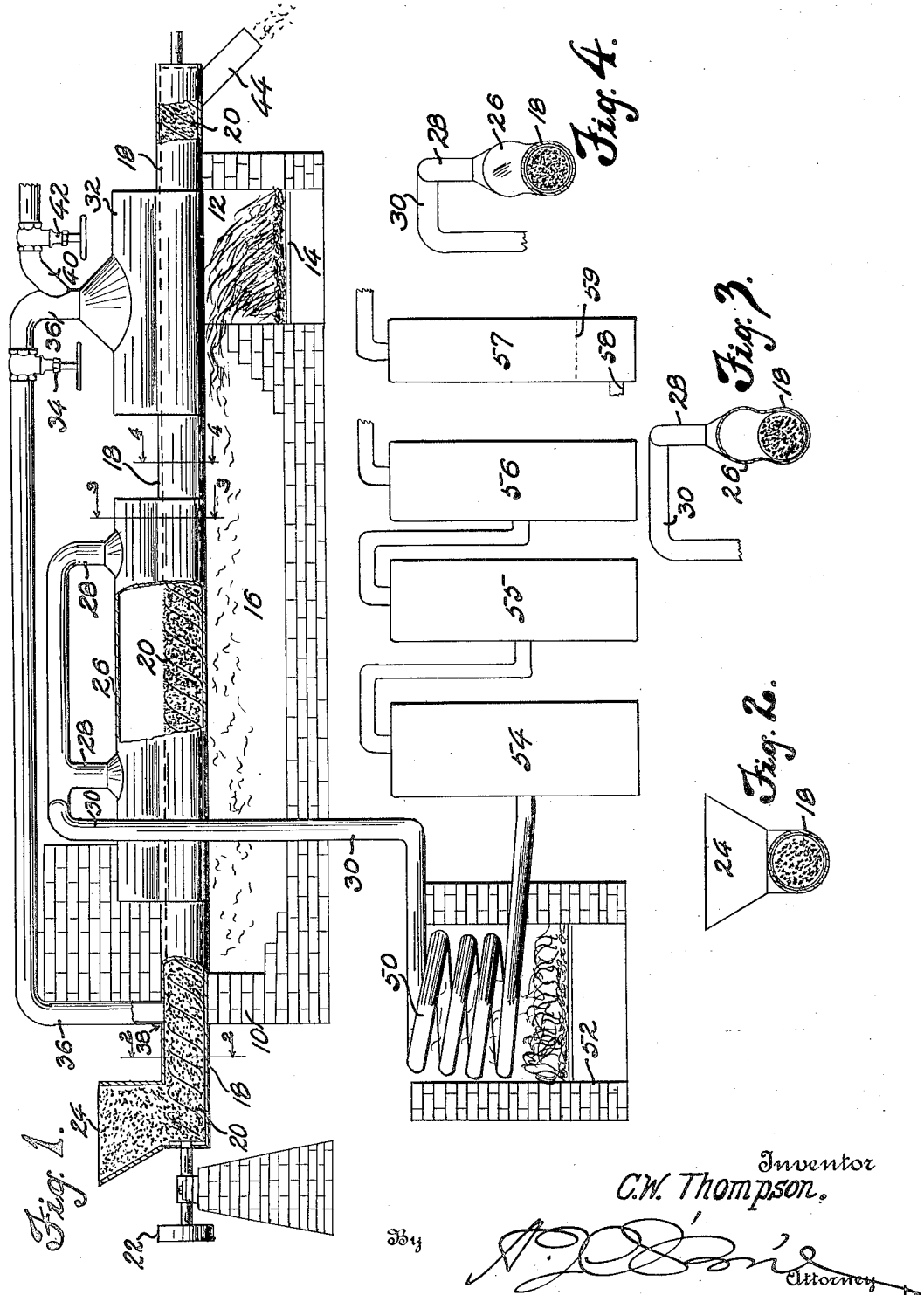
C. W. THOMPSON.

PROCESS AND APPARATUS FOR RECOVERY OF HYDROCARBONS FROM OIL SHALES.

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UNITED STATES PATENT OFFICE.

CAREY W. THOMPSON, OF NEW YORK, N. Y.

PROCESS AND APPARATUS FOR RECOVERY OF HYDROCARBONS FROM OIL SHALE.

Application filed September 15, 1919. Serial No. 323,883.

To all whom it may concern:

Be it known that I, CAREY W. THOMPSON, a citizen of the United States, residing at the city and county of New York and State of New York, have invented certain new and useful Improvements in Processes and Apparatus for Recovery of Hydrocarbons from Oil Shale; and I do 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, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

This invention relates to the recovery of gasolene and like hydrocarbons, suitable for motor fuels, as well as oils, from oil shales.

The object of the invention is to produce the maximum amount of gasolene and like compounds from the shale with the minimum amount of fixed gases, together with the resulting low production of carbon.

Briefly, the invention comprises advancing crushed oil shale through a heating device having a chamber heated to 600° or 700° F., wherein vapors of gasolene, like compounds, and light oils are driven off, these vapors being conducted directly from the chamber, superheated, and fractionally condensed. The shale is advanced farther through the apparatus into a second chamber heated to a temperature of from 800° to 900° F., wherein vapors of heavy hydrocarbons are driven off from the shale. The heavy hydrocarbon vapors are conducted in part to the intake of the device and introduced into the incoming shale, whereby the shale particles are coated with heavy hydrocarbon and the temperature of the shale is raised before entering the first heating chamber. The heavy hydrocarbon serves to prevent, or at least greatly retard (as the case may be with the particular shale being treated), the formation of fixed gases. In this manner more gasolene and the like, and less carbon are produced. The heavy hydrocarbons introduced at the head of the machine as vapor, and thus formed from the original shale content, are all driven off in the second heating chamber. The surplus of heavy vapors over the amount required for introduction into the incoming shale is taken off for condensation and refining.

In the drawings:

Fig. 1 represents diagrammatically one form of apparatus for carrying on the process.

Figs. 2, 3 and 4 are sections taken respectively on the lines 2—2, 3—3, 4—4, Fig. 1.

A furnace 10 having a fire box 12, grate 14, and combustion chamber 16, supports a heating device 18 through which extends a conveyor 20 driven by means such as a pulley 22. A hopper 24 feeds the heater 18. Above the combustion chamber 16 the heater 18 is enlarged to form a vapor chamber 26, the lower portion of the chamber being shaped to follow the contour of the conveyor 20 as much as possible, as shown in Fig. 3, in order to efficiently advance the shale. The top of the chamber 26 is provided with take-off connections 28, leading to a conduit 30. In this chamber gasolene and kindred compounds, together with light oils, are driven off in vapor form. The conveyor 20 then advances the shale to a second chamber 32, similar in construction to the chamber 26, this chamber 32 being located over the fire box 12, in order to be heated to a higher degree. Here all of the heavy hydrocarbon vapors that the shale will produce are driven off. These enter a conduit 36 which may be controlled by a valve 34, and are conducted to the forward end of the heater, where they are introduced from the conduit 36 into the shale in the heater 18 at the point 38. These highly heated vapors condense on the shale particles to form a coating over them and to raise their temperature. However, the quantity of vapors so introduced is not sufficient to form a flowing mass; it is only necessary that the particles be well coated.

I have found that when the shale particles are coated by means of the heavy hydrocarbon vapors, the formation of fixed gases is either entirely prevented or at least largely retarded. The result is an increase in the quantity of gasolene and the like, and light oils, to an extent almost double that where the shale is not so treated. There is a corresponding decrease in the production of carbon. At the same time, the process is not interfered with by the excess of heavy hydrocarbon, since it may be so controlled that it will all be driven off from the chamber 32.

Surplus vapors not required to treat the shale are drawn off through the conduit 40, controlled by the valve 42 for refining. The amount of vapors from the chamber 32 which

shall pass through conduits 36 and 40 is easily controlled by valves 34 and 42. The shale, deprived of its hydrocarbons, is discharged through a chute at 44.

In order to efficiently prevent the passage of vapors through the shale either from the hopper 24 or from the chute 44, the ends of the heater 18 beyond the chambers 26 and 32 are sufficiently long that the accumulation of the ground shale will check their passage.

As the light vapors leave the conduit 30, they are conducted directly and without condensation, to a coil 50 in a superheater 52, whence they pass to fractional condensation tanks 54, 55, 56 and 57, in a series as numerous as required for complete condensation. The object of superheating the vapors is to raise their temperature to a point where vaporization is complete so that the fractions condensed may be complete, due to the greater range in temperature.

One of the condensation chambers 57 will be used as a scrubber and the inlet into this chamber at 58 will be located below the level of a quantity of water therein indicated at 59. Beyond this chamber the products, consisting of kerosene, gasolene, and like compounds, will be clear.

The fractional condensation apparatus preferably will be located in a room in which the temperature may be controlled and the tanks air-cooled. In this manner there will be no requirements for water for the entire process, except that small amount used in the scrubber 57. This is a valuable feature, since in the shale regions water is usually very scarce.

It should be noted also that in the present process the heavy hydrocarbons are separated from the lighter constituents during the process itself. This therefore eliminates the separation of the heavy hydrocarbons in the condensation apparatus 54, 55, 56, 57. The heavy vapors will be condensed and refined in a different apparatus, which may be similar to that for the light vapors.

I claim:—

1. A process for distillation of hydrocarbons from oil shale comprising heating the shale by external means to free gasolene and light oils, removing light oils and gasolene then heating the shale at a higher temperature to vaporize the heavy hydrocarbons, and introducing the heavy vapors freed from said light oils and gasoline into a fresh cold quantity of shale prior to the first heat treatment.

2. A process for distillation of hydrocarbons from oil shale comprising introducing heavy hydrocarbon vapors at a high temperature into crushed shale having a lower temperature, the vapors being introduced in quantity sufficient to only coat the shale particles as the vapors condense without leaving a free liquid residue, and then heating the shale at a temperature sufficient to liberate gasolene and light oil vapors but insufficinet to vaporize heavy hydrocarbons.

3. Apparatus for the distillation of hydrocarbons from oil shale comprising a heating device having a chamber for driving off vapors of gasolene and light oils, and a second chamber for driving off heavy hydrocarbon vapors, means to convey the shale through said chambers, common means for heating the first chamber and for heating the second chamber to a higher temperature than the first, means to collect the vapors from the first chamber, and means to collect the vapors from the second chamber, the collecting means for the second chamber comprising a conduit leading to the intake of the device for introducing said heavy hydrocarbons into the incoming shale.

In testimony whereof I affix my signature.

CAREY W. THOMPSON.