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RETORT FOR THE TREATMENT OF OIL SHALES, BITUMENS, HYDROCARBONS, AND OTHER ELEMENTS

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Fig. 8.

Fig. 9.

Fig. 12.

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My invention relates to improvements in retorts for the treatment of oil shales, and solid bituminous materials.

The object of the invention is to provide a vertical retort in which a plurality of streams of finely ground shale are fed continuously into the upper end thereof and pass gradually to the lower end thereof, said shale being subjected to a continuously increasing temperature whereby the oil therein is released in the form of vapor which passes off to suitable condensing means, means being provided for carrying off the treated shale or waste from the lower end of the retort.

Further, to provide a vertical retort having a plurality of vertically disposed zigzag shale conveying chutes upon the inner face of its wall, which extend from the top to the bottom thereof, said retort being surrounded by an annular heat passage, whereby the entire surface of the retort is subjected to a uniform temperature, means being provided for deflecting the heat in the retort toward the wall thereof so that the shale as it passes down the zig-zag chutes is subjected to a high temperature, throughout its descent, heating means being provided beneath the lower end of said retort.

These objects are accomplished by the apparatus illustrated in the accompanying drawings in which:

Fig. 1 is a vertical sectional view through the improved retort, only one of the zigzag chutes being shown therein, and the axial heat deflecting element being shown in dotted lines.

Fig. 2 is a longitudinal sectional view through the feed hopper and its rotary discharging member.

Fig. 3 is a transverse sectional view of the same, slightly enlarged.

Fig. 4 is a plan view of the retort, the feed hopper, and feed pipes connecting the same with the top of the retort.

Fig. 5 is a plan view of the retort proper, the cover or cap being removed.

Fig. 6 is a bottom view of Fig. 5.

Fig. 7 is a side view of the base member of the retort.

Fig. 8 is a plan view of the base plate which supports the retort.

Fig. 9 is a diagrammatical sectional view illustrating a portion of the retort as it would appear if spread out flat, in order to more clearly illustrate the arrangement of the zig-zag chutes.

Fig. 10 is a transverse sectional view of the rotary valve and its support for discharging the shale from the lower end of the retort.

Fig. 11 is a horizontal sectional view of the same, the valve being in elevation, and Fig. 12 is a plan view of one of the zigzag chute members showing more clearly the inclined ruffles on the bottom thereof for deflecting the shale toward the inner side of the said member.

Referring to the accompanying drawings: The numeral 1 indicates a hollow cylindrical brick structure of suitable height and diameter which incloses the retort proper to be hereinafter described, and which will hereinafter be termed a stack. An opening or doorway 2 is formed in the lower end or foundation portion of the stack and an iron base plate 3 rests upon the foundation, the remaining portion of the stack resting upon the said base plate, as shown by Fig. 1. This base plate 3 has a central hole 4 which is surrounded by a depending threaded hub 5, the purpose of which will later appear. The retort 6 rests upon and is supported by the base plate 3, and this retort is in the form of a hollow metal cylinder of less diameter than the interior of the stack, so that a flue space 7 is formed between the retort and the stack. The lower end of the retort has welded thereto a conical bottom 8, having a short central outlet tube 9 which rests upon the base plate 3, and registers with the hole 4 therein, and integrally connected with the tube 9 and bottom 8 are four radial legs 10 in the form of plates which also rest upon the base plate 3 and form an additional support for the retort. The bottom 8 is faced on its under side with plate sections 8A which lie between the legs 10, and are formed at each end with narrow flanges 8B,
which are bolted, or riveted to the legs as clearly shown in Figures 6 and 7. The plate sections protect the bottom of the retort from the direct heat of the burners, to be later described, and when burnt out can be removed and replaced with others. The legs 10 are preferably formed with holes 10A as shown, which prevent warping of the legs under the action of the heat. The end of the outlet tube 9 rests in a circular groove 11 in the base plate 3, and the lower ends of the legs 10 also rest in corresponding slots 12 in the said base plate, which radiate from the groove 11, as shown in Fig. 8, and this arrangement centers the retort with respect to the central hole in the base plate, and also prevents sideways movement of the retort upon the base plates. The retort reaches to the top of the stack and its upper end is closed by a conical cap 13, which is preferably welded thereto. The top of the stack is also closed by a conical cap 14 which is spaced from the cap 13 and the cap 14 has a central outlet pipe or chimney 15.

Upon the inner face of the retort are secured a series of vertically disposed chutes A which are adapted to convey the ground shale gradually from the top of the retort to the lower end thereof, and discharge it upon the bottom plate 8, and these chutes are constructed and arranged as follows:

There are preferably twelve of these chutes and each chute is made up of a plurality of connected troughs or channel-like sections 16 which incline downwardly in opposite directions, the discharge end of one section connecting with the receiving end of the next succeeding section, thereby forming a zig-zag chute as clearly shown in Fig. 1, and in the diagrammatic view Fig. 9. These sections are curved to conform to the curvature of the wall of the retort and are secured to the retort by bolts or rivets 17 which pass through the wall of the retort and through the adjoining side of the section 16. The sections of each chute extend in between the sections of the adjoining chutes in the manner shown in Fig. 9, thus permitting the employment of a greater number of chutes than would otherwise be the case, and the chute sections or troughs are placed at such an inclination that the shale, in its passage through the chute, will have a heat exposure of a sufficient period before it discharges from the bottom of the chute.

In order to prevent the shale in its descent from hugging the outer side of the chute sections, the bottom of each chute section is formed with inclined rilles or corrugations 18, as shown in Fig. 13, which deflect the shale toward the inner side of the section as will be understood.

Extending through the cap 14 of the retort and through the cap 14 of the stack are six feed pipes 19 and each of these pipes terminates in a two part or yoke shaped pipe 20, which is coupled thereto, so that each yoke shaped pipe is arranged to supply two chutes as shown. The upper ends of the feed pipes 19 are connected to a chamber 21 which forms part of a semi-cylindrical casting 22 which is bolted to a similar casting 23, which is secured upon the bottom of a feed hopper 24. The castings 22 and 23, together form a cylindrical housing in which is fitted a tube 25, having an opening 26 which communicates with the hopper and an opposite opening 27 which communicates with the chamber 21. The tube 25 is clamped between the castings 22 and 23, and is held against movement by set screws 28 which extend through the castings and into the tube. The opposite ends of the castings form bearings 29 as shown in Fig. 2, in which are mounted the ends of a rotary valve or feeder 30, the main portion of which fits snugly in the tube 25.

The rotary valve 30 is provided with four longitudinal pockets 31 and one of its ends is reduced to form a stub shaft 32 upon which is rigidly mounted a power wheel, preferably a sprocket wheel 33, which is adapted to be connected with a power source. As the valve 30 rotates shaft from the hopper provides the pockets 31 in the said valve and is deposited in the chamber 21, whence it passes through the feed pipes 19 and 20 to the several chutes A.

The ends of the valve 30 are provided with packing rings and the valve is held against endwise movement, by a screw 35, which passes through one of the bearings 29, and into an annular groove 36 in the said valve.

Upon the threaded hub 5 of the base plate 3 is screwed a coupling ring 37, in which is screwed the neck 38 of a valve block 39, in which is rotationally mounted a rotary plug 40 provided in its surface with pockets 41, three being shown in Fig. 10. The block 39 has a vertical outlet passage 42 extending through the same, which intersects the aperture in which the rotary plug 40 turns, and one end portion of the plug is reduced in diameter to form a stub shaft 43, on which is rigidly mounted a driven wheel, preferably a sprocket wheel 44, which is adapted to be connected by a chain to a power source, an opening 45 being formed through the wall of the plug in line with the wheel 44, to accommodate such chain. The treated shale or other material which discharges from the zig-zag chutes A falls on the conical bottom 8 of the retort and passes thence through the outlet tube 9 and passage 42 to the pockets 41 in the rotary plug 40, which continuously discharges the material into a suitable conveyor 46, which is located below the outlet in the valve block 39 as shown.
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5 which extend to the wall of the retort. Upon this pipe is secured a number of circular deflections 58, which are adapted to throw the heat outward toward the wall of the retort. The pipe 55 and its defectors thus form a heat resisting and deflecting medium extending throughout the length of the retort whereby the heat in the retort is deflected from the center thereof outward in all directions so that the material passing down the chutes A is subjected to the full force of the heat both within and surrounding the retort. A gas outlet pipe 60 extends from the cap of the retort out through the stack cap 14, and carries off the gases liberated from the material passing through the retort. Inlet holes 61 are formed in the stack to admit air to the oil burners.

In operation, finely ground oil bearing shale or other oil bearing material is supplied to the hopper 24, and is carried thence by the rotary feed valve 30 to the chamber 21 whence it is conveyed by the pipes 19 and 20 to the upper ends of the zig-zag chutes A, and there begins a gradual descent to the bottom of the retort. During its passage through the retort the material is subjected to a continuously increasing temperature and the gases therein are liberated and pass off through the pipe 60 to condensation.

The treated material discharges through the outlet 9 in the bottom of the retort into the valve block 39, whence it is delivered to the conveyor 46 by the rotary pocketed plug valve 40.

While I have shown a cylindrical retort and a corresponding surrounding structure, my invention contemplates a retort which is rectangular or any other desired shape.

The opening 2 in the foundation portion of the structure permits access to the interior of the structure below the base plate 3, in order that proper attention may be given the oil burners and the valve block 39.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. An apparatus for the treatment of oil bearing shales and other materials comprising a structure in the form of a stack, a base plate in the lower portion of said stack, having a central opening, a vertically disposed retort in said stack having supports on its bottom which rest on said base plate and a tubular outlet registering with the opening in said base plate, a plurality of vertically disposed chutes in said retort for gradually conveying material from the top to the bottom thereof, means for supplying material to said chutes, a valve block secured to the under side of said base plate, a rotary pocketed valve in said block for receiving and discharging treated material from the retort, heating elements in the base plate, a flue space being left between the retort and the...
stack, and a gas outlet pipe in the top of the retort.

2. A cylindrical retort for the treatment of oil bearing shales and other materials, having a conical bottom provided with a central outlet aperture, a plurality of vertically disposed chutes in said retort each comprising a series of connected channel-like sections arranged in zig-zag order and secured to the wall of the retort, means extending through the top of the retort for supplying material to said chutes, means for discharging the residue from the bottom of said retort, means for deflecting the heated gases in said retort outward towards the wall thereof, and means for heating the retort, and a gas outlet extending from the top of the retort.

3. The combination with a retort for the treatment of oil bearing shales and other materials, having a plurality of chutes for gradually conveying material from the top to the bottom thereof and means for heating said retort, of means for supplying material to said chutes, comprising a hopper, a member on the bottom of said hopper having a rotary pocketed feed valve therein and a chamber below said valve, feed pipes connected at one end to said chamber, their opposite ends extending through the top of said retort in feeding relative to said chutes, rotary pocketed means for discharging the residue from the bottom of the retort, and a gas outlet pipe in the top of the retort.

4. The combination with a stack having a base plate; of a retort in said stack having a conical bottom provided with a tubular outlet, having radial supports integrally connected to said tubular outlet and said bottom and extending to the lower edge of said outlet, said radial supports resting upon said base plate; of plates disposed between said radial supports and bearing, against said bottom and having bolt flanges on their ends which are secured to said supports.

5. In an apparatus for the treatment of oil bearing shales and other materials, the combination with a vertically disposed cylindrical retort having a series of vertically disposed zig-zag chutes therein secured to its wall, and means for heating said retort, a heat deflecting element in said retort, comprising a central pipe extending the length of the retort and having a heat resisting filling, means for supporting said pipe, horizontal heat deflecting elements thereon, means for supplying material to said chutes and means for receiving and discharging the residue from the bottom of the retort, and a gas outlet pipe in the top of the retort.

6. In apparatus of the character described, a stacklike structure, a base plate in the lower portion of said structure having a central opening surrounded by a depend-