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HALOGEN TREATMENT OF OIL SHALE

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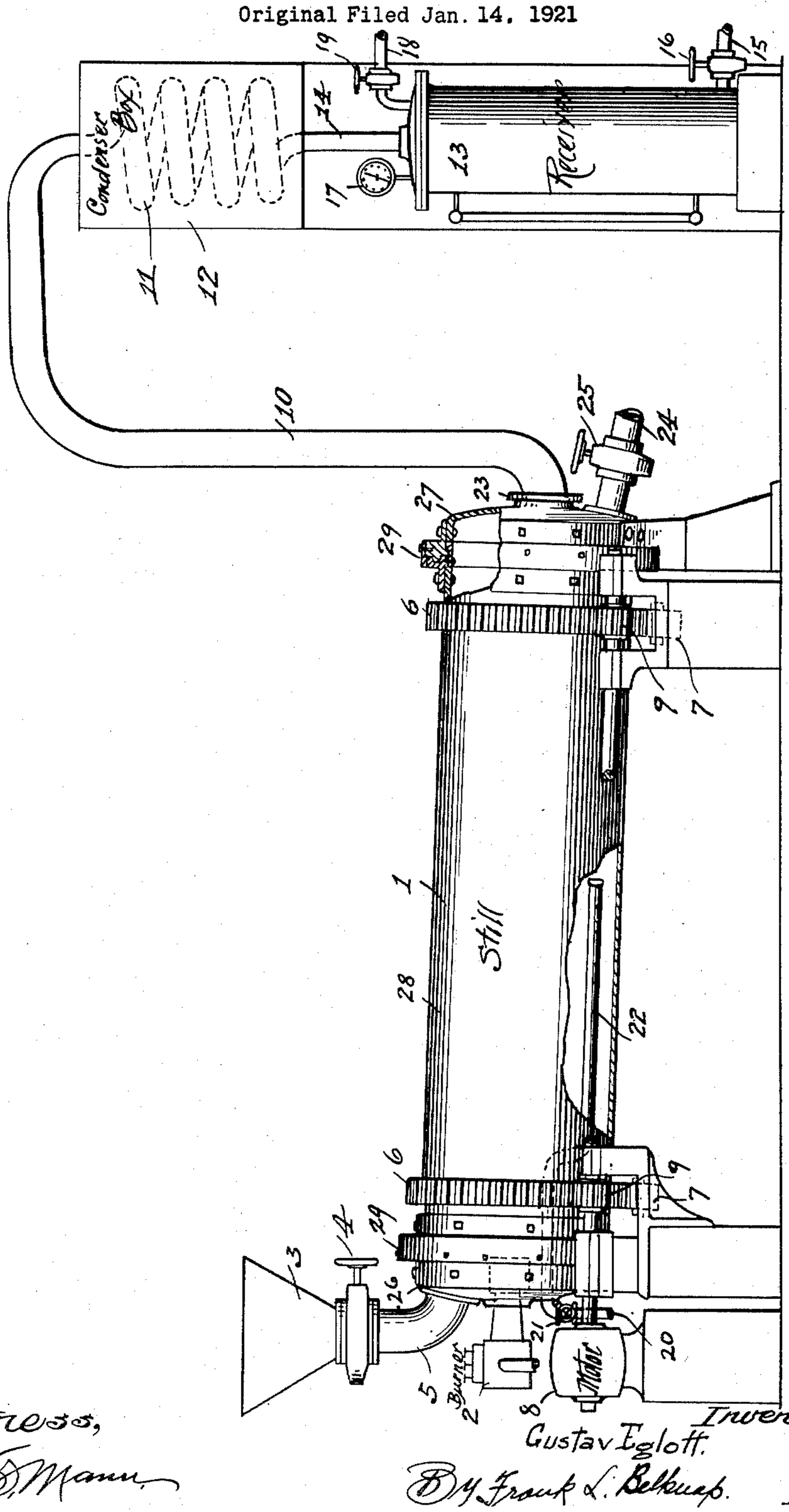

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UNITED STATES PATENT OFFICE.

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HALOGEN TREATMENT OF OIL SHALE.

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This invention relates to improvements in the halogen treatment of oil shale and refers more particularly to a process and apparatus for the treatment of oil shales with the halogen element and internal combustion by means of a rotating still.

I have found that chlorine in the presence of combustion gases impinging upon oil shale forms chlorides of the metals as for instance aluminum chloride. This aluminum chloride generated in situ generates or reacts with the products of the kerogen content of the shale so that the shale oil produced in the presence of the chlorides of the metal yields a light oil content which upon redistillation is a practically refined product suitable for marketing commercially.

The single figure in the drawing is a view partly in side elevation and partly in vertical cross section, of my improved apparatus for carrying out the above process.

Referring in detail to the drawing, 1 designates a rotating still in which a burner 2 is set. 3 is an oil shale hopper, said shale being passed into the still 1 through control valve 4 by means of pipe 5. 6 is a gear around still 1, supported by pinion gears 7, which gearing is operated by motor 8 and gear 9. 10 is a vapor line of the rotating still 1, connected to water condenser 11 set in box 12, coil 11 being connected to receiver 13 by means of pipe 14. The receiver 13 has liquid drawoff pipe 15 and control valve 16. To the upper portion of receiver 13, a pressure gauge 17 is attached, and also an uncondensable gas pipe 18 having control valve 19 attached thereto. The chlorine gas is fed into the system under pressure by means of pipe 20 and control valve 21, through the perforated pipe 22, set within still 1. 23 is a packing gland to make the system tight. 24 is a spent shale drawoff pipe having valve 25 attached thereto. The ends 26 and 27 are maintained stationary while the body of the still 28 rotates in the sealed joints 29.

One mode of operation of this process is to charge hopper 3 with the shale to be treated and feeding in said shale through control valve through pipe 5 into still 1. After still 1 has been charged with shale, burner 2 is ignited and depending on the shale under treatment, a mellow or a harsh heat may be impinged on the shale while simultaneously chlorine gas is fed into the system by means of perforated pipe 22. The chlorine reacts in part with the mineral matter in the shale, forming chlorides of metal and simultaneously from this shale, the kerogen content is produced. The volatile aluminum chloride reacts with the generated hydrocarbon vapors from the kerogen content of the shale, passing out of the still 1 through pipe 10 and is collected in receiver 13. It may be necessary to insert in the vapor line a trap to collect the aluminum chloride as a solid in said trap. I have found that the aluminum chloride forms addition compounds with some of the hydrocarbons generated in the kerogen and this gives a two-layer system in the receiver. However, this is not always the case as it depends largely on the type of shale which is being processed. When chlorine gas is used, chloride derivatives of the hydrocarbons are formed in addition to the aluminum chloride. These chloride derivatives have their specific commercial use. The hydrocarbon liquid which contains phenolic and nitrogen base compounds when formed in the presence of chlorine yield upon redistillation, gasoline motor fuel, waxes and lubricating oils. The internal temperature impinging on the oil shale in the presence of chlorine may range from 1600 to 2000 degrees or I may use such dilute combustion gases that an internal temperature may be maintained as low as 600 degrees F., in the presence of chlorine or another halogen.

Aluminum chloride and oil are largely settled out by gravity in the receiver and they may be separately collected in a receiver having drawoff pipe 15 and throttle valve 16 as shown. In the event the oil shale contains any substantial amount of water, the aluminum chloride is hydrolyzed forming a jell such as aluminum hydroxide or if the temperature is sufficiently high, the aluminum hydroxide is converted into aluminum oxide.

I claim as my invention:

1. A process of treating oil shale having an aluminum content, consisting in introducing the shale to a still, in maintaining the shale in a constant state of motion while in said still by a rotary movement of the still, in subjecting the shale to a distillation heat by directly impinging thereon the heating gases, and in introducing to the still during the distillation of the shale chlorine gas to unite the aluminum content of the shale to form aluminum chloride.

2. A process for distilling oil shale, hav-

ing an aluminum content comprising introducing a supply of said shale to a rotating still to be maintained in a state of motion while therein, in introducing directly into the still chlorine gas, in subjecting the oil to a distillation heat in the presence of chlorine gas to distill the oil contents of the shale and unite the chlorine gas with the aluminum content of the oil shale to form aluminum chloride.

3. A process for distilling carbonaceous substances having an aluminum and an oil content comprising introducing such substances to a still, rotating the still to maintain the substances in a state of motion, introducing directly to the still chlorine gas, subjecting the substances and chlorine gas to heat sufficient to distill the oil content of the carbonaceous substances and unite the chlorine gas with the aluminum content of the substances to form aluminum chloride.

4. A process for treating a carbonaceous substance having an aluminum content comprising introducing the substance to a still, maintaining the substance in a constant state of motion while in the still by rotary movement of the still, subjecting the substance to a distillation heat by directly impinging thereon heating gases, introducing to the still during the distillation of the carbonaceous substance chlorine gas to unite with the aluminum content of the substance and form aluminum chloride.

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