matter including the asphalt base, and the powdered mineral matter emerging from the outlet 15, may be separated into its component parts by an air nozzle 37, and a water nozzle 38, located one above the other under the outlet, and discharging jets of water and air against the stream of residual matter over a tank 39. The air jet separates the asphalt base from the mineral matter, and the water jet effects further separation.

The nozzles 31 and 38 may be supplied with water under suitable pressure by a pump 40. The air nozzle 37 may be supplied with air under pressure, by a pump or blower 41, which may also supply air through nozzles 42, to air passages 43, in the fire-brick lining 44 of the retort, to protect said lining.

The conduit 14ª may be provided with a screw conveyor 45, driven by a pulley 46.

The spout 15ª may be provided with a screw conveyor 47, driven by a pulley 48.

I claim:

1. An apparatus for separating oil from oil shale, comprising, in combination, a vertical retort having an inlet for crushed material at its upper end, and an outlet for residuum at the lower end, air-excluding feeding means for delivering material to said inlet, and permitting the material to fall in a vertical stream through the retort, the said outlet being formed to deliver residual matter in the form of a moving plug, which prevents the entrance of air into the retort through the outlet, heating means within the retort in the path of said stream, organized to act on the falling material and cause destructive distillation thereof, a condensing conduit for the volatilized products of distillation, communicating with the upper end of the retort, means for condensing the volatilized products in said conduit, and a pump connected with the conduit, and adapted to maintain a constant suction in the retort and the conduit, and to force the condensate to a receptacle.

2. An apparatus substantially as specified by claim 1, the said feeding means including a substantially cylindrical chute, communicating with the inlet, a rotary air-excluding gate located in the chute and extending across the same, said gate having curved wings forming pockets, adapted to deliver charges of material from the chute, and a conduit communicating with the chute, and having a discharge end located in the retort and constituting the retort inlet, the charges in said pockets forming plugs which prevent the introduction of air through said inlet into the retort.

3. An apparatus substantially as specified by claim 1, the said feeding means including a substantially cylindrical chute, communicating with the inlet, a rotary air-excluding gate located in the chute and extending across the same, said gate having curved wings forming pockets, adapted to deliver charges of material from the chute, and a conduit communicating with the chute, and having a discharge end located in the retort and constituting the retort inlet, the charges in said pockets forming plugs which prevent the introduction of air through said inlet into the retort, the chute being provided with a pivoted scraper adapted to bear yieldingly on said wings.

4. An apparatus substantially as specified by claim 1, the said feeding means including a substantially cylindrical chute, communicating with the inlet, a rotary air-excluding gate located in the chute and extending across the same, said gate having curved wings forming pockets, adapted to deliver charges of material from the chute, and a conduit communicating with the chute, and having a discharge end located in the retort and constituting the retort inlet, the charges in said pockets forming plugs which prevent the introduction of air through said inlet into the retort, said wings having hardened nose pieces contacting with the interior of the chute, and radially adjustable to compensate for wear and maintain air-excluding contact between the wings and the chute.

5. An apparatus substantially as specified by claim 1, the said feeding means including a substantially cylindrical chute, com-

municating with the inlet, a rotary air-excluding gate located in the chute and extending across the same, said gate having curved wings forming pockets, adapted to deliver charges of material from the chute, a conduit communicating with the chute, and having a discharge end located in the retort and constituting the retort inlet, the charges in said pockets forming plugs which prevent the introduction of air through said inlet into the retort, and means for heating said conduit.

6. An apparatus substantially as specified by claim 1, the said feeding means including a substantially cylindrical chute, communicating with the inlet, a rotary air-excluding gate located in the chute and extending across the same, said gate having curved wings forming pockets, adapted to deliver charges of material from the chute, a conduit communicating with the chute, and having a discharge end located in the retort and constituting the retort inlet, the charges in said pockets forming plugs which prevent the introduction of air through said inlet into the retort, and a conveyor adapted to force material through the retort inlet.

7. An apparatus substantially as specified by claim 1, the said feeding means including a substantially cylindrical chute, communicating with the inlet, a rotary air-excluding gate located in the chute and extending across the same, said gate having curved wings forming pockets, adapted to deliver charges of material from the chute, a conduit communicating with the chute, and having a discharge end located in the retort and constituting the retort inlet, the charges in said pockets forming plugs which prevent the introduction of air through said inlet into the retort, and a conveyor adapted to force material through the retort outlet.

8. An apparatus substantially as specified by claim 1, said heating means being embodied in carbon electrodes projecting into the retort and adapted to produce heat sufficient to volatilize the oil in the falling material.

9. An apparatus substantially as specified by claim 1, comprising also means for separating the ingredients of residual matter discharged through the said retort outlet.

10. An apparatus substantially as specified by claim 1, comprising also a horizontal water-holding tank arranged to receive residual matter discharged through said retort outlet, an air-discharging nozzle, and a water-discharging nozzle, said nozzles being arranged between the retort outlet and the tank, to horizontally direct a water jet and an air jet against a stream delivered by said outlet, means being provided for forcing water and air through said nozzles.

11. An apparatus substantially as specified by claim 1, said condensing conduit being horizontally elongated and provided with a series of water-sealed traps between the retort and the pump, and with a water-delivering nozzle adjacent to the retort, means being provided for forcing water through said nozzle.

12. An apparatus substantially as specified by claim 1, the retort being provided with a refractory lining, containing air passages, and the apparatus comprising means for forcing air through said passages to protect the lining.

13. An apparatus substantially as specified by claim 1, comprising also an oil-collecting tank, arranged to receive oil from said pump, and a gasometer interposed between the tank and the pump, and adapted to receive gas passing through the pump.

In testimony whereof I have affixed my signature.

WILLIAM R. SMITH.