Jan. 19, 1937. H. R. STOLTZ 2,068,091

METHOD OF RECIRCULATING FLUE GASES

Filed Jan. 8, 1934 3 Sheets-Sheet 1

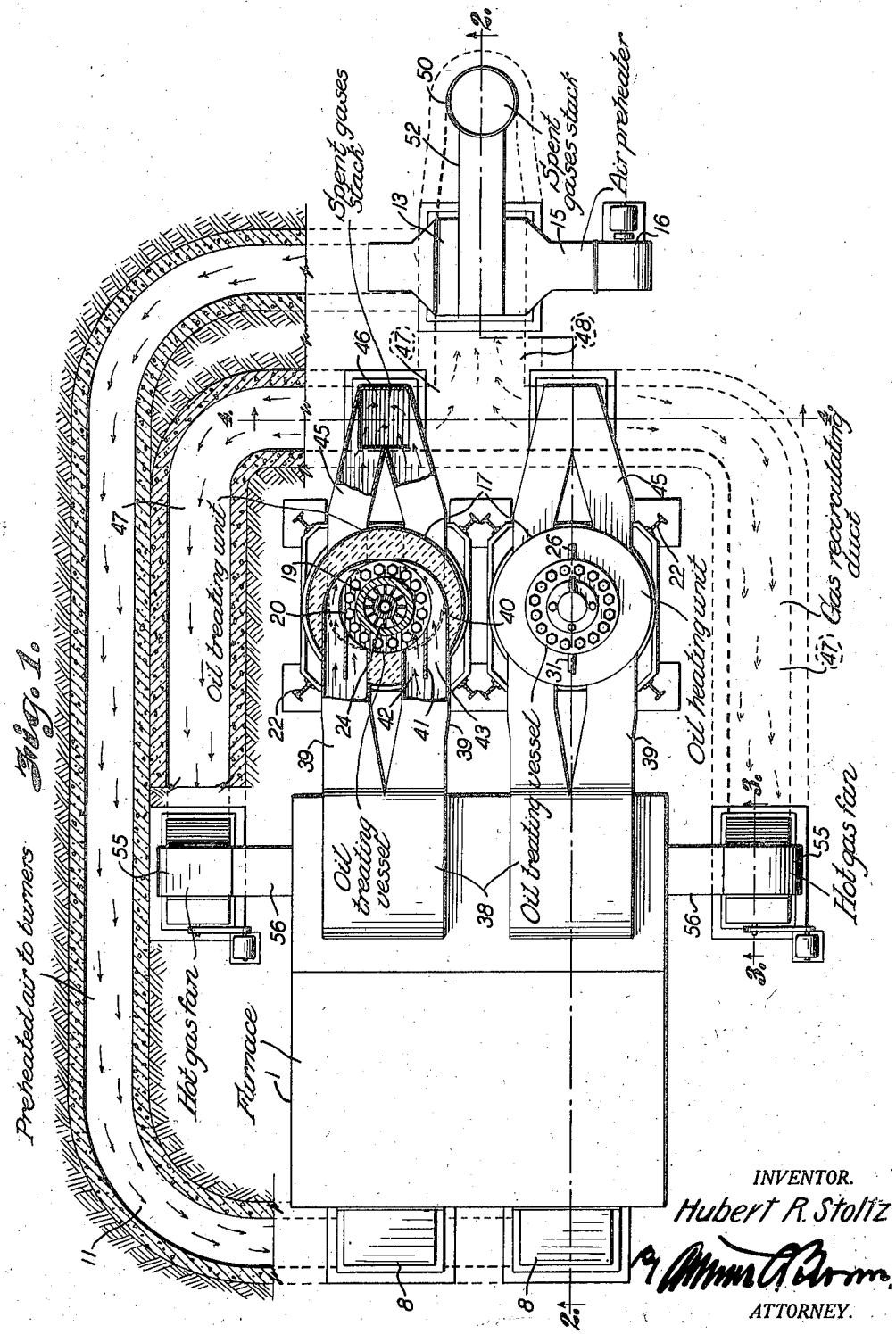


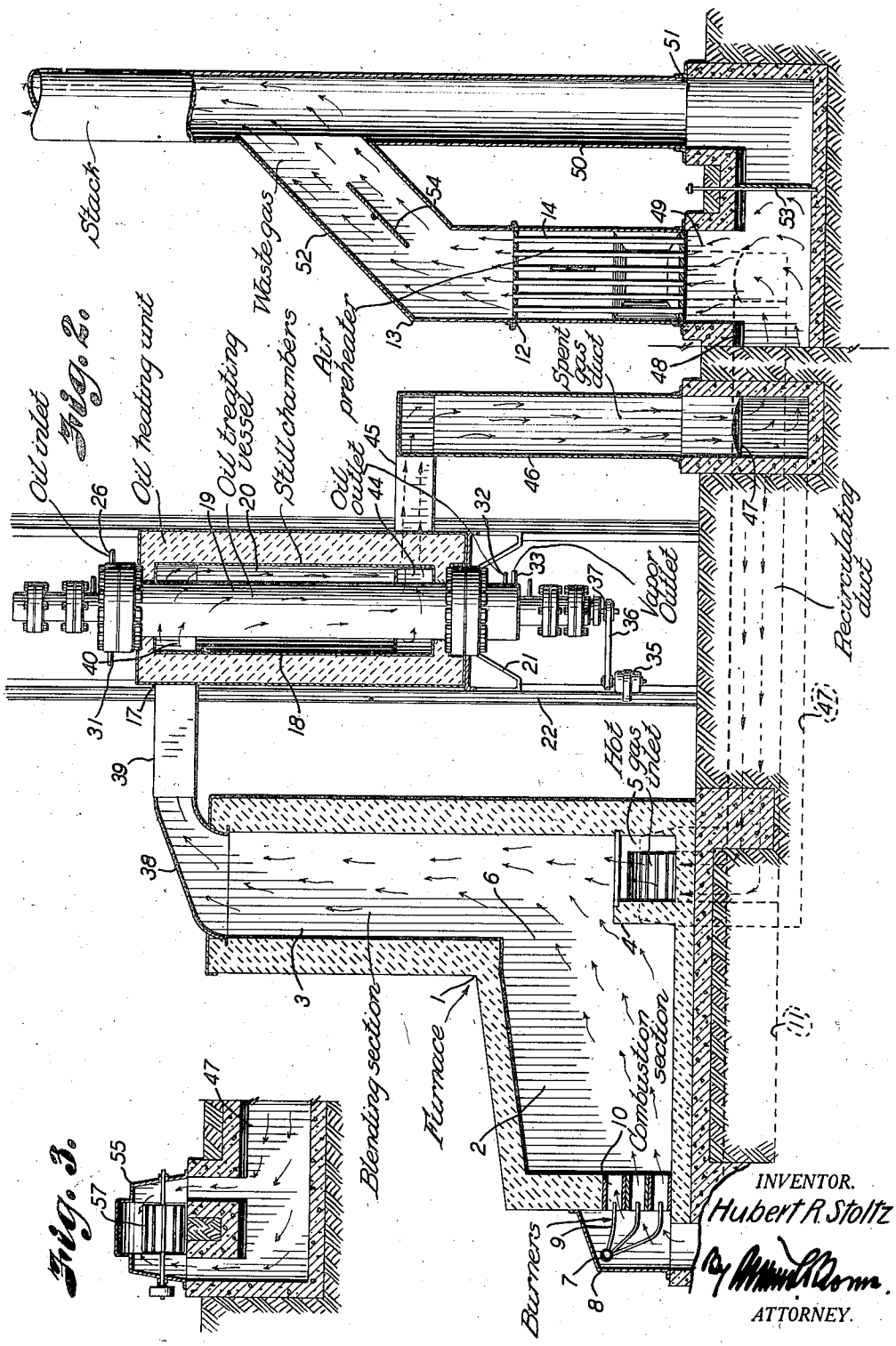
Fig. 1.

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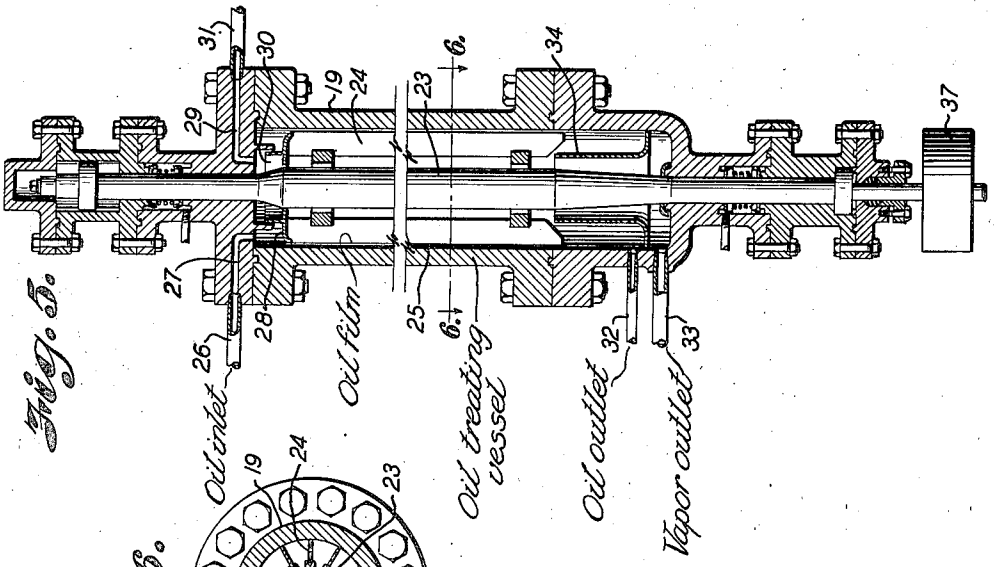


Fig. 5.

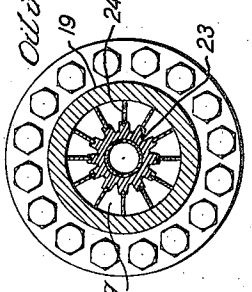


Fig. 6.

Fig. 4.

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2,068,091

METHOD OF RECIRCULATING FLUE GASES

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Application January 8, 1934, Serial No. 705,730

4 Claims. (Cl. 196—71)

My invention relates to a method of heat treating hydrocarbon oil, and more particularly to a method of that character involving continuous flow of a gaseous heating medium over the exterior wall of a treating vessel containing the oil, also in continuous flow, for extraction and/or change of characteristics of certain fractions of the oil.

In heat treating oil for the recovery of fractions, as in the manufacture of gasoline, by continuous distillation, variation in temperature of the heating medium necessarily results in undesirable variation in quality of the product of the still, and lack of uniformity in application of the heating medium throughout the entire surface of the treating vessel produces "hot spots" in the wall of the vessel, at which the metal will tend to yield under pressures lower than those which the vessel should withstand for safe operation.

It is the object of my invention to obviate the disadvantages above mentioned by more uniform application of heat to the treating vessel than has heretofore been employed in the practice of refining oil, and in accomplishing this object I have provided improved details of structure, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a plan view of apparatus for heat treating hydrocarbon oil in accordance with my improved method, parts being broken away for better illustration of distribution and recirculation of fluid heating medium relative to a treating vessel.

Fig. 2 is a longitudinal vertical section on the line 2—2, Fig. 1.

Fig. 3 is a vertical section of a part of a gas return line and recirculation fan on the line 3—3, Fig. 1.

Fig. 4 is a transverse vertical section on the line 4—4, Fig. 1, particularly illustrating parts of return lines from a plurality of still chambers.

Fig. 5 is an enlarged vertical section of a heating vessel which may be employed in connection with my invention.

Fig. 6 is a transverse section on the line 6—6, Fig. 5.

Referring more in detail to the drawings:

1 designates a furnace of recirculation type, having communicating horizontal combustion and vertical blending sections 2, 3, and a bridge wall 4 providing a recirculation-gas inlet chamber 5 for delivery of spent gases into the throat 6 connecting the combustion and mingling chambers, as presently described.

The furnace is shown to be of oil or gas burning type in which liquid fuel is delivered from a source of supply (not shown) through a manifold 7 extending through a burner housing 8 along a plurality of burner positions in the front of the furnace, and from the manifold through branches 9 to mixing chambers 10, where the fuel is mixed with air admitted through the housing 8 for combustion in the chamber 2.

Air for supporting combustion is supplied to the housing 8 through a conduit 11 leading underground along one side of the furnace from a preheater 12, preferably including a housing 13 containing a tube bundle 14 through which hot gases leaving the still chamber, as presently described, pass on their way to a stack, and an air inlet 15 through which fresh air is drawn by a fan, indicated at 16, and by the fan impelled through the preheater and supply conduit to the oil burner.

Located adjacent the furnace 1 is a plurality of heating units 17, preferably of the type here illustrated, each including a cylindrical chamber 18 and interior treating vessel 19 spaced from the interior wall of the heating chamber to provide an annular space 20, the heating chamber being closed tightly about the treating vessel at both top and bottom, and both the heating chamber and treating vessel supported by brackets 21 on a skeleton frame 22 of structural steel formation in order to provide access to the chamber and vessel.

The treating vessel here illustrated is of the type disclosed in Letters Patent No. 1,732,805 issued October 22, 1929, to E. C. D'Yarmett, including a rotatable shaft 23 extending centrally through the treating vessel and provided with vanes 24 having outer edges spaced slightly from the inner wall of the vessel to provide space 25 for effecting circumvolution a film of oil progressively along the inner surface of the vessel, an inlet line 26 for supplying oil through a conduit 27 to the top of the treating vessel over a distributor 28, a conduit 29 communicating with a trap 30 about the shaft at the top of the vessel chamber for supply of gas or steam for combination with free carbon in the treating chamber under certain operating conditions, connecting with an in-take line 31, and with lines 32, 33 leading from separate compartments formed by an inverted skirt 34 in the bottom of the chamber for removal respectively of unvaporized liquid oil and vapor generated from the oil within the treating chamber. A motor 35 for rotating the shaft 23 through a belt and pulley

36, 37, is preferably supported on the chamber supporting frame 22.

I refer but briefly to detail construction of the still, as it, per se, forms no part of the present invention. As the method may be employed with a single still tube or a plurality of similar tubes, I will, in the following specific description, refer to one only, with the understanding that such description relates equally to all, except as hereinafter stated.

Opening from the top of the gas mingling chamber 3 is a hood 38 having branches 39 leading horizontally along opposite sides of the upper portion of the vertical still chamber 10, and communicating with said chamber through elongated ports 40 extending throughout substantial circumferential areas at opposite sides of the chamber, the inner wall of each of said branches terminating at the wall of the chamber adjacent the furnace side thereof to provide an unobstructed flow of gases transversely across the chamber in one direction, the outer wall of the same branch being curved inwardly and terminating at the wall of the chamber opposite the furnace side to direct gases tangentially of the chamber wall, each branch being provided with a vertical partition 41 for dividing the gas stream to limit swirling of the gases in the chamber that would result from the tangential delivery referred to, it being apparent that the stream of gases flowing through the throat 42 will strike the deflected stream delivered through the throat 43 within the chamber and reduce velocity of the flow.

The two branches 39, opening to the chamber directly opposite each other, direct their gas flows to the chamber in opposite directions so that remaining velocity of the stream entering the chamber through one branch is absorbed by that of the gases entering from the other branch, and the combined gases tend to spread about the upper end of the chamber to fill that portion of the chamber. Elongated ports 44, corresponding in size and arrangement with the ports 40 at the top of the chamber, provide outlet from the chamber to branches 45 of a vertical conduit 46 opening to a duct 47 leading in one direction through a conduit 48 to the preheater housing 13 through a throat 49 and stack 50 through throat 51, the preheater housing also communicating with the stack through a pipe 52.

Located in the conduit 48 between the preheater throat 49 and stack 50 is a damper 53 for regulating flow of gases between the preheater and the stack, and located in the pipe 52 is a damper 54 for the same purpose.

The duct 47 leads, in a direction opposite to that conducting gases to the stack, to a fan housing 55 at the side of the furnace adjacent the gas distributing chamber 5, and connects with said chamber through a duct 56, a hot fan in the housing (indicated at 57) when in operation drawing spent gases through the duct 47 and impelling the gases into the mingling or blending chamber 3 within the furnace structure.

When two or more still units are employed in bank as illustrated, the outer end of the duct 47 of each opens into the outlet line 48, then common to each, so that while gases from each of the heater units is recirculated through its individual duct 47, surplus of the gases from both units is passed to the preheater and stack through a common line.

Assuming the apparatus to be constructed and assembled as described, fresh products of combustion generated in the combustion chamber are mixed with gases recirculated in the mingling or blending chamber and the combined stream conducted into the top of a heating chamber through the branches of the furnace outlet hood, the gases being automatically proportioned between the separate chambers of a bank of units when more than one unit is employed. Whether or not more than one heating unit is employed, gas entering the upper portion of a heater chamber loses its velocity because of the manner of its delivery into the chamber, and, spreading about the upper end of the chamber, is drawn down by draft in the outlet line uniformly about the treating vessel to provide uniform application of heat to all parts of the vessel that will produce a uniform product, and avoid weakening of the vessel wall incident to uneven heat application. Gases leaving the heating chamber through the branch and outlet enter the outer end of the underground duct 47, where a quantity thereof desired for blending with fresh products of combustion to regulate temperature and quality of the heating medium, is returned to the furnace, the balance of the gases being passed to stack through the preheater, thereby effecting saving of heat units by return of said units to the heating medium and employment of surplus units for preheating the air required for supporting combustion.

While I have illustrated and referred briefly to a specific type of still, it is apparent that the invention is not so limited, and while I have shown and described a bank of stills and distribution of gases for such arrangement, it is further apparent that number as well as construction of the stills may be varied to suit individual requirements without departing from the spirit of the invention.

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

1. The method of heat treating hydrocarbon oil including rotating the oil within a cylindrical vessel with sufficient velocity for the centrifugal force generated by its rotation to cause the oil to pass over the inner surface of the vessel in the form of a continuous film, moving hot gases in separate streams tangentially of an end of the vessel whereby the velocity of one stream is absorbed by the other and the combined gases move uniformly in a longitudinal direction of the outer surface of the vessel, collecting a portion of the gases, and recirculating the collected gases over the surface of the vessel.

2. The method of heat treating hydrocarbon oil including rotating the oil within a cylindrical vessel with sufficient velocity for the centrifugal force generated by its rotation to cause the oil to pass over the inner surface of the vessel in progressive advancement in the form of a continuous film, producing hot gases, moving the hot gases in separate streams tangentially of opposite sides of the vessel whereby velocity of one stream is absorbed by the other and the combined gases move uniformly in the same direction as the advancement of the film, collecting a portion of the gases, blending the collected gases with freshly produced hot gases, and passing the blended gases over said outer surface of the vessel in the same direction as the previous flow.

3. The method of heat treating hydrocarbon oil including rotating the oil within a cylindrical vessel with sufficient velocity for the centrifugal forces generated by its rotation to cause the

oil to pass over the inner surface of the vessel in progressive advancement in the form of a continuous film, moving hot gases in separate streams tangentially of opposite sides of the vessel whereby the velocity of one stream is absorbed by the other and the combined gases move uniformly in the same direction as the advancement of the film, collecting a portion of the gases, and recirculating the collected gases in the same direction.

4. The method of heat treating hydrocarbon oil including moving a continuous film of oil in progressively advancing circumvolution from the top downwardly over the inner surface of a vessel, moving hot gases in separate streams transversely in confined contact with opposite sides of the vessel whereby velocity of one stream is absorbed by the other and the combined gases move in the same direction along the length of the vessel, collecting a portion of the gases after passage over said vessel, and returning the collected gases for flow over the vessel in the same direction.

HUBERT R. STOLTZ.