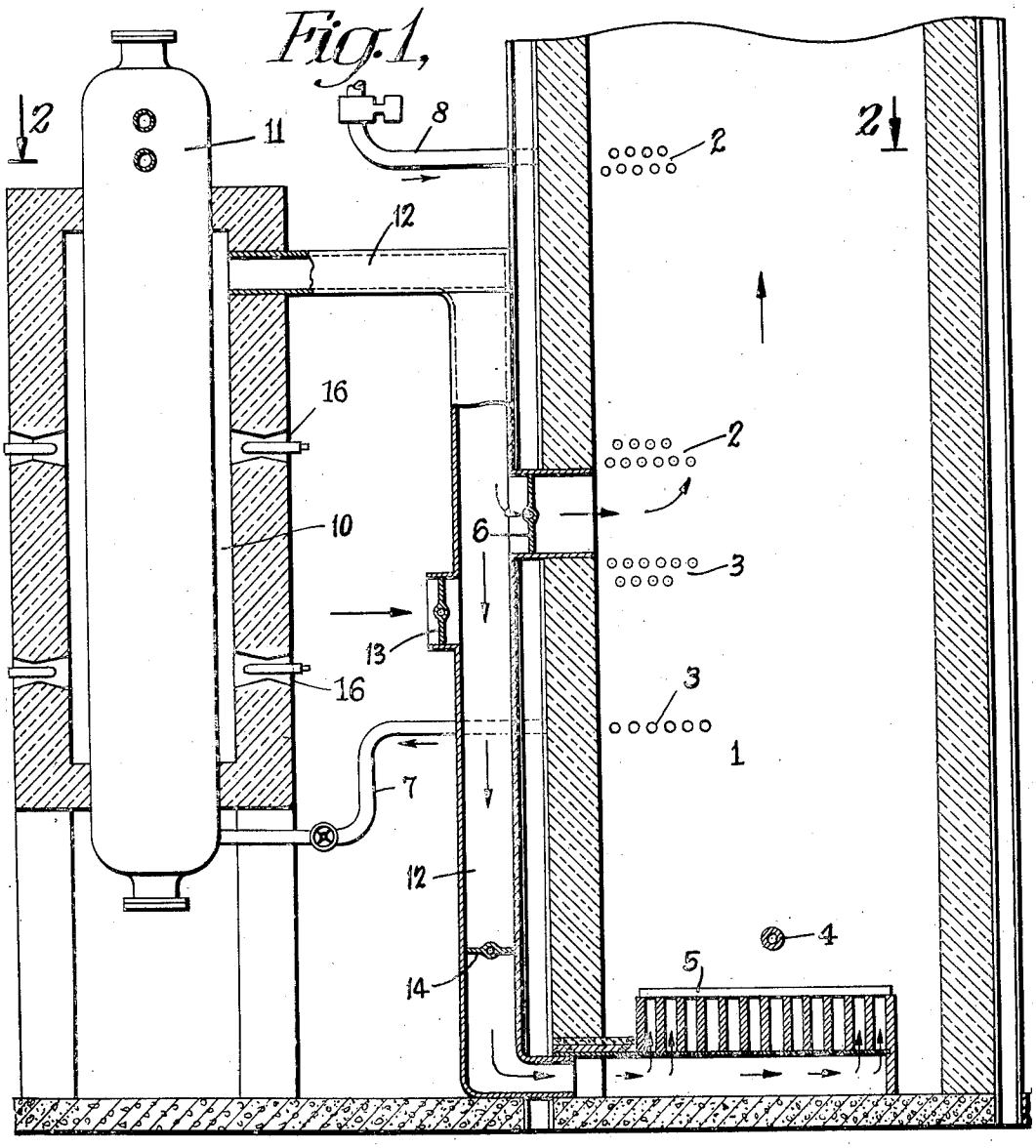
April 3, 1934. R. F. DORSCH 1,953,395

METHOD AND APPARATUS FOR HEATING OILS

Filed Jan. 16, 1928 2 Sheets-Sheet 1

Fig. 1,



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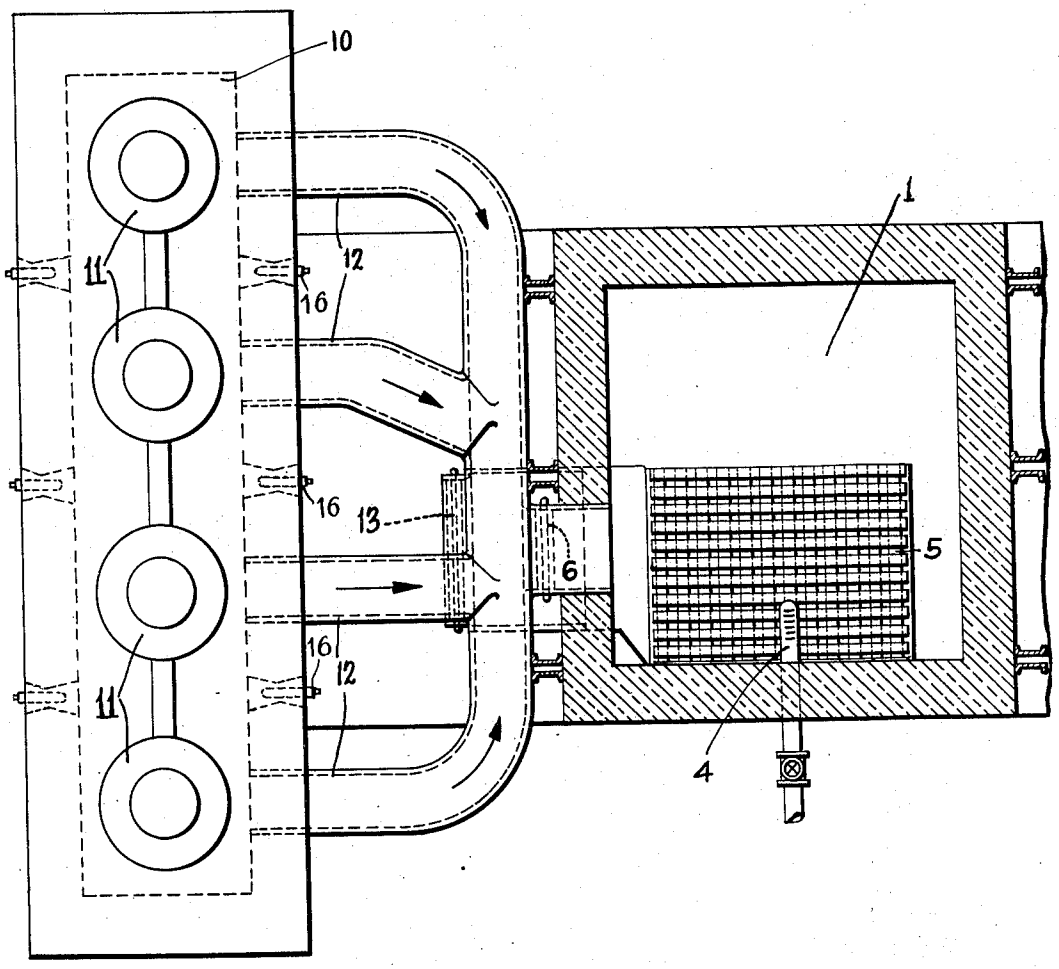
By his Attorney
R. J. Deachon

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METHOD AND APPARATUS FOR HEATING OILS

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Fig. 2,



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METHOD AND APPARATUS FOR HEATING OILS

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Application January 16, 1928, Serial No. 247,038

15 Claims. (Cl. 196—116)

This invention relates to a method and apparatus for the heat treatment of hydrocarbon oils and has particular reference to method and apparatus for effecting heat treatment in which the oils are preliminarily heated in a tubular heater and thereafter maintained at the desired temperature in a distillation or reaction vessel by the application of a sufficient quantity of heat to such vessel.

Although it is not desired to thus limit the invention, it may be described and illustrated with reference to apparatus and method of operation suitable for the cracking of higher boiling hydrocarbon oils to lower boiling hydrocarbon oils, in which the oils are heated to a cracking temperature in a tubular heater and are then passed into a reaction vessel or still in which the oils may undergo destructive distillation, the heat requirements for which may be supplied by the combustion of fuel in a furnace surrounding the reaction vessel. The waste gases from this furnace may effectively be utilized by supplying them to the combustion zone in the furnace surrounding the heating coil and supplying sufficient additional air to furnish satisfactory combustion conditions in that furnace. The considerable heat content in the waste gases from the furnace surrounding the reaction vessel is thus utilized, while a far greater efficiency in the transmission of heat to the heating coil is obtained on account of greater velocity of the hot gases passed to the tubes of the heating coil.

The waste combustion gases have also been found to be relatively rich in oxygen content and therefore capable of supporting further combustion in themselves. However, inasmuch as they contain considerable quantities of inert combustion gases, they serve to dilute the gases in the combustion zone of the heater and permit the transfer of the same quantity of heat to the oil in the heating coil with a lower differential in temperatures. The heating efficiency is thus greatly increased and tube failures and the resultant loss of time in replacement of burned out tubes are greatly decreased.

The invention may further be described and illustrated in reference to the accompanying drawings, in which Fig. 1 is a diagrammatic illustration, partly in section and partly broken away, of apparatus suitable for carrying out the invention.

Fig. 2 is a plan view partly in section taken on the line 2—2 of Fig. 1.

In the drawings like numerals will be used in reference to like parts.

The furnace 1 is of a type commonly employed in the heating of oils in tubular heaters or pipe stills and contains banks of tubes 2 and 3 which may be arranged in any desired manner in the heating chamber. Oil is supplied from a suitable source of supply (not shown) to the upper bank of tubes 2 through a supply pipe 8. Heat is furnished by combustion of fuel supplied through the burner 4. Adjacent to the furnace 1 may be located a second furnace 10, in which one or more reaction vessels 11 may be mounted and which may be connected by suitable means with the heating coil or tubes in the furnace 1. For example, the pipe 7 may connect the bottom row of the heating tubes 3 with the bottom portion of one of the vessels 11.

In the form of apparatus illustrated the reaction vessel or vessels 11 are supported vertically in the furnace 10, although the placing of the vessels horizontally or in any other desired arrangement is not precluded. These vessels may be heated in the furnace 10 by means of small burners 16 and means provided near the top of the furnace, such as flue 12, for leading away the waste combustion gases. The reaction vessel or vessels 11 may be provided with the usual liquid level lines and vapor lines and the latter may connect with any desired form of fractionating and condensing equipment which may also be provided with suitable means for maintaining the desired pressure on the reaction vessels. These gases may flow as indicated by arrows through the flue 12 and into the bottom of the furnace 1, where they may pass upwardly through checker brickwork 5 to properly distribute them in the furnace chamber. A damper 6 may be provided in a breeching in the furnace walls to permit the by-passing of a portion of the waste gases from the flue 12 into the upper portion of the furnace 1 and through the bank of heating tubes 2. Another damper 13 is provided in the flue 12 for the admission of air. A third damper 14 may be placed in the flue 12 to control the draft, or the flow of gases through the flue.

In Fig. 2 the furnace 10 is shown as enclosing a battery of four reaction vessels, although it is apparent that any desired number may be employed. The flue 12 is shown as having several branches leading from different portions of the furnace but which unite before they enter the bottom of the furnace 1.

The operation of the system may be as follows:

Oil is introduced preferably under pressure into the upper rows of the bank of tubes 2 and

these are connected in such a manner as to enable the oil to flow, in countercurrent relation to the rising furnace gases, through the lower rows of tubes in bank 2, and through the bank of tubes 3 into one or more of the reaction vessels 11. These vessels are heated by the combustion of fluid fuel and the waste combustion gases pass out of the furnace 10 into the flue 12 and are finally drawn into the furnace 1 through the checker brickwork 5 under the influence of the draft created in the furnace 1. A certain amount of fresh air is admitted by adjustment of the damper 13 and the mixed hot gases serve as a suitable supporting medium for thorough and efficient combustion of the fluid fuel which may be admitted through the burner 4.

Owing to the increased percentage of inert gases contained in the combustion products from the furnace 10, the quantity of gases furnished for combustion of the fuel in the furnace 1 is considerably larger than would be the case if fresh air alone were used as a combustion medium and consequently these combustion gases pass upwardly through the furnace 1 at very largely increased velocities but at a lower temperature differential between the gases and the temperature of the oil in the tubes. By this arrangement the whole cracking operation is greatly improved by a uniform heating of the oils in the heater and the efficiency of the operation is increased due, in part at least, to a lowering in fuel consumption. This arrangement and method of operation enables a very efficient heat transfer to the oil without an overheating of the tubes, and with a distinct saving of the heat carried by the hot gases from the furnace 10. In case the volume of combustion gases from the furnace 10 is so great as to cause a detrimental lengthening of the flame from burner 4, a portion of these gases may be by-passed through the upper bank of tubes 2 by adjusting the damper 6.

While I am aware of certain of the prior art, heretofore commonly employed, in which heating of the oils and other materials has been effected by a recirculation of a portion of the flue gases to the combustion chamber for dilution of the combustion gases and lowering the temperature differential, my invention is regarded as presenting novel features in apparatus for and method of specifically treating hydrocarbon oils, in which the oils are preheated in a tubular heater and passed to a distillation or reaction vessel heated by combustion of fuel, the waste gases from which are passed to the combustion zone surrounding the heater to effect more efficient heating of the oil therein and over-all economy of operation of the unit.

Obviously many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. The method of effecting a heat treatment of hydrocarbon oils in a system including a heating coil and an enlarged chamber connected thereto, each surrounded by a separate furnace, comprising passing the oil through the heating coil countercurrent to heating gases, passing the oil into the chamber, supplying heat by combustion to the furnace surrounding the chamber, withdrawing the combustion gases from a point near the top of the chamber furnace, mixing them with a predetermined quantity of air, and passing them to the coil furnace and supporting combustion therein by means of said mixture to effect heating of the oil in the heating coil.

2. The method of effecting a heat treatment of hydrocarbon oils in a system including a heating coil and an enlarged chamber connected thereto, each surrounded by a separate furnace, comprising passing the oil through the heating coil countercurrent to heating gases, passing the oil into the chamber, supplying heat by combustion to the furnace surrounding the chamber to maintain the temperature of the oil therein at the desired point, withdrawing combustion gases from the chamber furnace, and passing them to the coil furnace while adding to the withdrawn combustion gases sufficient air to effect efficient combustion conditions in said coil furnce.

3. The method of effecting a heat treatment of hydrocarbon oils in a system including a heating coil and an enlarged chamber connected thereto, each surrounded by a separate furnace, comprising passing the oil through the heating coil countercurrent to heating gases, passing the oil into the chamber, supplying heat by combustion to the furnace surrounding the chamber to maintain the temperature of the oil therein at the desired point, withdrawing the waste combustion gases from the chamber furnace, supplying them to the combustion zone in said heating coil furnace, and admitting sufficient air to the withdrawn combustion gases about to enter said zone to effect efficient combustion conditions.

4. In apparatus for the heat treatment of hydrocarbon oils, a furnace, a burner for heating the same, a tubular heater mounted therein, an enlarged chamber connected to said tubular heater, a second furnace surrounding said chamber, means to effect the heating of the second furnace by combustion, means for withdrawing the combustion gases from a point near the top of the second furnace and leading them to a point near the bottom of the furnace surrounding the tubular heater adjacent to said burner to support combustion and means for admixing a predetermined quantity of air with said combustion gases from the second furnace to effect complete combustion.

5. In apparatus for the heat treatment of hydrocarbon oils, a furnace having mounted therein a tubular heater, a burner for heating the same, an enlarged chamber connected to said tubular heater, a second furnace surrounding said chamber, means to effect the heating of the second furnace by combustion, means for withdrawing the combustion gases from the second furnace and leading them to the combustion zone in the furnace surrounding the tubular heater, and means for admitting air to said zone to promote combustion.

6. In apparatus for the cracking of hydrocarbon oils, a furnace having a tubular heater mounted therein, a burner adapted for heating the oil in the heater to a cracking temperature, a reaction chamber connected to said heating coil, a second furnace surrounding said chamber, means to effect the heating of the second furnace by combustion to maintain the desired temperature for the promotion of cracking and distillation of the oils therein, means for withdrawing the waste combustion gases from the second furnace and for leading them to the combustion zone in the furnace surrounding the heating coil, and means for mixing a predetermined quantity of air with

said combustion gases to effect complete combustion.

7. In combination, a pipe coil for oil, a furnace for heating said coil for oil, a furnace for heating conversion chambers into which said coil feeds, burners for said furnaces, and a conduit from said second furnace adapted to lead combustion gases to the first said furnace and supply same in lieu of air to the burners thereof.

8. In combination, a furnace, a coil for heating oil therein, a second furnace, a conversion chamber in said second furnace adapted to receive heated oil from said coil, burners in said second furnace and adapted to heat the conversion chamber, fluid fuel burners for first said furnace, a conduit adapted to lead combustion gases from the second furnace to and around said fluid fuel burners of the first furnace and auxiliary air inlets leading into said conduit.

9. In combination, a furnace, a coil for heating oil therein, a second furnace, conversion chambers in said second furnace adapted to receive heated oil from said coil, burners in said second furnace and adapted to heat the conversion chambers, fluid fuel burners for first said furnace, a conduit adapted to lead combustion gases from the second furnace to and around said fluid fuel burners of the first furnace, and an inlet for permitting air to enter into said conduit near the point of exit from said second furnace.

10. The method of cracking hydrocarbon oils which consists in heating a confined stream of oil in a furnace, operating said furnace with a slight excess of oxygen, passing said stream into a conversion chamber adapted to be heated by a furnace, operating said furnace with substantial excess of oxygen and using the gases of combustion therefrom as combustion air in first said furnace.

11. The method of cracking hydrocarbon oils which consists in heating a confined stream of oil in a furnace, operating said furnace with a slight excess of oxygen, passing said stream into a conversion chamber adapted to be heated by a furnace, operating said second furnace with substantial excess of oxygen, mixing the gases of combustion therefrom with fresh air, and using said admixed gases and fresh air as combustion air in first said furnace.

12. The method of cracking hydrocarbon oils which consists in heating a confined stream of oil in a furnace, operating said furnace with a slight excess of oxygen, passing said stream into a conversion chamber adapted to be heated by a furnace, operating said second furnace with substantial excess of oxygen, mixing the gases of combustion therefrom with fresh air, and using the admixed fresh air in first said furnace, all of said fresh air being introduced into the stream of combustion gases near their point of exit from said second furnace.

13. The method of cracking hydrocarbon oils to produce lower boiling hydrocarbon oils, characterized by subjecting the oil to heat treatment in two successive stages which comprises, passing the oil through the first stage in heat relation to hot gases evolved from the combustion of fuel, passing the oil into the second stage, independently supplying additional heat by combustion to said second stage, withdrawing combustion gases from said second stage adding air to said withdrawn combustion gases; and admixing the withdrawn combustion gases from said second stage of treatment and the added air with combustion gases in said first stage after the combustion gases of the first stage have passed in heat relation with the oil through a portion of the first stage.

14. The method of cracking hydrocarbon oils to produce lower boiling hydrocarbon oils, characterized by subjecting the oil to heat treatment in two successive stages which comprises, passing the oil through a coil in the first stage in heat relation to hot gases evolved from the combustion of fuel, passing the oil into the second stage, independently supplying additional heat by combustion to said second stage, withdrawing combustion gases from one of the stages, adding air to said withdrawn combustion gases and admixing the withdrawn combustion gases and the added air with combustion gases from the other stage after the latter combustion gases have passed in heat relation with the oil through a portion of said other stage.

15. The method of cracking hydrocarbon oils to produce lower boiling hydrocarbon oils, characterized by subjecting the oil to heat treatment under pressure in two successive stage, comprising passing the oil through the first stage in countercurrent relation to hot combustion gases, passing the oil into the second stage, independently supplying additional heat by combustion to said second stage, withdrawing combustion gases from said second stage of treatment, and conducting said withdrawn combustion gases to the combustion gases formed in the first stage of treatment to be admixed therewith at a point where the combustion gases for the first stage of treatment are being formed, and also at another point separated from said first mentioned point and after said combustion gases for the first stage of treatment have already passed in countercurrent relation to only a portion of said first stage.

RUSSELL F. DORSCH.