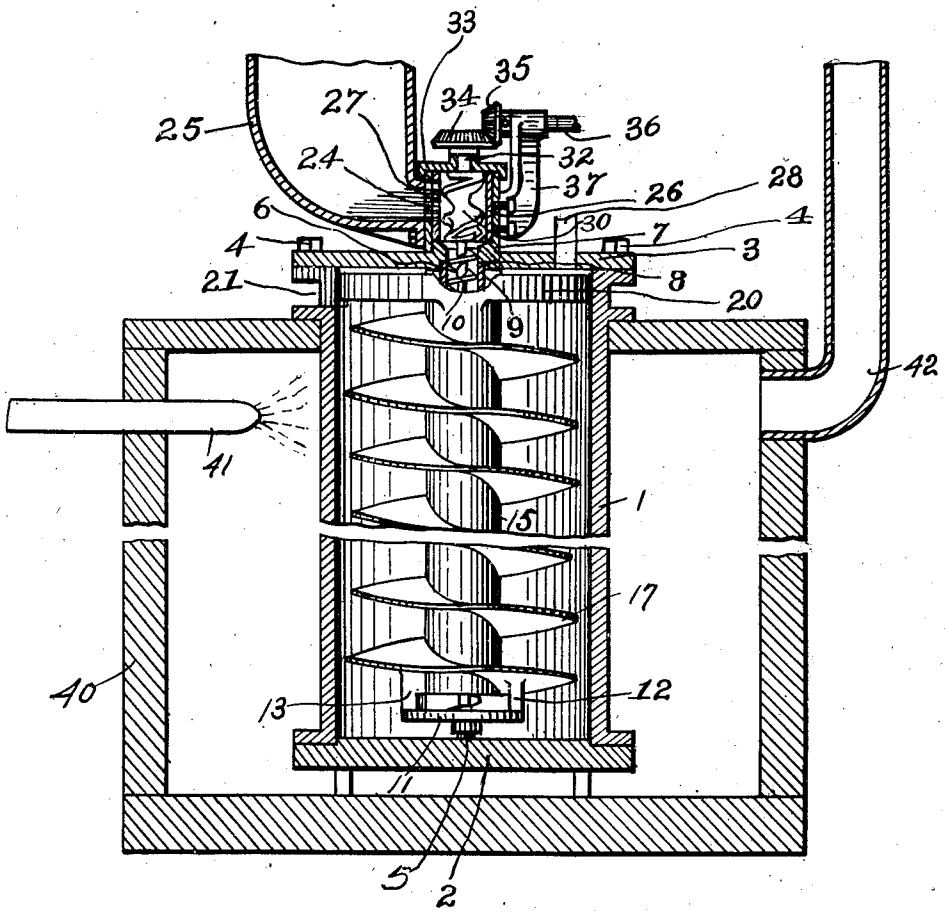
L. B. ARD.

METHOD OF TREATING SHALE AND LIKE MATERIAL.

APPLICATION FILED FEB. 3, 1921.

1,373,698. **Patented Apr. 5, 1921.**



INVENTOR

L. B. Ard

by A. P. Greeley

ATTORNEYS.

UNITED STATES PATENT OFFICE.

LIGON B. ARD, OF NEW YORK, N. Y.

METHOD OF TREATING SHALE AND LIKE MATERIAL.

1,373,698. Specification of Letters Patent. Patented Apr. 5, 1921.

Application filed February 3, 1921. Serial No. 442,142.

To all whom it may concern:

Be it known that I, LIGON B. ARD, a citizen of the United States, residing at New York city, in the county of New York, State of New York, have invented certain new and useful Improvements in Methods of Treating Shale and like Material, of which the following is a description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to a method or process for treating shale and like material containing volatile matter to extract such volatile matter. My invention has for its object to provide a method or process for this purpose which will be effective to effect the heating of the shale or other material quickly to the temperature necessary to completely drive off the volatile matter and will prevent clogging of the retort with spent material, and will at the same time require for carrying it out comparatively inexpensive apparatus and small expense for operation.

With the objects above outlined and other objects hereinafter described in view my invention consists in the method hereinafter described and claimed.

Referring to the drawing,

The figure shown is a central vertical sectional view of an apparatus adapted to carry out my invention it being understood that the drawing is illustrative only and is not intended to be in any way a limitation of the invention to the use of the apparatus shown and described or to the use of any particular apparatus.

In the apparatus shown in the drawing 1 indicates a retort of any convenient construction here shown as comprising a cylindrical body portion flanged at its ends, to which flanges are secured the bottom 2 and the cover 3, the cover being secured by bolts 4 or in other convenient way. At its center or other convenient place the bottom has a pin 5 on which the conveyer rotates. The cover 3 has a central opening 6 and a sleeve 7 extends upward about this opening. The inner face of the cover is adapted to receive, concentric with the opening 6, a sleeve 9 extending downward preferably to the bottom of the retort and having a conveyer 10, shown as a screw conveyer, arranged therein. At its lower end this conveyer is mounted to rotate on pin 5. Secured to the lower end of the conveyer is a disk 11 from which is supported, by uprights 12 and 13, a sleeve 15 concentric with the sleeve 9 and conveyer 10 surrounding the sleeve 9 at a distance therefrom sufficient to permit of free movement thereon.

On the sleeve 15 and extending outward therefrom nearly to the walls of the retort, is arranged a helical vane or helix of relatively thin metal the helices being spaced apart sufficiently to permit the melted lead or other melted or heated metal or combination of metals with which the retort is filled, to fill these spaces. The helices near the lower end of the device are preferably closer together than those near the upper end so as to regulate the upward travel of the material being treated so as to cause it to move more slowly while it is being heated up by the heat of the molten metal or combination of metals. This helix terminates some distance below the cover 3. Between the upper end of the helix and the cover 3 is arranged a disk 20 of relatively thick metal to serve to keep the spent material away from the opening 6 and the bearings of the sleeve 9. An opening 21 in the side of the retort and an opening 28 in the cover provide for the discharge of the spent material and the escape of the volatile matter respectively.

The lower end of the sleeve 15 is spaced apart from the disk 11 sufficiently to provide an opening 22 for free discharge of the material to be treated from the lower end of the conveyer.

The screw of the conveyer 10 and the helix 17 are oppositely pitched so that when rotated together the screw conveyer will carry the material downward and the helix will carry it upward.

The sleeve 7 on the upper face of the cover has an opening in one side at 24 and about this opening is secured the lower end of a chute or hopper 25 for the material to be treated. Within the sleeve 7 is a lining or wear tube 26 having an opening 27 in line with the opening 24 in the sleeve 7. Within this lining tube 26 is arranged a rotary crushing and feeding device 30 having formed thereon a helix of relatively small diameter opposite the opening 24—27, decreasing in pitch toward the lower end of the device, adapted to receive freely relatively coarse material from the chute or hopper and force it downward and, at the same time, force it to pass through relatively small spaces between the helices and so re-

ducing it to relatively fine condition. The chute or hopper 25 is preferably of such size that it will hold a sufficient mass of the material to block the opening 24 against entrance of air.

I do not herein claim the apparatus herein shown and described as that forms the subject matter of a separate application for patent filed by me on February 4, 1921, Serial No. 442,398.

The crushing and feeding device 30 is carried by a stub shaft 32 which extends upward through the cap 33 which is screw-threaded or otherwise secured on the upper end of the sleeve 7. On its upper end the stub shaft carries a bevel pinion 34 which meshes with a bevel wheel on a power shaft 36 carried in a bearing in bracket 37 secured to the sleeve 7.

The retort may be heated by any convenient means. As here shown it is arranged in an inclosing fire box 40 provided with burners 41 and a flue 42. The retort is filled nearly to the level of the opening 21, with molten metal, sufficient heat being maintained to keep the metal constantly in molten condition. The shale or other material to be treated is supplied by the chute or hopper to the crushing and feeding device by which it is fed downward to the conveyer 10. By the conveyer the material is carried downward to be discharged near the lower end of the retort directly into the molten metal. The finer particles of the material will be at once heated to substantially the temperature of the molten metal, which, of course, may be varied somewhat, and will, thereby be caused to give up the volatile matter carried by them. Larger particles will, of course, be heated through more slowly. The helices 17 will present these larger particles from rising through the molten metal too rapidly to permit of their being completely and uniformly heated. By reason of the lower helices being nearer together than those nearer the top the travel upward of the particles of the material will be somewhat retarded until they are fully heated after which they are permitted to rise more rapidly and, if necessary, their upward travel is enforced by the helices.

Having thus described my invention what I claim is;

1. The method of treating shale and like material to drive off volatile matter therefrom, which consists in forcing relatively cool material immediately downward below the surface of a bath of molten metal of higher specific gravity than that of the material to be treated, discharging it in relatively cool condition into the bath of molten metal to permit it to float upward through said molten metal, and retarding the upward movement of the material whereby all of the volatile matter is driven off during its upward movement through said molten metal.

2. The method of treating shale and like material to drive off volatile matter therefrom, which consists in forcing relatively cool material immediately downward below the surface of a bath of molten metal of higher specific gravity than that of the material to be treated, discharging it in relatively cool condition into the bath of molten metal to permit it to float upward through said molten metal, and regulating the upward movement of the material by retarding the upward movement of the lighter particles and aiding the upward movement of the heavier particles whereby all of the volatile matter is driven off during the upward movement of the material through the molten metal.

In testimony whereof I affix my signature this 2nd day of February 1921.

LIGON B. ARD.