June 9, 1925.

1,541,404

B. H. SMITH

RETORT.

Filed Nov. 26, 1921

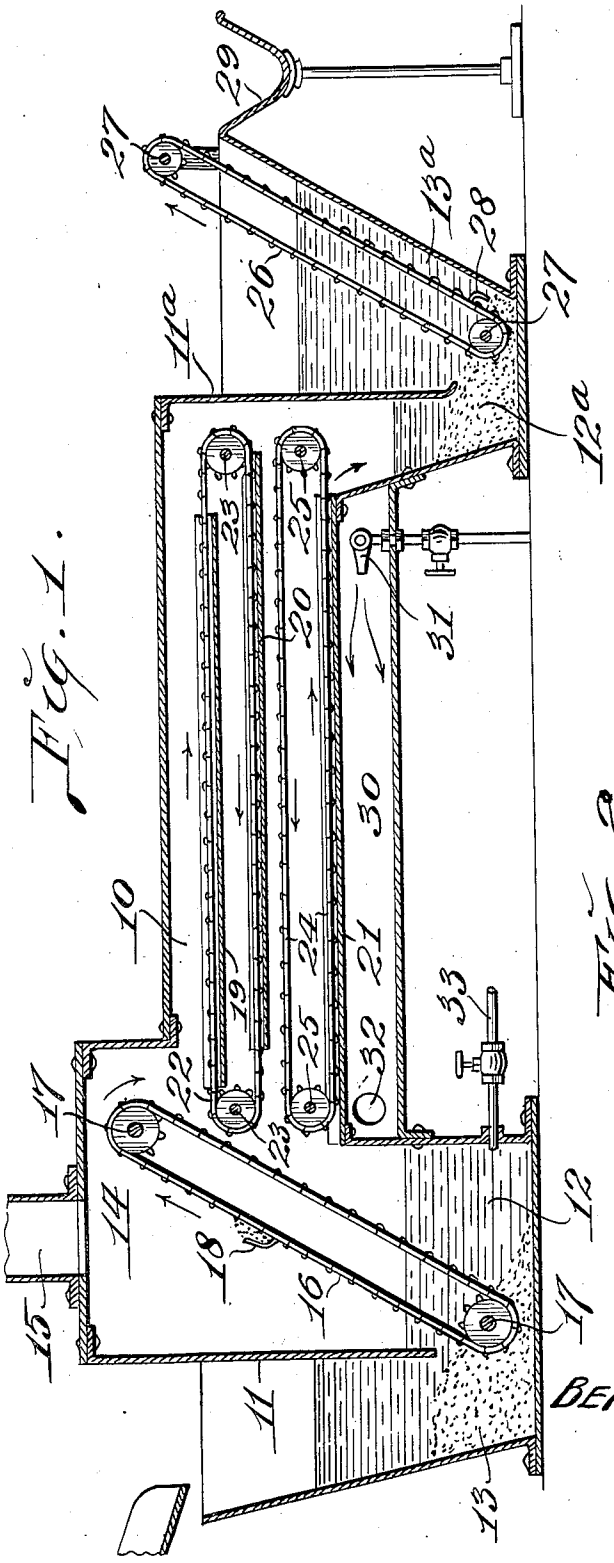

FIG. 1.

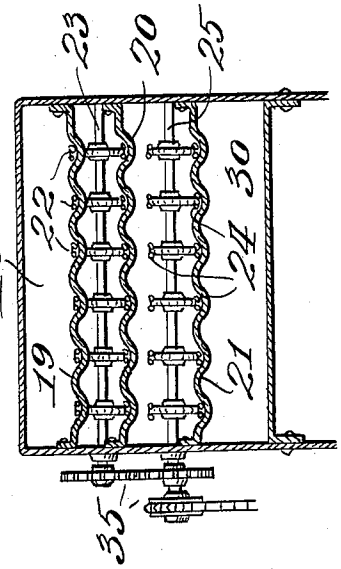

FIG. 2.

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UNITED STATES PATENT OFFICE.

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RETORT.

Application filed November 26, 1921. Serial No. 517,947.

To all whom it may concern:

Be it known that I, BENJAMIN H. SMITH, a citizen of the United States, residing at Los Angeles, county of Los Angeles, State of California, have invented new and useful Improvements in Retorts, of which the following is a specification.

This invention is a retort particularly adapted for distillation of oil sand and shale, or the treatment of antimony and cinnabar ore and the like.

It is the object of the invention to provide a construction having a heating surface for a layer of material which is to be treated, said surface having portions thereof normally projecting through and above the layer of material, and arranged so as to maintain relatively thin layers of material in the supporting depressions formed between said projections, in order to obtain uniform heating of said layers of material, by subjecting all portions thereof to direct heat radiations from either the supporting or projecting portions of the heating member, thereby preventing insulation of the upper portion of the layers of material from the heating surface, as would result from completely covering the latter with said material.

It is a further object of the invention to provide a heating surface as described, which will permit movement of excess material across the projections of the heating surface, in the event of temporary excessive packing and piling up of said material in any one of the supporting depressions formed between said projections, said heating surface being so constructed however, that any excess of material thus moving across a projection of the heating surface from one supporting depression to another, will not remain upon said projection so as to insulate the heat radiations therefrom, but will all drop into the next adjacent supporting depression.

It is a further object of the invention to provide flexible means for moving layers of material along the supporting depressions of a heating surface as described, so that the material will be spread out in thin layers in said depressions, with the projections of the heating surface extending through and above the material at all times, except during momentary transfer of excess material from one depression to another, in the event of abnormal piling up of said material in any one depression as previously described.

It is a still further object of the invention to provide for continuously moving the material in a circuitous course over heating surfaces as described, in order to obtain the necessary heating without unduly enlarging the heating chamber.

More particularly the invention contemplates the provision of a heating chamber having a plurality of superimposed corrugated heating plates, with endless flexible conveyors received in said corrugations so as to move material along the same with the ridges of the corrugated plates normally extending above the layer of material, the parts being so arranged that material received in the corrugations of the uppermost plate, will be first moved along the same and will then be successively moved in opposite directions along the corrugations of succeeding lower plates, before its final discharge from the retort.

The invention will be readily understood from the following description of the accompanying drawings, in which:

Fig. 1 is a vertical longitudinal section through a retort constructed in accordance with the invention.

Fig. 2 is a vertical transverse section through the same.

The improved retort consists of the chamber 10, having the end walls 11 and 11ª. At the respective ends of the chamber are formed downward extension chambers 12 and 12ª, which have their bases extended beyond end walls 11 and 11ª, in spaced relation below the same, so as to terminate in hoppers 13 and 13ª beyond said end walls.

Hoppers 13 and 13ª are intake and discharge hoppers respectively, and at the intake end of the retort the chamber 10 is preferably provided at the top with a cupola 14 having a discharge pipe 15. An endless conveyor 16, preferably comprising a plurality of chains running over sprocket wheels 17, and having hoisting buckets 18, extends from chamber 12 into cupola 14, and is adapted to hoist the oil shale or other material being treated, from hopper 13 to the top of chamber 10.

From the endless conveyor the material passes to members extending the length of

chamber 10 and adapted to support said material while it is being heated in order to drive off the volatile matter through the pipe 15. These supporting members are arranged to cause a circuitous passage of the material through the heating chamber, and are shown as plates 19 and 20 in superimposed spaced relation above the bottom 21 of the heating chamber 10, and extending the length and width of said chamber.

The material is adapted to pass back and forth over plates 19, 20, and 21, and it will of course be obvious that the number of the intermediate plates may be varied at will, as it is desired to increase or decrease the heating period.

Plates 19, 20, and 21 are longitudinally corrugated, preferably on both faces thereof, and so as to form relatively shallow ridges and depressions with the ridges and depressions of the corrugations upon opposite faces in alinement, so that the plates are of uniform thickness, in order that the surfaces of the ridges and depressions of the corrugations on the upper material supporting faces of the plates will be uniformly heated.

The material to be treated is adapted to be moved in relatively thin layers along the depressions of the corrugations on the upper supporting faces of the heating plates, with the peaks of the ridges of said corrugations free of said material and projecting above the same, in order that the upper portion of the layer of material will be subjected to direct heat radiations from the exposed ridges of the corrugations, while the lower portion of the layer of material is heated by contact with the depressions of the corrugations.

Movement of the material as thus described is preferably accomplished by means of endless flexible conveyors, which in the present instance are shown as link chains running in the respective depressions of the corrugations on the upper supporting faces of the heating plates.

The link chains are of a size to fit in the bases of the depressions of the heating plates, with the peaks of the ridges of said heating plates extending slightly above said chains, so that the layers of material moved by said chains will be normally spread out over only the bases of said depressions. But the depressions of said corrugations are comparatively shallow so that in the event of excessive piling up of the material upon the chain in any depression of the corrugated plates, said excess of material will be moved laterally across the adjacent ridges of the corrugated plates, until the excess of material has passed the peaks of said ridges, when it will drop by gravity into the next adjacent depressions, thereby maintaining uniform layers of material in the respective depressions of the heating plates, and also keeping the ridges of the corrugations clear of the material, except during momentary transfer thereof from one depression to another.

The stretches of the endless conveyors cooperating with the respective plates are adapted to move in opposite directions, so that the material will first move along the upper most plate, and then be dumped onto the succeeding lower plates for movement along the same in opposite directions.

In the form of the invention illustrated, two endless conveyors are employed, one of which, shown at 22, is received over rotary supports 23, and has the upper stretch of its endless loop cooperating with plate 19, while the lower stretch of the loop, which is moving in the opposite direction, extends along plate 20.

The second conveyor, shown at 24, is carried by rotary supports 25, and is arranged with the upper stretch of its endless loop moving idly beneath plate 20, while the lower stretch of the loop cooperates with plate 21, and moves in the opposite direction to the lower stretch of conveyor 22.

Suitable gearing such as shown at 35 may be employed for driving the conveyors in opposite directions, and it will be seen that the construction as thus described, provides for a circuitous passage of the material through the heating chamber, and the final dumping of the shale from which the volatile matter has been driven off, into chamber 12^a and the discharge hopper 13^a.

An endless conveyor 26 moving over rotary supports 27, and having buckets 28, extends upwardly from hopper 13^a, for the removal of the shale or other material after its discharge from the retort, and this waste material may be dumped into any suitable trough such as shown at 29.

The heating of chamber 10 may be accomplished by providing a chamber 30 beneath said retort chamber, and arranging a suitable burner 31 in this lower chamber. The products of combustion from the burner may be discharged through a vent 32.

In practice, liquid seals are maintained at the inlet and discharge ends of the retort, during operation of the same, and for this purpose a suitable liquid may be supplied through a pipe 33, to the bottom of chamber 12 and hopper 13, before starting the apparatus, and water or other suitable liquid may be supplied to the bottom of chamber 12^a and hopper 13^a.

The construction as thus described provides an extremely practical means for continuously moving the material being treated, through the retort; and the provision of the superimposed corrugated plates, over which the material passes, affords a maximum heating surface, and means for subject-

ing the material to a relatively long heating period, without increasing the length of the apparatus.

It will also be noted that the use of heating plates having relatively shallow corrugations on both faces, in conjunction with flexible conveyors received in the bases of the respective depressions of the corrugations on the upper, material supporting faces of the plates, with the peaks of the ridges of said corrugations extending slightly above said flexible conveyors, provides for uniform heating of said plates, and movement of the material along the bases of the depressions of the corrugations in relatively thin layers, with the ridges of said corrugations normally projecting above the material, but permitting of momentary transfer of said material across said ridges, when there is an excess of material in any one depression, the ridges of the corrugations being again clear of material as soon as uniform layers thereof are obtained in the respective depressions. It is thus possible to obtain uniform heating throughout the layers of material, since the upper portions of said layers are not insulated from the heating surfaces by layers of material completely covering the same.

While I have illustrated and described but one practical embodiment of the device, it will be apparent that various changes may be made in the construction, arrangement, and combination of parts without departing from the spirit of the invention.

What is claimed is:

1. A device of the character described including a heating plate having a series of parallel longitudinally extending relatively shallow corrugations, and non-connected transversely spaced conveyor chains received in and adapted to move along the bases of the respective depressions of said corugations with the peaks of the ridges of said corrugations projecting slightly above said chains, whereby relatively thin layers of material will be normally moved along the bases of said depressions on said chains with the peaks of the ridges of said corrugations normally free of and projecting above said relatively thin layers of material for direct heat radiation from said exposed ridges to the upper portions of said relatively thin layers of material in said depressions, the relatively slight projection of the peaks of the ridges of said corrugations above said chains permitting lateral movement across adjacent ridges of any abnormal excess of material piling up in any one of said depressions, so as to maintain uniform relatively thin layers of material in said depressions, and the movement by gravity of said excess of material from said ridges into the next adjacent depressions maintaining said ridges free of said material except during momentary transfer thereof from one depression to another.

2. A device of the character described including a heating plate having a series of parallel longitudinally extending relatively shallow corrugations, and means for moving layers of material longitudinally along said corrugations on the bases of the depressions thereof so that said layers of material are spaced apart by the peaks of the ridges of said corrugations projecting slightly above said layers of material, for direct heat radiation from said exposed ridges to the upper portions of the layers of material in said depressions.

3. A device of the character described including a heating plate having a series of parallel longitudinally extending relatively shallow corrugations, and flexible conveyors adapted for movement along the bases of the depressions of said corrugations with the peaks of the ridges of said corrugations extending slightly above said conveyors, so that said peaks of the ridges of the corrugations will be normally free of and project slightly above relatively thin layers of material received in said depressions of the corrugations upon said flexible conveyors, for direct heat radiation from said exposed ridges to the upper portions of the layers of material in said depressions.

4. A device of the character described including superimposed heating plates each having a series of longitudinally extending relatively shallow corrugations, and endless flexible conveyors forming elongated loops with the upper and lower stretches of said loops moving in opposite directions and received in the bases of the depressions of the corrugations of the respective plates, so that the peaks of the ridges of said corrugations are free of and project slightly above relatively thin layers of material received in said depressions on said flexible conveyors, for direct heat radiation from said exposed ridges to the upper portions of the layers of material in said depressions.

In testimony whereof I have signed my name to this specification.

BENJAMIN H. SMITH.