J. H. GINET.

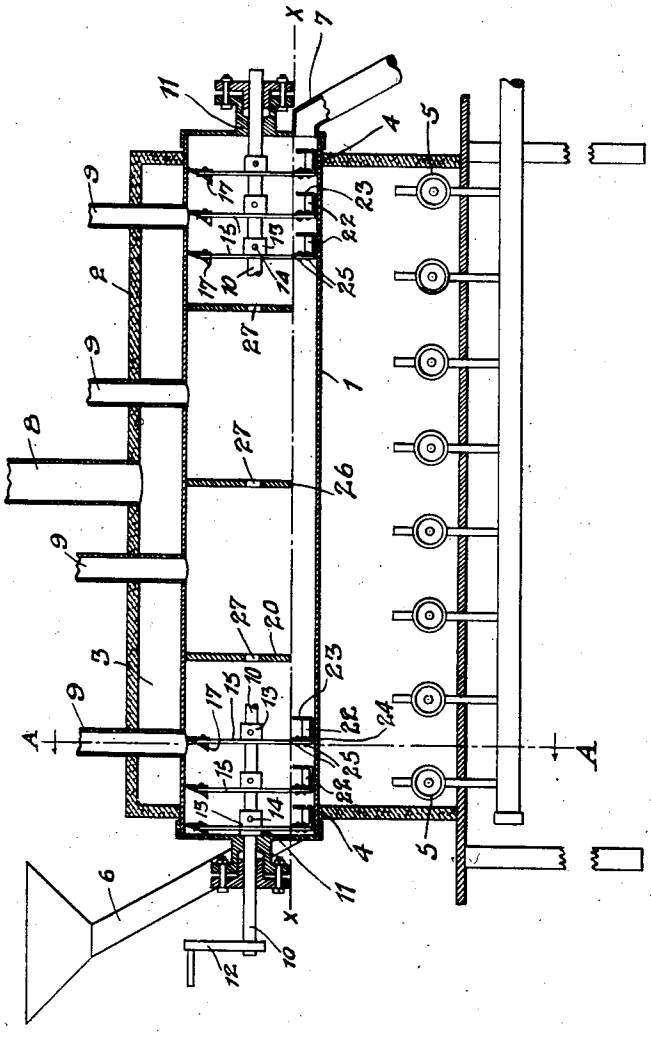
PROCESS FOR TREATING BITUMINOUS SHALE.

APPLICATION FILED OCT. 31, 1919.

1,371,160. Patented Mar. 8, 1921.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 3

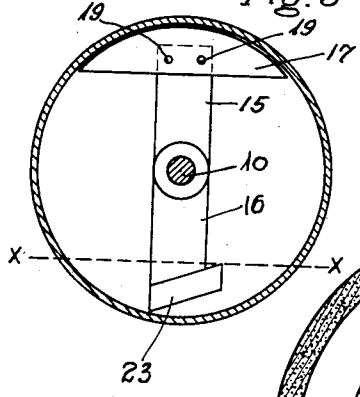


Fig. 2

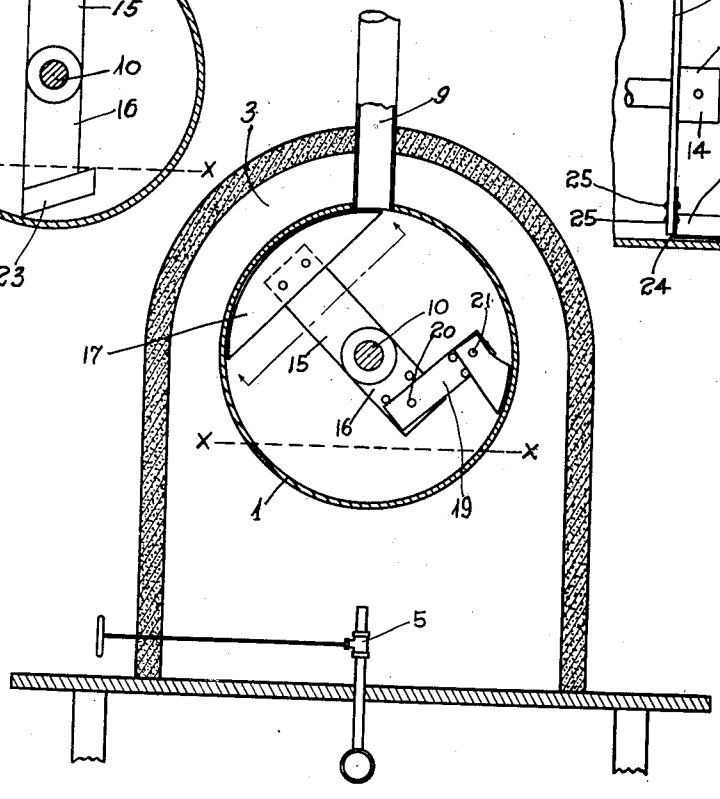


Fig. 4

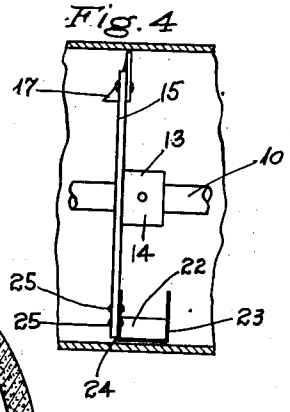


Fig. 8



Fig. 6



Fig. 7



Fig. 5



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UNITED STATES PATENT OFFICE.

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PROCESS FOR TREATING BITUMINOUS SHALE.

1,371,160. Specification of Letters Patent. Patented Mar. 8, 1921.

Application filed October 31, 1919. Serial No. 334,840.

To all whom it may concern:

Be it known that I, JOSEPH H. GINET, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Processes for Treating Bituminous Shale; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to the treating of bituminous shales commonly known as oil shales.

An object of this invention is to provide an improved method of subjecting shale in a furnace or retort to the heat thereof.

A further object of this invention is to provide an improved process of treating the shale whereby the shale in each section or zone of the furnace is quickly and substantially simultaneously heated to a predetermined temperature and the gases evolved drawn off while still at that temperature.

The invention hereinafter set forth is described in connection with and illustrated by an improved apparatus by means of which the process can be efficiently carried out.

In the draw.

Figure 1 is a diagrammatic longitudinal section, partly in elevation of a furnace constructed in accordance with my invention, the agitating and conveying mechanism being omitted at the central sections.

Fig. 2 is a vertical section on line A—A Fig. 1, showing a modified form of agitator.

Fig. 3 is a detail elevation view of one of the agitating and conveying members showing the preferable form of agitating member.

Fig. 4 is an edge elevation of the construction shown in Fig. 3.

Fig. 5 is a detail view of one of the conveying blades.

Figs. 6, 7 and 8 are detail views of the form of agitating blade, shown in Fig. 2.

Bituminous shales contain organic matter which, when the shale is heated volatilizes and passes off as hydrocarbon gases. Different hydrocarbon gases pass off at different temperatures. At the lowest temperature there will be evolved the gas from which the lightest oil, such as gasolene, etc., may be obtained by condensation.

At successively higher temperatures there will be successively evolved the various gases from which respectively there may be obtained by condensation successively heavier oils.

If, at any time, or any stage of the process any portion of the shale be subjected to a substantially higher temperature than that at which the lightest gas still contained in the shale is evolved, fixed gases and free carbon will be formed and likewise any gas evolved at the lower temperature will, by subjection to the higher temperature, be changed to fixed gas and free carbon.

Therefore, in recovering oils from shale it is desirable to subject the shale to successively increasing temperatures and at each stage of the treatment to subject it to the lowest temperature at which any substantial quantity of hydrocarbon gas will be evolved therefrom and to hold the shale at such temperature until there has been evolved therefrom all of the gas that can be evolved at that temperature and it is likewise evidently desirable that all of such gas be drawn off, while still at that temperature, for condensation.

The uniform heating of all of the shale in each stage or zone of the treatment is essential and likewise the free escape of the gas as it is evolved, is essential. An uneven heating of the shale and compelling the evolved gas to pass through the mass of shale as it escapes, will result in premature condensation of gas and also in coking and fluxing the shale thus losing values and rendering the shale impossible of efficient treatment.

The principal element of my invention, therefore, is the devising of a process for treating shale in which the shale is so handled, moved or agitated that the heat is given free access to each particle of shale and gas is permitted to freely escape from each particle without having to pass through the shale mass and this is accomplished while and in combination with moving large quantities of shale through the furnace in which the treatment takes place.

My apparatus and process are more particularly described as follows:—

I provide a shell 1 within housing 2, spaced therefrom as at 3 and supported therein in any suitable manner as by resting in the end walls thereof as at 4. Any

suitable heating means as burners 5 may be employed for independently heating the various sections or zones of the shell 1. Any suitable means as hopper 6 may be employed for feeding the fresh shale into one end of the shell, the spent shale being discharged at the opposite end of the shell through any suitable discharge means indicated at 7. A suitable vent for products of combustion from the heating means may be provided as indicated at 8.

At predetermined desirable points along the shell vents as 9 are provided for drawing off the evolved hydrocarbon gases.

Within the shell 1 is positioned a shaft 10, extending through and suitably revolubly mounted and packed in the ends of the shell as at 11, which shaft may be revolved by any suitable means indicated by crank 12.

Upon the shaft 10 I mount and attach in any suitable manner as by collar 13 and set screw 14, suitable arms 15 and 16, preferably formed integral as shown, for carrying conveying blades 17 and lifting, turning, spraying or showering members 18. The conveying blades 17 are attached in any suitable manner as by rivets 19 to the arms 15. The shell 1 being here shown as circular conforms to the contour of the outer edge of the conveying blades. This conformity is essential only in part viz, at the lower portion of the shell, indicated by line X—X on which the shale will lie and along which it will be moved while being treated. The relative conformity of that portion of the shell above the shale mass with outer contour of the conveying blades is immaterial. The portion of the shell above the shale may be of any desired shape so long as sufficient space be left for the necessary movement of the conveying blades.

By varying the angularity of the conveyer blades, the speed of movement of the shale may be varied at any desired point in the shell by variation of the angle of the blades at various points.

On the arms 16 are positioned the agitating or shale lifting, turning and spraying or showering members. The work of these members is to agitate, lift, turn and spray or shower the shale so that the heat shall have free access to every particle of the shale and so that the gas evolved shall have free escape from each particle.

This may be accomplished by the use of devices which will alternately lift the shale from the floor and let it fall and cause it, in falling, either to be turned over as a plow turns over the earth or to be sprinkled or showered down.

Any construction which will raise the shale from the floor and, during its operation, turn it over or break up or loosen the mass, may be employed. I have found the two forms of lifters shown in the drawing to be most effective for this purpose, the form shown in Figs. 1, 3 and 4 being preferable because more effective.

The preferable form of lifting device is in the form of a short shallow trough or shovel with floor 22 and sides 23 and 24, one side being attached in suitable manner as by rivets 25 to arm 16. The shovel is so positioned that its front edge as the shaft revolves will slide along the floor of the shell scooping up the shale therefrom while the bottom of the shovel is inclined backward and upward at an acute angle to the floor of the retort as shown. This operation causes the shale to be sucessively lifted completely from the floor of the shell and showered, sprayed or sprinkled down from the rear edge of the shovel thus thoroughly breaking up the mass of shale and separating the particles, allowing the heat free access to each particle and allowing free escape of gas from each particle. It is also found that this operation, to a large extent, turns over the shale, depositing on the bottom of the shell those particles which before the passage of the shovel had been on the top of the layer on the shell. Furthermore the shale thus showered, sprayed, or cascaded over the rear edge of the shovel by this operation, is spread out thereby in a relatively thin and substantially uniform layer over the floor of the shell thus securing a uniform heating from the shell.

The lifting or agitating member shown in Fig. 2 and in detail in Figs. 6 and 8, is a blade resembling in shape a plow. It is attached to arm 16 in any suitable manner as by intermediate arm 19. The joining of these members may, if desired, be by pins 20 and 21 permitting the arm 19 and blade 18 to swing respectively on arm 16 and arm 19. These parts may, of course, be fixedly attached to each other by rivets or other suitable means, in any desired relative position as shown in Fig. 2.

It will be evident that as the shaft 10 revolves the blades 18 will plow through the shale which is in the shell below the line X—X and will lift the shale from the inner surface of the shell and turn it over on the shale just ahead or upon the bare floor of the shell, as the case may be, according to the relative position of the different blades.

It is evident that the lifting and conveying blades may be spaced along the shaft as desired, and also that they may be set on the shaft at such relative angles that any two or more blades may be made to strike the shale simultaneously or in any desired order.

The relative adjustment of the blades will be determined in practice according to the quality and quantity of shale to be treated.

In case a given shale is found to give off its gases readily it may be found desirable

to move it quickly through the shell or it may be found desirable to treat a lesser depth of shale and move it more quickly.

Conversely if a shale responds slowly or if a greater depth of shale is to be treated, the shale should be moved forward slowly in relation to the number of strokes of the lifting blades or scoops.

With the conveying and lifting means here described it is possible to quite effectively divide the shell into sections or zones and this I do by providing partitions or baffles 26 with apertures 27 therein to accommodate shaft 10. These partitions or baffles divide the shell completely except at the bottom where they terminate at a sufficient height to permit the shale to pass beneath.

By regulating the heating units 5 the desired heat may be obtained in each section or zone in order to evolve the lightest gas evolvable from the shale when it reaches that zone. That gas being evolved and escaping freely, passes off through the vent 9, from that zone or section and is conveyed to and condensed in a suitable condenser not shown.

I claim:

1. A process of treating bituminous shale and the like consisting of placing the shale on a surface in a heated chamber and alternately lifting the shale and causing it to fall within said heated chamber, substantially all of the shale on a given portion of said surface being thus lifted and made to fall, whereby gaseous products are evolved from the shale, and collecting said products.

2. A process of treating bituminous shale and the like consisting of placing the shale on a surface in a heated chamber and alternately lifting the shale and causing it to fall in a shower within said heated chamber, substantially all of the shale on a given portion of said surface being thus lifted and showered, whereby gaseous products are evolved, and collecting said products.

3. A process of treating bituminous shale and the like consisting of passing shale over a surface in a heated chamber and successively and alternately lifting the shale and causing it to fall in a shower within said heated chamber, whereby in each successive operation substantially all shale on a given portion of said surface is lifted and showered, whereby gaseous products are evolved, and collecting said products.

4. A process of treating bituminous shale and the like consisting of placing the shale on a surface in a heated chamber and alternately lifting the shale and causing it to fall in a shower in such manner as to invert the relative positions of the particles of shale on said surface within said heated chamber, substantially all of the shale on a given portion of said surface being thus lifted and showered, whereby gaseous products are evolved, and collecting said products.

5. A process of treating bituminous shale and the like consisting of passing the shale over a surface in a heated chamber and alternately lifting the shale and causing it to fall in a shower within said heated chamber in such manner as to invert the relative positions of the particles of shale on said surface, substantially all of the shale on a given portion of said surface being thus lifted and showered, whereby gaseous products are evolved, and collecting said products.

6. A process of treating bituminous shale and the like consisting of passing the shale over a heated surface and, while so doing, alternately lifting and showering the shale, substantially all of the shale on a given portion of said surface being thus lifted and showered, whereby gaseous products are evolved from the shale, and collecting the products.

7. A process of treating bituminous shale and the like consisting of passing the shale over a heated surface and, while so doing, lifting and showering the shale, substantially all of the shale on a given portion of said surface being thus lifted and showered in a layer of substantially even depth, whereby gaseous products are evolved from the shale, and collecting the products.

8. A process of treating bituminous shale and the like consisting of passing the shale over a heated surface and, while so doing, alternately lifting and showering the shale, substantially all of the shale on a given portion of said surface being thus lifted and showered in such manner as to invert the relative positions of the particles of shale in the layer, whereby gaseous products are evolved from the shale and collecting the products.

9. A process of treating bituminous shale and the like continuously for the purpose of recovering oil therefrom, which consists in passing comminuted shale continuously and successively through zones of successively higher temperature and repeatedly lifting and showering substantially all of the shale throughout its passage through each heat zone, and collecting the gases evolved in each zone.

10. A process of treating bituminous shale and the like continuously for the purpose of recovering oil and like products therefrom, which consists of passing comminuted shale continuously and successively through zones of successively higher temperature and showering substantially all of the shale substantially continuously throughout its passage through each heat zone, and collecting the gaseous products evolved in each zone.

11. A process of treating bituminous shale

and the like consisting of continuously passing the shale through a heated air tight chamber, successively lifting substantially all of the shale from different areas of the floor of the chamber and showering it and continuously removing the resulting gas and spent shale from the chamber.

12. The process of distilling oil from a given quantity of comminuted bituminous shale which consists in showering substantially all of said shale within a heated retort for the entire period necessary to distil substantially all of the volatilizable products.

In testimony whereof I affix my signature.

JOSEPH H. GINET.