Nov. 6, 1934. G. E. McCLOSKEY 1,979,838

DISTILLATION OF TAR

Filed June 3, 1930 4 Sheets-Sheet 1

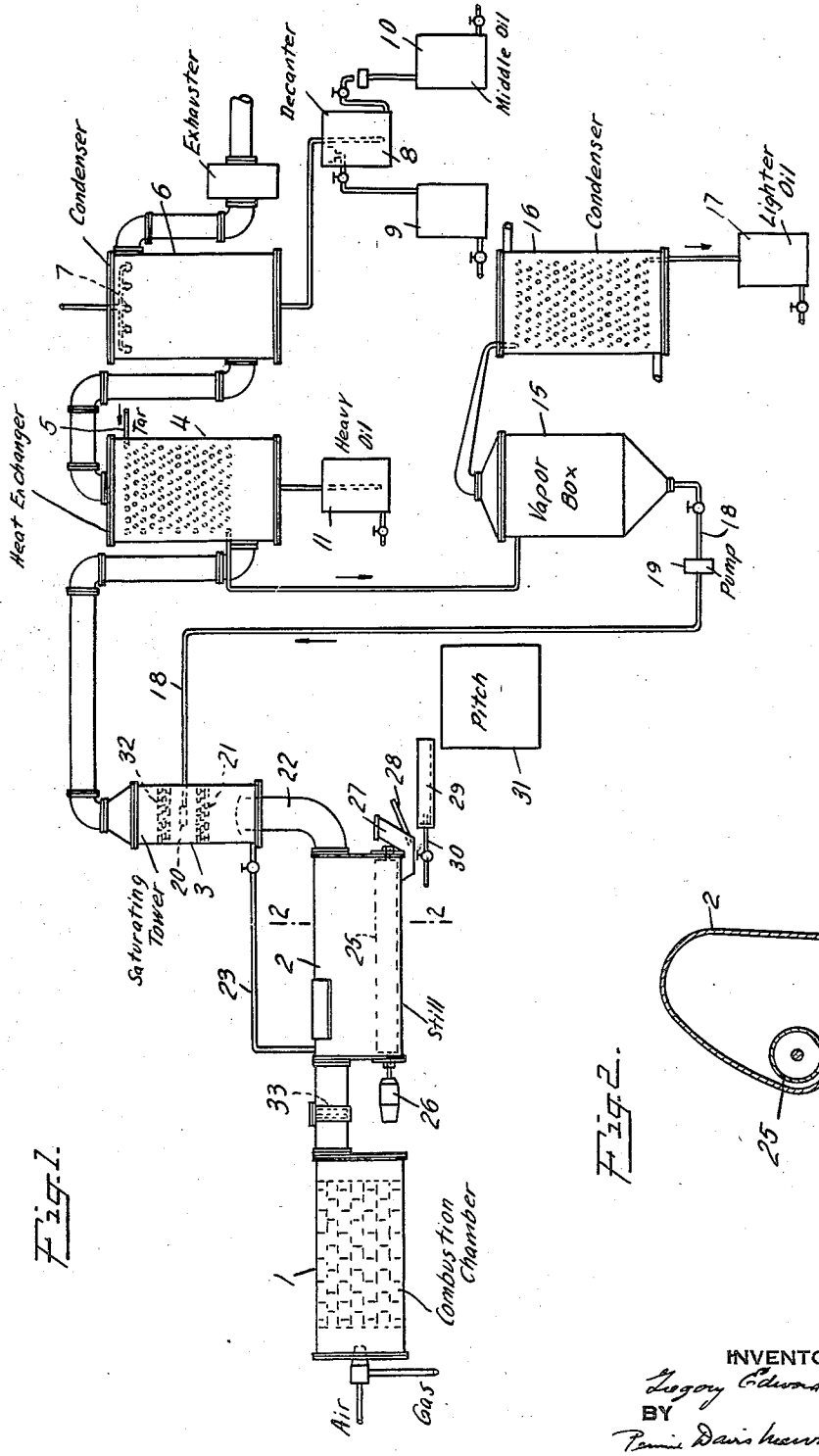


Fig. 1.

Fig. 2.

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DISTILLATION OF TAR

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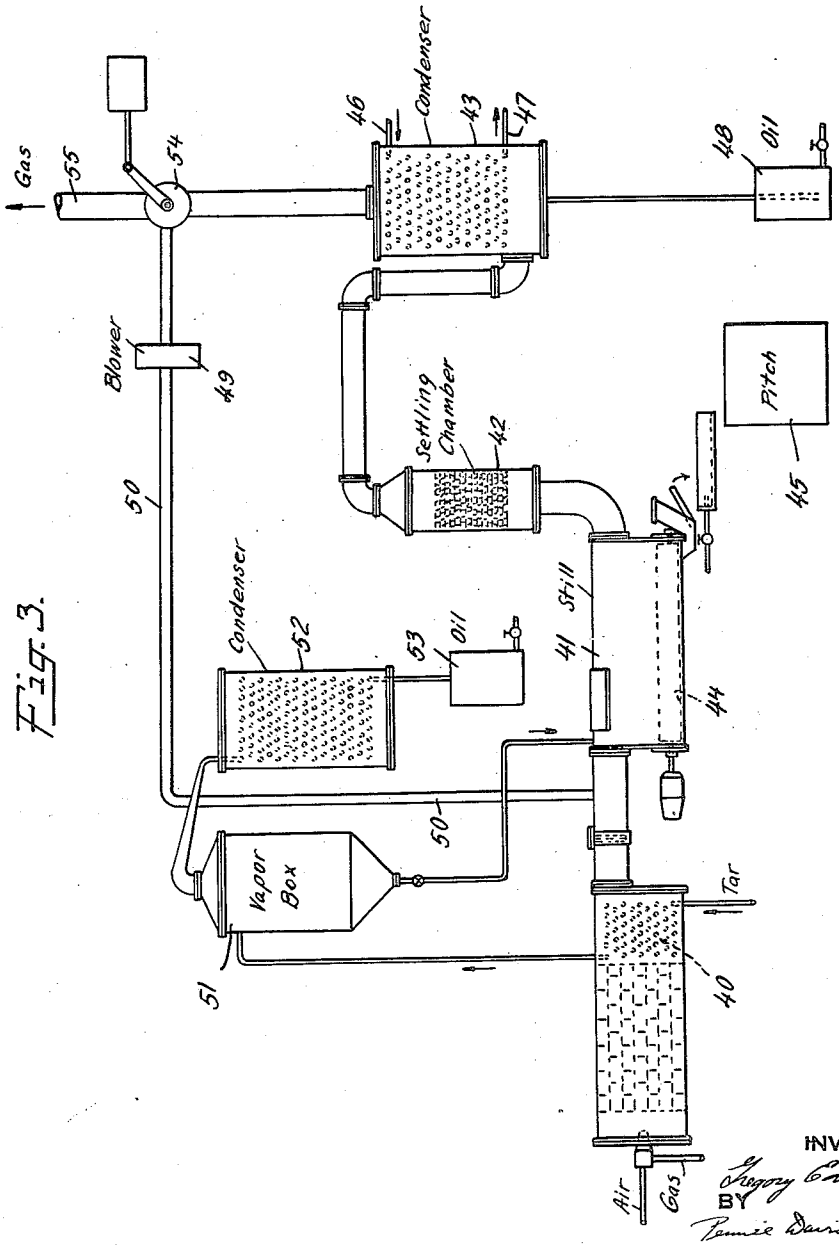


Fig. 3.

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DISTILLATION OF TAR

Filed June 3, 1930 4 Sheets-Sheet 3

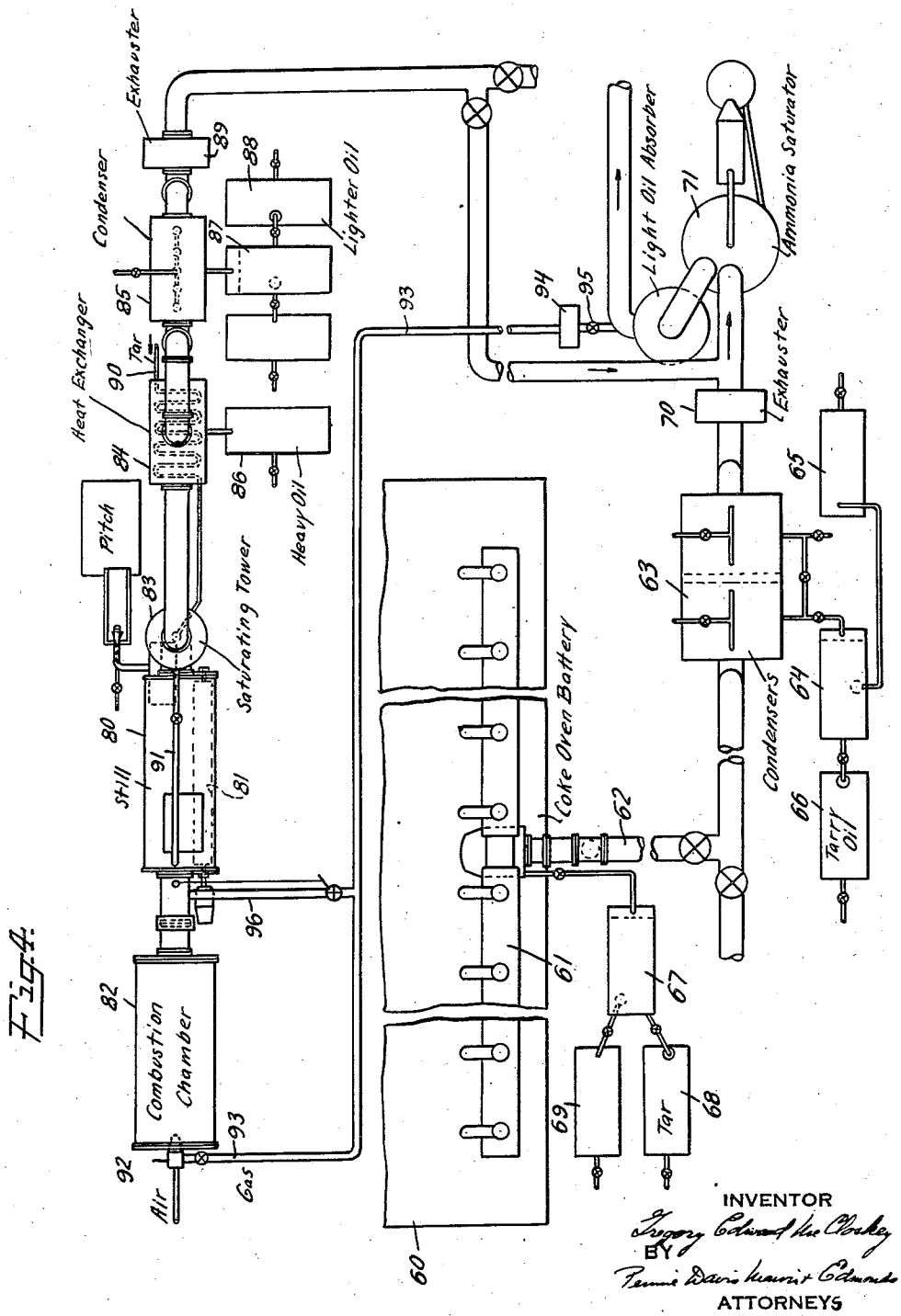


Fig. 4.

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DISTILLATION OF TAR

Filed June 3, 1930 4 Sheets-Sheet 4

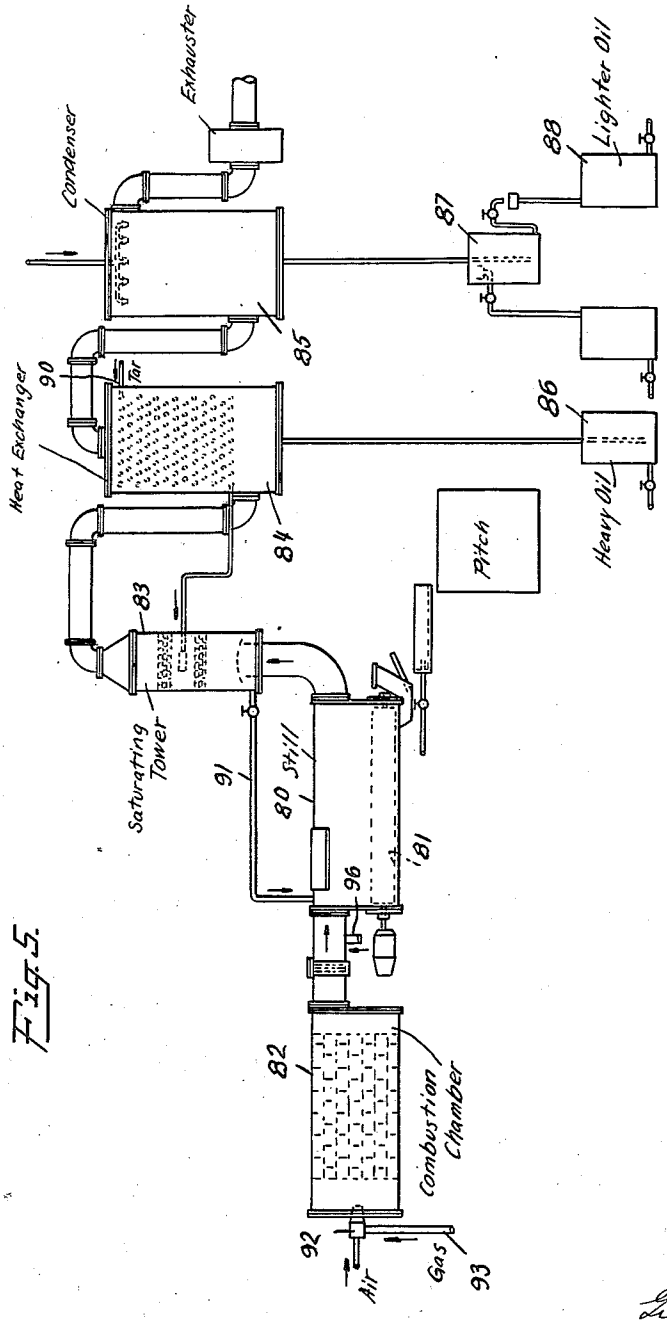


Fig. 5.

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UNITED STATES PATENT OFFICE

1,979,838

DISTILLATION OF TAR

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Application June 3, 1930, Serial No. 459,025

20 Claims. (Cl. 202—30)

This invention relates to an improved process of distilling tar with combustion gases.

The present invention provides an improved method of distilling coal tar with combustion gases in which the gases employed have a radically higher temperature than that heretofore proposed for such distillation and in which the gases are sprayed with the tar in the form of an intense spray and in an amount such that the gases are almost instantly cooled and coking of the tar by the hot gases is thus avoided. Distillation is effected and pitch of high melting point is produced with only minimum decomposition of the tar.

The combustion gases, according to this invention, are employed at a temperature above that at which complete distillation and carbonization of the pitch residue resulting from the distillation of coal tar would take place, and these gases are employed in such a manner that objectionable carbonization is avoided and rapid and effective distillation is accomplished.

In the present process I employ combustion gases at a high temperature, e. g. around 500–1000° C. Coal tar if heated in the usual manner to such a high temperature would rapidly carbonize. In the process of the present invention tar is distilled without objectionable carbonization and the combustion gases are employed at a high temperature in a particularly advantageous manner.

The combustion gases employed for the tar distillation of this invention may be fresh hot combustion gases, i. e. gases resulting directly from the combustion of carbonaceous material, or preferably the fresh hot combustion gases are partially cooled before they are employed for the tar distillation.

Fresh hot combustion gases which are too hot for distilling tar even by the method of this invention, may be cooled in any suitable manner and may then be used for distillation. They may be cooled, for example, by bringing a gas or a liquid into indirect heat interchanging relation with them to cool them before they are brought into direct contact with the tar. The tar to be distilled may be preheated by being brought into such indirect heat interchanging relation with the hot gases in a pipe coil still before being brought into direct contact with the gases. Water may be heated or even converted to steam by indirect contact with the fresh gases. Where a portion of the gases employed for the distillation are to be recirculated as described below, such recirculated gases may be reheated by indirect contact with these fresh hot combustion gases. The hot combustion gases may be cooled by indirect contact with air or they may be allowed to cool merely thru radiation of heat from the walls of the conduit thru which they pass from the burner or burners to the still.

Fresh hot combustion gases may be cooled by diluting them with a gas of lower temperature. Ordinary stack gases, such as the waste flue gases from a coke oven battery, may be blended with the hot gases and the heat in the waste gases may thus be utilized. The fresh gases may be diluted with steam, which may advantageously be wet steam; when such a gas mixture is cooled to 80° C., for example, to effect the condensation of oils, the relative amount of non-condensable gas present is less and the loss of oils such as light oil in the gases is correspondingly reduced. Somewhat the same effect may be accomplished by spraying the fresh hot combustion gases with a limited amount of water. The proportion of diluent employed or the extent to which the gases are cooled by other means should be so regulated that the resulting gases are at the high temperature desired for the tar distillation.

Fuel gas, such as coke oven gases after they have been passed thru a by-product recovery condensing system, may be employed for diluting the fresh combustion gases. Such gases are desirable as a diluent because of their low oxygen content. The oxygen content of the gases brought into direct contact with the tar should preferably be kept low. Where the diluent contains oxygen the combustion of the fuel must be so regulated as to produce combustion gases of unusually low oxygen content. Where a diluent is employed and it contains no oxygen or only a small percent of oxygen, the amount of oxygen in the combustion gases may be somewhat higher. The oxygen content of the gases brought into contact with the tar should not be more than a few percent, i. e. considerably less than 5%. Fuel gases are a desirable diluent because they can be employed to decrease the oxygen content of the combustion gases. A further desirable feature of such fuel gases as, for example, coke oven gases, is that they are already saturated with condensable oil constituents of the same character as those resulting from the distillation of tar and therefore no condensable vapors are lost in the fuel gases escaping from the condensers of the tar distillation unit.

When fuel gases such as coke oven gases or other coal carbonization gases are employed as the diluent, the gases escaping from the con-

densers of the tar distillation unit may be blended with the fuel gases in the coal distillation by-product recovery system for the recovery of light oil resulting from the tar distillation.

Fuel gases may be burned to produce the combustion gases employed for the distillation of the tar, and in this case the hot combustion gases resulting from the combustion may be cooled by diluting with fuel gases. These fuel gases may be introduced into and blended with the fresh combustion gases by being passed thru the burners in excess of that required for the combustion. Instead of thus being blended with the combustion gases, additional fuel gases may be blended with the combustion gases in any suitable manner between the burners and the tar still.

Any suitable fuel may be employed for producing the combustion gases employed for the distillation.

According to the present invention, fresh hot combustion gases or combustion gases which have been brought to the temperature desired for the tar distillation are brought into a chamber containing a body of the tar or pitch to be distilled. The gases enter the chamber at a high temperature, for example a temperature of 500–1000° C. The tar in the chamber is atomized or sprayed up into the gases with such intensity of spray that the tar is rapidly distilled and the gases are almost instantly cooled from their high temperature to a temperature approaching that of the pitch formed by the rapid distillation of the tar.

Such intense spraying or atomizing of the tar or pitch can readily be accomplished by means of one or more rapidly rotating rolls either smooth or with peripheral grooves or the like, which dip into the body of tar or pitch in the bottom of the apparatus and cause a continuous intense spray of the tar or pitch to fill all parts of the apparatus so that the entering high temperature gases are rapidly cooled and almost immediately brought into equilibrium with the intense spray with resulting cooling of the gases and rapid heating and vaporization of oil constituents from the spray.

Thus high temperature combustion gases and tar can be supplied in regulated amount to a still having one or more rapidly rotating spray rolls and the rate of supply of the gases and of the tar can be so regulated that rapid and continuous distillation can be accomplished and pitch of high melting point produced, for example pitch up to around 400° F. melting point or higher, with an unusually high yield of oil from the tar amounting to around 75% or higher and varying somewhat with the character of the tar distilled. The rapidity with which the hot gases are cooled to a temperature below that at which objectionable decomposition of the pitch takes place is such that the decomposition can be reduced to a minimum and rapid and effective distillation be nevertheless accomplished.

Where some decomposition is desired, for example in order to increase the carbon content of the pitch residue, this can readily be accomplished by regulation of the temperature of the gases entering the still, the rate of supply of the gases and the tar to the still or prolongation of the time of contact of the pitch and gases within the chamber.

In carrying out the process the large surface of contact between the tar and gases will ordinarily be such that the gases pass thru the chamber at a rapid rate and escape so that they are in contact with the intense spray of tar or pitch only for a short period of time, amounting, for example, to from one to five seconds more or less, depending upon the size of the apparatus and the conditions of operation. Similarly the supply of tar or partly distilled tar to the still and the removal of high melting point pitch therefrom can be so regulated that the entire period of operation from the time the tar enters until the pitch leaves will be short, amounting, for example, to as little as one minute or less in some cases, or to five or ten minutes or more in other cases. Only a very short time is required with the intense atomizing or spraying of the tar or pitch into the hot gas and with a regulated supply of the hot gas to accomplish distillation of the tar to the desired extent.

The tar which is distilled may be ordinary coal tar from coke oven or gas retort plants or it may be other tar such as low temperature tar, water gas tar, producer gas tar, etc. Instead of distilling total tar heavier or lighter tar fractions can be distilled, such as the heavier tar recovered from the collector main of a by-product recovery plant or the lighter tar recovered from the condensers of such a plant.

The distillation can be carried to the extent necessary to produce a pitch of higher or lower melting point as desired and a greater or less percentage of distillate oils, but it is one advantage of the present process that it enables an unusually high yield of distillate oils to be produced and an unusually high melting point pitch to be produced rapidly and continuously and with relatively little decomposition of the pitch produced. In some cases a pitch of intermediate melting point may be desired, for example around 150 or 200 or 250° F. melting point, while in other cases higher melting point pitches may be desired up to 300° F. melting point or even up to 400° F. melting point or higher. These pitches can readily be produced according to the present process.

The still itself may vary in its construction but it should have provision for forming an intense spray of the tar or pitch to be distilled so that the hot gases will be almost instantly cooled to a temperature below that at which objectionable carbonization and coking will result. The forming of such an intense spray with a rapidly rotating roll will not only effect rapid cooling of the gases and utilization of their heat for distillation, but will keep the interior of the still washed with the tar and pitch spray and thereby prevent the interior walls from becoming coated with coke. The tar is advantageously supplied to the still in a continuous manner and the pitch produced continuously withdrawn.

In distilling tar to produce a pitch of high melting point, for example around 400° F. or higher, the gases and admixed oil vapors resulting from the distillation will leave the still at a high temperature, for example around 300° C. or 325° C. or higher, although the temperature may be somewhat lower and may vary with the method of operation, the character or melting point of pitch produced, the temperature and amount of gases entering the still, etc. Gases and oil vapors at such temperatures carry a large amount of heat which can advantageously be employed for preheating and distilling tar and such preheating and distillation can be combined with the distillation proper so that the partly distilled tar resulting from such preheating and distillation is supplied to the still proper for further distillation. Such preheating of the tar by the hot gases and vapors will result in simultaneously cooling of

the gases and vapors and condensation of some of the higher boiling oil constituents therefrom. By carrying out the condensation in a countercurrent manner, a part of the heat contained in the gases and vapors can be recovered for use in preheating and then distilling tar at the same time that the oil vapors are thus condensed.

Tar preheated by indirect contact with the gases and vapors coming from the still may be discharged into a vapor box to effect partial distillation of the tar and removal of low boiling constituents from the tar before it is brought into direct contact with the hot gases. This is advantageous since it allows recovery of the vapors of the low boiling oils distilled from the tar in this manner without dilution with hot gases and by thus first removing the low boiling constituents before bringing the tar into direct contact with the hot combustion gases loss of such low boiling constituents in vapor form by dilution with the combustion gases may be prevented.

A portion of the gases coming from the condensers may be recirculated where desired and be employed for cooling and diluting fresh hot combustion gases before they enter the tar still. The gases may be passed thru the burner and be used for atomizing the fuel where fuel oil, for example, is employed, or the gases may be blended with the fresh combustion gases after they have left the combustion chamber.

Tar may be preheated by passing it thru a pipe coil still in heat interchanging relation with the fresh hot combustion gases when it is desirable to lower the temperature of the gases before they enter into direct contact with the tar, and the tar thus heated may be passed into a vapor box to effect the vaporization of low boiling oils therefrom and the residue comprising only higher boiling oils may then be brought into direct contact with the hot combustion gases. This affords another method of removing low boiling constituents from the tar before it is brought into direct contact with the hot gases.

Where the tar is heated and then flashed before being brought into direct contact with the hot gases, the vapor box in which the tar is flashed may be maintained under a vacuum, where desirable, to assist in the removal of the lower boiling oils.

It is one advantage of the present invention that the use of the high temperature gases enables a radically smaller amount of gases to be employed for accomplishing the distillation than would be necessary where low temperature gases were employed so that the oil vapors distilled are admixed with a relatively small amount of gases. As a result the oil vapors can more readily be condensed from the gases. Further, if the hot gases and vapors leaving the still are employed for preheating and partially distilling the tar, an increased rate of distillation can be realized with the same amount of gases.

In the specification and claims the word "tar" is used to include raw tar, dehydrated tar, heavier and lighter tar fractions, and partially distilled tar, such as semi-pitch.

The invention will be further described in connection with the accompanying drawings, which illustrate in a somewhat conventional and diagrammatic manner an arrangement of apparatus for carrying out the invention, but it is intended and will be understood that the invention is not limited thereto.

Fig. 1 is an elevation of apparatus adapted for carrying out the invention;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is an elevation of a modified form of apparatus;

Fig. 4 is a plan view of another modification in which the tar distillation is carried on in conjunction with the operation of a coal distillation plant; and

Fig. 5 is an elevation of a part of the apparatus shown in Fig. 4.

Fig. 1 shows apparatus in which the fresh hot combustion gases from the combustion chamber 1 pass into the still 2 where they are brought into contact with tar or semi-pitch and are employed for distillation of this tar or semi-pitch by direct contact therewith. The gases and vapors resulting from this distillation pass up thru the saturating tower 3 and thence to the heat interchanger 4. In the heat interchanger they are employed for preheating the tar which enters thru the line 5. From the heat interchanger 4 the gases and remaining vapors pass to the condenser 6. This is here shown as a direct contact condenser in which the gases are sprayed with water thru the sprays 7. The water and condensate drawn off from the bottom of the condenser are separated in the decanter 8 and water and a medium-boiling oil fraction are separately collected in the tanks 9 and 10. Higher boiling oils are drawn off from the bottom of the heat interchanger into the tank 11.

The tar is heated in the heat interchanger above the distilling point of lower boiling constituents in the tar and the heated tar is passed into the vapor box 15. Low boiling constituents which are vaporized in the vapor box are condensed in the condenser 16 and collected in the tank 17. This fraction may be rich in naphthalene and commercially valuable tar acids.

The residue from this flashing operation is pumped thru the line 18 by the pump 19 and sprayed into the saturating tower thru the spray 20. Tar passes over the baffles 21 and is further distilled by the hot gases and vapors which leave the still thru the pipe 22. The residue which is a pitch or semi-pitch, enters the still 2 thru the line 23.

The semi-pitch and the hot combustion gases from the combustion chamber pass thru the still in a concurrent direction. The semi-pitch is sprayed and resprayed into contact with the hot gases as they enter the still and the pitch produced by further distillation of this semi-pitch is brought into contact only with gases which have been partially cooled and are partially saturated as a result of the distillation of the semi-pitch therein. Such concurrent flow of the hot gases and material to be distilled together with intense spraying of the tar produced by rapid rotation of the roll 25 prevents undesirable decomposition of the pitch even though the gases enter the still at a temperature high enough to otherwise effect substantial decomposition. When desired, as when gases of relatively lower temperature are introduced into still 2, the tar or pitch may be introduced into the still thru the gas outlet pipe 22, and the overflow 28 and trap 27 may be at the gas inlet end of the still; in such an apparatus gas and tar or pitch flow in countercurrent directions.

The roll 25 which is located in the still may be sixteen inches in diameter. It is rapidly rotated by the motor 26 at a speed of 900–1500 R. P. M. The roll dips to but a slight extent into the body of tar or pitch in the still and produces a fine intense spray of the tar which fills the

entire distilling chamber and flushes its walls. This intense spray of tar rapidly cools the gases and the tar is rapidly distilled. In this manner pitch of high melting point may be produced.

The pitch is drawn off from the chamber in any suitable manner. It may be drawn off thru a trap 27 by means of the levelling arm 28. The angle at which this levelling arm is maintained determines the depth to which the roll 25 dips into the body of tar or pitch. Where high melting point pitch is to be produced it may advantageously be drawn off into a trough 29 and be chilled and granulated therein by a spray of water from the line 30. The resulting pitch product is then collected in the bin 31.

The gases and vapors leave the still thru the pipe 22 and pass up over the baffle 21 where entrained particles of the spray are removed from the gases. Baffles 32 are provided to remove any particles of spray which may be carried up thru the saturating tower by the hot gases and vapors from the spray nozzle 20. The gases leaving the saturating tower or the condensers are substantially clean gases and yield clean oils. Particles of smoke or carbon, etc., which may be present in the gases as they leave the combustion chamber are removed from the gases by the scrubbing action of the intense tar and pitch spray maintained in the still, and reduced to an amount that insures the production of commercially clean oils.

A fine wire gauze may, if desired, be provided at 33 to prevent explosions and other safety means such as means for regulating the oxygen content of the gases may be employed to prevent ignition of the gases and vapors in the tar still from the combustion chamber.

Gas, tar, pitch, oil, coal, coke or other fuel may be burned in the combustion chamber. Firebrick or other heat-resistant material is advantageously placed within the combustion chamber in the way well known in the art to expose a large surface of highly heated refractory material to aid in effecting complete combustion.

According to the arrangement shown in Fig. 3, the fresh hot combustion gases pass over the pipe coil 40 and are partially cooled before they enter the still 41 by indirect heat interchange with tar which passes thru the coil. Distillation is effected in the still by direct contact between tar or semi-pitch and the hot gases, and the resulting gases and vapors pass from the still thru the settling chamber 42 where baffles are provided to effect removal of any spray from the gases and vapors. From the settling chamber they pass to the condenser 43. The still 41 is provided with a spray roll 44 and the operation of this still is similar to the operation of the still 2 of Fig. 1 which is equipped with the spray roll 25. The pitch produced is collected in the bin 45.

The condenser 43 may be a direct or indirect condenser. It is shown as an indirect condenser in the drawings in which water enters at 46 and passes out through the exit line 47. The oil recovered in the condenser 43 is collected in the tank 48.

The cooled gases which leave the condenser 43 are in part recirculated by the blower 49 thru the line 50 and mixed with the hot gases from the combustion chamber before they enter the still 41. Baffles or suitable means may be provided for effecting admixture of these recirculated gases with the fresh gases from the combustion chamber, where necessary.

The tar is heated in the coil 40 above the boiling point of lower boiling constituents. The heated tar is passed to the vapor box 51 where lower boiling constituents are volatilized. Vapors from the vapor box are passed into the condenser 52 where they are condensed. They are collected in the tank 53 and constitute a low boiling oil. The residue from the flashing operation in the vapor box is conveyed to the still 41. This residue is distilled by direct contact with the combustion gases and converted to pitch within the still.

Lower boiling oils are flashed from the tar in the vapor box and the gases which leave the condenser 43 are therefore substantially free of vapors of such lower boiling oils. A regulating valve 54 is provided to control the amount of gases recirculated through the still 41. The position of this valve may advantageously be controlled by automatic temperature control means so that gas at uniform temperature is supplied to the still 41. The balance of the gases not recirculated thru the line 50 are exhausted to the atmosphere thru the pipe 55.

Figs. 4 and 5 illustrate how distillation with combustion gases may be carried out in conjunction with the operation of a coke oven battery. The coke oven battery is indicated at 60. The individual ovens of the battery are connected in the usual way with a gas collector main 61. The gases pass from the collector main thru the crossover main 62 to condensers 63 which may be direct or indirect condensers. They are here shown as direct condensers. The tarry oil which separates from the gases in these condensers is collected in one or more decanters 64. The ammonia liquor and tarry oils are separately collected in the tanks 65 and 66. Tar and ammonia liquor from the collector main 61 are collected in the decanter 67. From this decanter the tar and ammonia liquor may be separately collected in the tanks 68 and 69.

From the condensers 63 the gases pass thru an exhauster 70 to means for the recovery of ammonia and light oil. Apparatus for the recovery of ammonia is indicated in a diagrammatic way as an ammonia saturator 71. From the ammonia saturator the gases pass to a light oil absorber 72. From the light oil absorber the gases pass to storage or fuel gas mains or to means for the removal of sulfur, etc. This apparatus may all be of the usual type.

The tar still shown at 80 is similar to the still described in connection with the preceding figures. It is equipped with a spray roll 81. Combustion gases pass from the combustion chamber 82 into the still where they are sprayed with a fine intense spray of tar and pitch. The tar is distilled to pitch and the gases and vapors pass from the still to the saturating tower 83. This is similar in construction and operation to the saturating tower 3 of Fig. 1. From this saturating tower the gases pass to the heat interchanger 84 and then to a direct condenser 85 where they are cooled progressively for the separation of heavy oil which is collected in the tank 86, and lighter oil which is drawn off into the decanter 87 and thence to the storage tank 88. An exhauster 89 is provided for drawing the gases and vapors thru the system.

The tar enters the heat interchanger thru the pipe 90 and is heated therein simultaneously with the condensation of the heavy oil. It is sprayed into contact with the gases and vapors in the saturating tower 83 where lower boiling oils are distilled from the tar. The partially distilled tar or semi-pitch which results from this distillation

is conveyed thru the line 91 to the still and it enters the still in direct contact with the high temperature combustion gases admitted thereto and is rapidly heated and distilled by being sprayed into the gases in the form of a fine intense spray by the spray roll 81.

Fuel gas from the coke oven battery is burned in the combustion chamber 82 to provide heat for the distillation in the still 80. The fuel gas is supplied to the burner 92 thru the line 93 by the blower 94 from beyond the benzol extractor 72. A valve 95, preferably an automatic pressure regulating valve, is provided to regulate the amount of gas thus supplied to the burner 92.

When desirable, the hot combustion gases resulting from such combustion may be diluted by blending with fuel gases taken from the by-product recovery system. The drawings show a pipe 96 equipped with thermostatically regulated valve 98 for this purpose. Fuel gas may be supplied thru this line 96 for diluting the fresh combustion gases and lowering their temperature. An excess of fuel gas may be supplied to the burner thru the line 93 for this purpose. Care should be taken to prevent deposition of carbon from the fuel gases when excess fuel is supplied to the burner in this manner.

The gases leaving the system have a substantial fuel value. They may be blended with the fuel gases employed for heating the coke ovens or may be employed otherwise as fuel gases.

The apparatus shown provides for the collection of various oil fractions in addition to a high melting point pitch. The melting point of the pitch may be controlled by regulating the temperature and amount of gases and the rate and temperature of the tar fed to the still. Other oil fractions may be recovered as desired by providing suitable condensing means.

In the apparatus illustrated the general flow of the tar and pitch and hot gases in the still is a concurrent flow so that the hot gases entering the still come in contact with the tar containing the largest proportion of oil constituents. The rapid distillation of such oil constituents rapidly cools the gases to a temperature below that at which objectionable decomposition of the pitch will take place. The pitch produced will escape from the outlet end of the still approximately in equilibrium with the escaping gas and vapors. Even with gases at somewhat lower temperatures than those mentioned, combustion gases can be utilized in a particularly advantageous manner in a still of the type herein described.

I claim:

1. The method of distilling tar and producing distillate oils and pitch therefrom, which comprises bringing tar into direct contact with combustion gases at a temperature above that at which coking of tar or pitch normally occurs in the form of a spray of such intensity that the tar is rapidly distilled to pitch and the gases are almost instantly cooled to a temperature below that at which objectionable coking of the tar or pitch takes place and withdrawing the resulting gases and oil vapors and cooling them to condense oils therefrom.

2. The method of distilling tar and producing distillate oils and pitch therefrom, which comprises bringing combustion gases at a temperature in excess of 500° C. in the form of a continuous stream into a still containing a body of tar to be distilled, spraying the tar and pitch resulting from the distillation of said tar into the gases in the form of a spray of such intensity that the gases are almost instantly cooled to a temperature approximating that of the spray and the spray is heated to a temperature approximating that to which the gases are cooled thereby rapidly distilling the tar and producing pitch, withdrawing the resulting pitch residue from the still in a continuous manner, continuously supplying tar to the still to be distilled, and continuously withdrawing from the still the gases and oil vapors resulting from the distillation and cooling the same to condense oil constituents therefrom.

3. The method of distilling tar by direct contact with hot combustion gases, which comprises bringing the tar into contact with the hot combustion gases in the form of a spray of such intensity and in such an amount that the gases are almost instantaneously cooled to a temperature at which coking is avoided.

4. The method of distilling tar and producing distillate oils and pitch therefrom, which comprises burning a carbonaceous fuel and cooling the resulting combustion gases to a temperature not below 500° C., passing the gases at this high temperature into a still, spraying tar into the gases in the form of a fine intense spray which rapidly cools the gases and distills the tar to pitch, continuously adding tar to the still and withdrawing pitch therefrom and cooling the gases and vapors resulting from the distillation to condense oils therefrom.

5. The method of distilling tar and producing pitch of a melting point of at least 350° F., and obtaining a high yield of distillate oils, which comprises passing hot combustion gases into one end of a still containing a body of tar and pitch, continuously supplying tar to the end of the still at which the gases enter, producing a fine intense spray of tar and pitch resulting from the distillation thereof in the still by atomizing or spraying means which dips into the tar and pitch in the still whereby the tar is rapidly distilled to pitch, withdrawing the pitch produced from the opposite end of the still in a continuous manner, and continuously withdrawing gases and vapors resulting from the distillation from the end of the still at which the pitch is drawn off, and cooling the gases and vapors to separate oils therefrom.

6. The method of distilling tar and producing distillate oils and pitch therefrom, which comprises passing hot combustion gases at a temperature of at least 500° C. into a still, spraying them therein with a fine intense spray of partially distilled tar whereby the gases are rapidly cooled and pitch is produced by further distillation of the tar, continuously withdrawing pitch from the still, bringing the resulting gases and vapors into indirect heat interchanging relation with the tar to be distilled, whereby the tar is heated and oils are simultaneously condensed from the gases, flashing the heated tar into a vapor box, thereby volatilizing low boiling oils, separately condensing such low boiling oils and bringing the residue from this flashing operation into direct contact with the hot gases in the still for further distillation thereof.

7. The method of distilling tar and producing distillate oils and pitch therefrom, which comprises burning a carbonaceous material, passing tar thru a pipe coil still in indirect contact with the resulting hot combustion gases thereby partially cooling the gases to a temperature not below 500° C., and heating and distilling the tar, flashing the heated tar to remove low boiling constituents therefrom and separately condensing such low boiling constituents, bringing the residue

from this flashing operation into the partially cooled combustion gases in the form of a fine intense spray, whereby the residue from the flashing operation is distilled to pitch and the gases are rapidly cooled, withdrawing the pitch from the still and withdrawing the gases and vapors and condensing them to separate oils therefrom.

8. The method of distilling tar and producing distillate oils and pitch therefrom, which comprises bringing partially distilled tar into direct contact in the form of a fine intense spray with gases at a temperature of at least 500° C. resulting from blending fresh hot combustion gases with a portion of the gases employed for prior distillation of the tar, thereby further distilling the partially distilled tar and producing pitch, withdrawing pitch from the still, withdrawing hot gases and vapors resulting from the distillation from the still, bringing tar to be distilled into heat interchanging relation with these hot gases and vapors whereby they are cooled and oils are condensed therefrom and the tar is heated above the boiling point of lower boiling constituents contained therein, flashing the tar thereby volatilizing low boiling constituents, and conveying the residue of partially distilled tar to the still for further distillation by direct contact with the hot gases therein in the form of a fine intense spray and blending a portion of the gases coming from the still after separation of oils therefrom with fresh combustion gases thereby diluting the gases and cooling them to a temperature not below 500° C., and admitting the blended gases to the still.

9. The method of distilling tar by direct contact with combustion gases in combination with the operation of a coal distillation plant and producing distillate oils and pitch therefrom, which comprises diluting combustion gases with fuel gases from the by-product recovery system of the coal distillation plant, thereby cooling them to a temperature suitable for distillation, spraying the resulting gases with a fine intense spray of tar whereby the tar is rapidly distilled and pitch is produced therefrom, and cooling the resulting gases and vapors to separate oils therefrom.

10. The method of distilling tar by direct contact with combustion gases in combination with the operation of a coal distillation plant and producing distillate oils and pitch therefrom, which comprises diluting combustion gases with fuel gases from the by-product recovery system of the coal distillation plant thereby cooling them to a temperature not below 500° C., spraying the resulting gases with a fine intense spray of tar whereby the tar is rapidly distilled and pitch is produced therefrom, cooling the resulting gases and vapors to separate oils therefrom, and blending the gases after separation of oils therefrom with fuel gases in the by-product recovery system before these fuel gases enter the benzol extractor, and extracting therein light oil resulting from the tar distillation.

11. The method of distilling tar in combination with the operation of a coal distillation plant and producing distillate oils and pitch therefrom, which comprises burning a portion of the fuel gas from the coal distillation, diluting the resulting combustion gases with other fuel gas to produce gases having a temperature of at least 500° C., passing the gases at this high temperature into a still and spraying them with a fine intense spray of tar therein and distilling the tar thereby.

12. The method of distilling tar and producing distillate oils and pitch therefrom, which comprises introducing hot combustion gases into a still at a temperature in excess of 500° C., and filling the still with a fine intense spray of tar and pitch resulting from the distillation of said tar, thereby exposing a large surface of the tar and pitch to the distilling action of the hot gases whereby it is rapidly distilled and pitch is produced, while flushing the walls of the still with the material sprayed into the gases to prevent the formation of pitch or coke deposits thereon.

13. The method of distilling tar, which comprises introducing into one end of a still combustion gases at a temperature in excess of 500° C., introducing tar into this end of the still and producing a fine intense spray of tar in this end of the still and flushing the walls at this end of the still with tar, and separately drawing off from the other end of the still pitch and gases enriched in oil vapors resulting from the distillation of the tar.

14. In combination with a still containing means for producing a fine intense spray of tar, a combustion chamber with means for burning a carbonaceous fuel therein, a pipe coil for heating tar located between the means for burning the carbonaceous fuel and the still, a vapor box connected with said pipe coil, a separate condensing system for said vapor box, and means for conveying residue from the vapor box to the still.

15. In combination with a still containing means for producing a fine intense spray of tar, a combustion chamber with means for admitting air and a carbonaceous fuel thereto and for passing the combustion gases into the still, a heat interchanger and a vapor box with a condensing system connected thereto, means for conveying tar thru the heat interchanger, means for passing gases and vapors from the still thru the heat interchanger in indirect contact with the tar, means for passing the heated tar from the heat interchanger to the vapor box, and means for passing residue from the vapor box into the still.

16. In combination with the by-product recovery system of a coal distillation plant, a tar still with means therein for producing a fine intense spray of tar, a combustion chamber, means for passing combustion gases therefrom into the still, and means for conveying fuel gases from the by-product recovery system and blending them with the combustion gases before they enter the still.

17. The method of distilling tar by direct contact with hot combustion gases at a temperature above that at which coking of tar may occur, which comprises passing the hot combustion gases into a still containing a body of tar, rapidly rotating a spray roll having its peripheral face substantially parallel to and dipping into the liquid surface of the body of tar so as to form a spray of such intensity and in such an amount that the gases are almost instantly cooled to a temperature at which coking is avoided.

18. In combination with the by-product recovery system of a coal distillation plant, a tar still with means for producing a fine intense spray of tar therein, a combustion chamber with means for conveying combustion gases therefrom into the tar still, means for passing a portion of the fuel gases from the by-product recovery system into a burner operated in connection with the combustion chamber to effect combustion of the fuel gases therein, and means for blending other fuel gases from the by-product recovery system

with the combustion gases before they enter the still.

19. In combination with a tar still with means for producing a fine intense spray of tar therein, a combustion chamber and condensers, means for passing gases and vapors from the tar still to the condensers, means for blending a portion of the gases from the condensers with the combustion gases and passing the blended gases into the tar still, means for stripping low boiling constituents from tar without substantially diluting vapors thus formed with inert gas, a separate condensing system for the recovery of these low boiling constituents, and means for passing residue from the stripping operation into the tar still.

20. A method of distilling tar and producing distillate oils and pitch therefrom, which comprises blending fresh hot combustion gases with colder inert gases so as to substantially reduce the temperature of the combustion gases and produce a gas mixture having a temperature of at least 500° C., introducing the gas mixture into a still containing a body of the tar to be distilled, rapidly rotating a spray roll having its peripheral face substantially parallel to and dipping into the liquid surface of the body of tar so as to form a spray of such intensity and in such an amount that the tar is distilled to pitch and the gases are almost instantly cooled to a temperature at which coking is avoided, withdrawing the resultant mixture of gases and vapors from the still and further cooling it to condense distillate oils.

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