

June 2, 1925.

1,540,662

E. G. STONE

RETORT

Filed Sept. 22, 1924

3 Sheets-Sheet 1

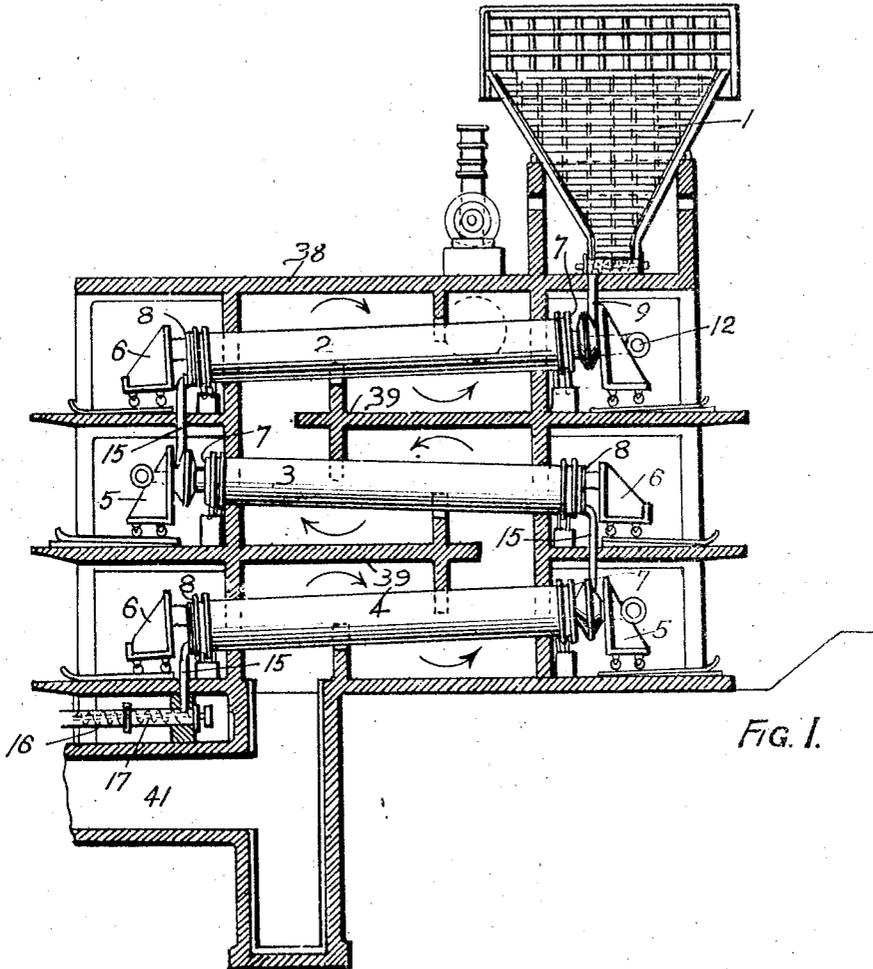


FIG. 1.

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3 Sheets-Sheet 2

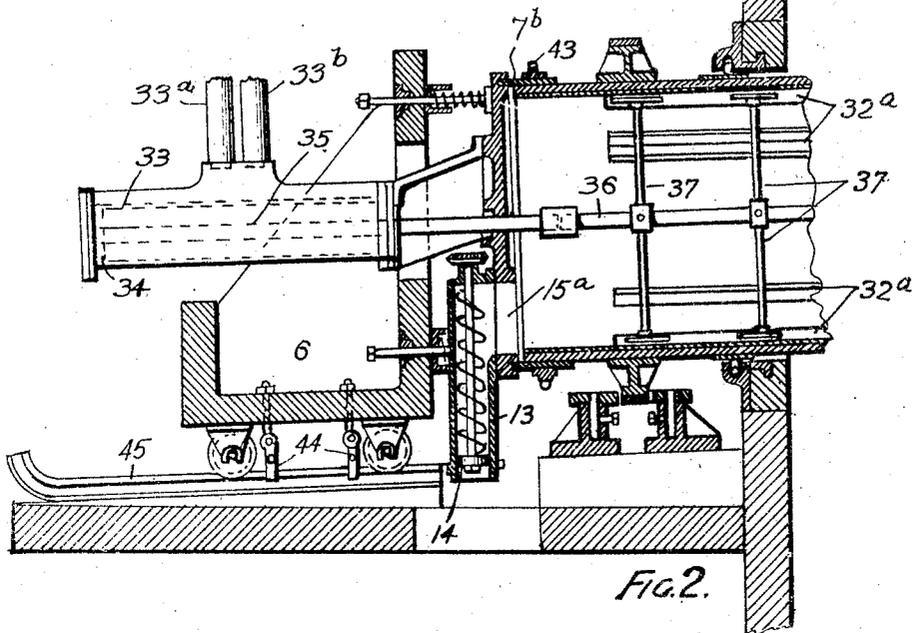


FIG. 2.

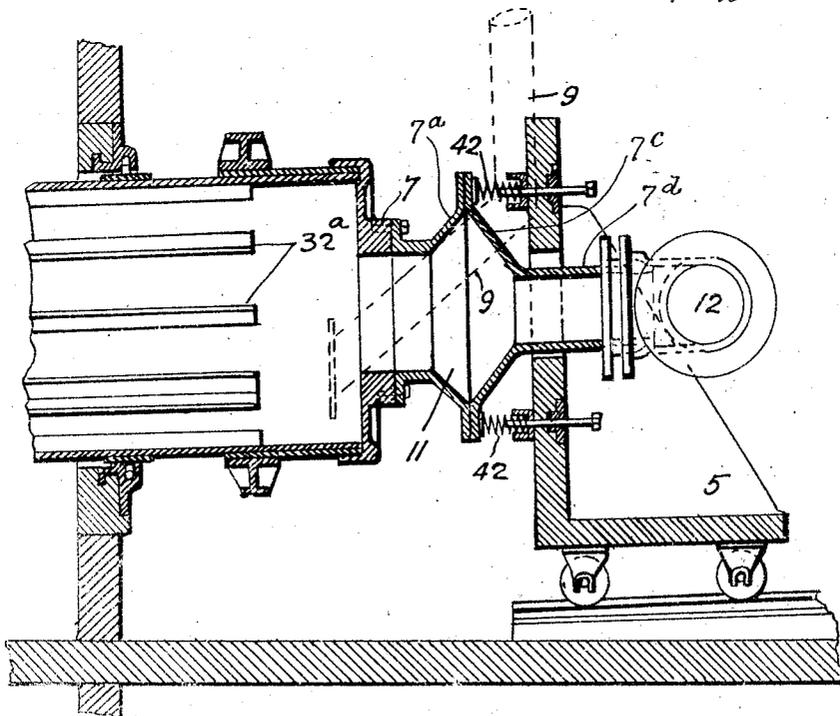


FIG. 3.

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3 Sheets-Sheet 3

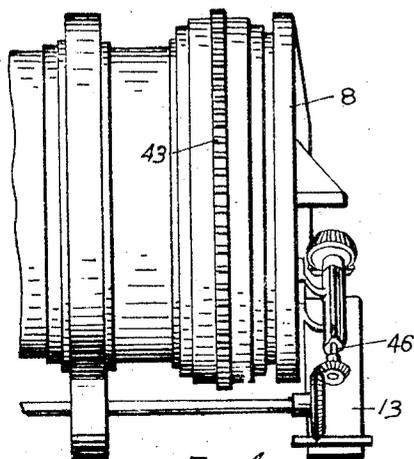


Fig. 4.

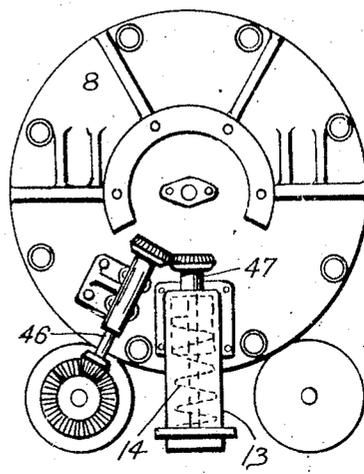


Fig. 5.

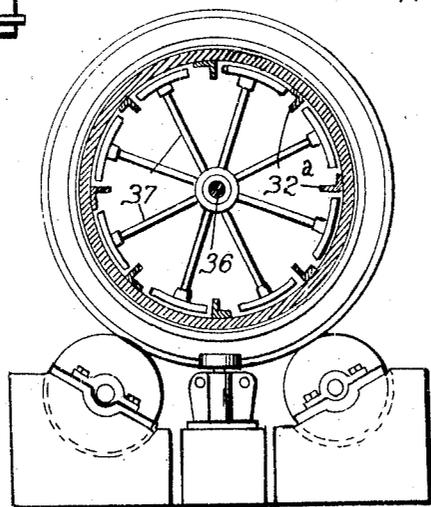


Fig. 6.

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# UNITED STATES PATENT OFFICE.

EDWARD GILES STONE, OF DEVONPORT, TASMANIA, AUSTRALIA.

RETORT.

Application filed September 22, 1924. Serial No. 739,167.

*To all whom it may concern:*

Be it known that I, EDWARD GILES STONE, a subject of the King of Great Britain and Ireland, residing at Devonport, Tasmania, Commonwealth of Australia, have invented certain new and useful Improvements in Retorts, of which the following is a specification.

This invention relates to retort apparatus adapted to be heated for the purpose of distilling ground shale, whereby hydrocarbon oil gases contained in the shale may be volatilized and conducted from the retort apparatus to a suitable condenser and a scrubber to recover incondensable gases as well as other products to be derived from the shale.

Though the invention is intended primarily for treating ground shale, it is to be understood that it is also applicable for use in the retorting of other substances. The invention will, however, be described in connection with the retorting of ground shale.

Referring to the accompanying drawings in which the invention is illustrated;

Fig. 1 is a longitudinal sectional view of the entire apparatus.

Fig. 2 is a similar enlarged view of the lower end portion of one of the retorts.

Fig. 3 is a similar view of the upper end portion of one of the retorts.

Fig. 4 is a side view of one end portion of one of the retorts with certain parts omitted.

Fig. 5 is an end view of the same.

Fig. 6 is a vertical sectional view of one of the retorts, illustrating a portion of the mechanism for cleaning the same.

When the shale has been ground by any suitable mechanism, it is fed by means of a suitable hopper 1 to the upper retort 2 of a series of inclined retorts. Preferably there are three inclined retorts 2, 3 and 4, each being arranged above and inclined toward the others, whereby material may be fed by gravity from one retort to the other. The retorts are rotatably carried on rollers or other suitable bearings and they may be rotated by any preferred means, end thrust rollers being also provided.

It is necessary, however, in connection with certain retorting operations that the ends of the retorts be furnished with gas tight joints. For this purpose, the upper ends of the retort tubes may be provided with apertured end plates 7 having flared

flanges 7<sup>a</sup> bolted thereto, and the lower ends of the retorts may be provided with closure sleeves 7<sup>b</sup>. The flanges 7<sup>a</sup> contact with flanges 7<sup>c</sup> on the vapor take-offs 7<sup>d</sup>, while the sleeves 7<sup>b</sup> extend into annular grooves in lower end plates 8. The flanged vapor take-offs 7<sup>d</sup> and end plates 8 form closure means for the ends of the tubes and these parts are carried by movable trucks 5 and 6, which hold the parts 7<sup>c</sup> and 8 stationary during the rotation of the retorts.

The upper end trucks 5 are adjustable relatively to the retorts, and the flange 7<sup>a</sup> of the uppermost vapor take-off 7<sup>d</sup> is provided with a chute 9, whereby ground shale may be fed to the interior of the retort 2. An oil gas receiving channel 11 is formed between the flanges 7<sup>a</sup> and 7<sup>c</sup> of each retort, and such oil-gas may be withdrawn from said channel to an outlet pipe 12 (provided on the said trucks 5) by any suitable exhausting apparatus and be thereby transferred to a condenser and a scrubber (not shown), from which incondensable gases are conveyed to a receiver.

The constructions of the removable adjustable trucks 6 (see Fig. 2) for the lower ends of the retorts is different from the trucks 5, as the lower end trucks cooperate with the closure plates 8 to seal the lower ends of the retorts. Located near each of the lower end trucks 6 and carried by the latter, is a chute 13 having a worm-conveyor 14 to convey partially treated shale (passed through an opening 15<sup>a</sup>) to the chute 15 of the next lower retort. The worm-conveyor 14 may be rotated by any suitable means and said means may consist, as shown in Figs. 4 and 5, of a spindle 46 driven from any of the retorts and gear connected to a spindle 47, which in turn is gear connected to the spindle of the conveyor 14. To permit the trucks 5 and 6 to be adjusted relatively to the parts 7<sup>d</sup> and 8 and to ensure gas-tight joints, a series of spiral springs 42 may be arranged between each truck and the member 7<sup>d</sup> or 8 which it carries (see Figs. 2 and 3). The retorts may be rotated by any suitable means, for instance by gearing connected to the spur wheels 43. The lower end trucks 6 may be held in position by means of adjustable clamps 44 adapted to grasp the rails 45.

If the ground shale which is being re-

torted is not required to be further retorted, it may be fed from the lower retort of the inclined series direct to a hopper or the like. Should it be desired, however, to subject the shale to further retorting, it may be fed to a horizontally disposed trough or chamber 16 having a rotatable worm-conveyor 17.

In certain cases it may be desirable to provide means whereby the material treated in the retorts may be agitated and whereby also the stirring means as well as the inner walls of the retorts may be cleaned and kept free from material adhering thereto. The stirring means may consist of angle plates 32<sup>a</sup> fixed to the inner surface of the retorts, and the cleaning means may consist of a steam cylinder 33 (see Fig. 2) fitting the lower end trucks 6. The steam cylinders for each of the retorts have steam inlets and outlets 33<sup>a</sup> and 33<sup>b</sup> respectively and each carries a piston 34 having a piston rod 35 to which is swivel-connected a spindle 36 which has fixed thereon a series of arms 37 adapted to act as scrapers for the plates 32<sup>a</sup> and the inner surface of the retort tubes. The scrapers 37 and their carrying spindles 36 rotate with the retorts and said scrapers may be reciprocated when steam is admitted to the steam cylinder 33 to operate the pistons 34, rods 35 and spindles 36.

The inclined retorts may be heated in any suitable manner. They are preferably carried in a chamber 38 to which hot gases are admitted from a flue 41, the said hot gases being preferably directed around the retorts by baffles 39 as indicated by the arrows in Fig. 1. Certain of the incondensable gases derived from the shale may be utilized for supplying fuel for heating the retorts and it is preferred that the lowest one of the retorts be arranged to receive the greatest amount of heat, the retort 3 a less amount and the retort 2 a still less amount.

What I claim and desire to secure by Letters-Patent is:

1. Retorting apparatus comprising a rotatable element adapted to have heat communicated thereto and inclined in such manner that material fed thereto at one end will pass by gravity to an exit opening at the other end thereof, means within such element for stirring the contents thereof, means whereby volatile constituents derived from the material heated in said element may be discharged from the latter, a truck arranged at the higher end of the element, a vapor take-off for said element carried by said truck, said off-take being movable toward and away from the truck, and resilient means carried by the truck for forcing the off-take away from the truck and against the higher end of the rotatable element to seal said higher end.

2. Retorting apparatus comprising a rotatable element adapted to be heated and in-

clined in such manner that material fed into its higher end will flow therethrough by gravity, means for stirring the contents of said element, means for discharging volatile constituents from the element, a truck arranged at the higher end of said element, a vapor take-off carried by the truck and movable toward and away from the latter, and resilient means for forcing said take-off toward the higher end of the rotatable element for closing said higher end of the rotatable element and said take-off including a channel into which the volatile constituents from the rotatable element may collect and be discharged through the means for discharging volatile constituents from the element.

3. Retorting apparatus comprising a rotatable element adapted to be heated and inclined in such manner that material fed thereto will flow through the same by gravity, means for stirring the contents of the element, means for discharging volatile constituents from the element, a truck arranged at the lower end of the rotatable element, an end plate arranged between the truck and the lower end of the rotatable element for closing the lower end of the rotatable element, said end plate being movable toward and away from the truck, resilient means carrier by the truck for forcing the end plate toward the rotatable element, and means for clamping said truck in position relatively to said rotatable element.

4. Retorting apparatus including a rotatable tube provided on its inner surface with longitudinally extending bars fixed to rotate with the element, scrapers arranged in the tube and adapted to slide along the inner surface of the latter for cleaning said inner surface and said bars, an axially movable and rotatable shaft connected to said scrapers, an actuating rod for said shaft, swivel means connecting the rod and shaft, and means for reciprocating said rod.

5. Retorting apparatus as claimed in claim 4 in which the means for reciprocating said rod includes a cylinder arranged at one end of the tube, a piston mounted in the cylinder and connected to said rod, and means for introducing a pressure medium into the cylinder and for discharging the pressure medium from said cylinder.

6. Retorting apparatus including a chamber provided with internal baffles for directing a rising heating gas in a zig-zag path, means at one end of said chamber for introducing a heating gas into the same, a superposed series of inclined rotatable retorts extending through the chamber and having their ends arranged exteriorly of the chamber, closure means for each end of each retort, a truck arranged at the end of each retort and carrying the closure

means at that end of the retort, resilient  
means for forcing the closure means to-  
ward the ends of the retorts, means for feed-  
ing the material treated, from the lower end  
5 of each retort to the upper end of the re-  
tort immediately below the same, means car-  
ried by the truck at the upper end of each  
retort for discharging volatile constituents  
from each retort, and means for feeding the  
material to be treated into the upper end 10  
of the uppermost retort.

In testimony whereof I hereunto affix  
my signature.

EDWARD GILES STONE.