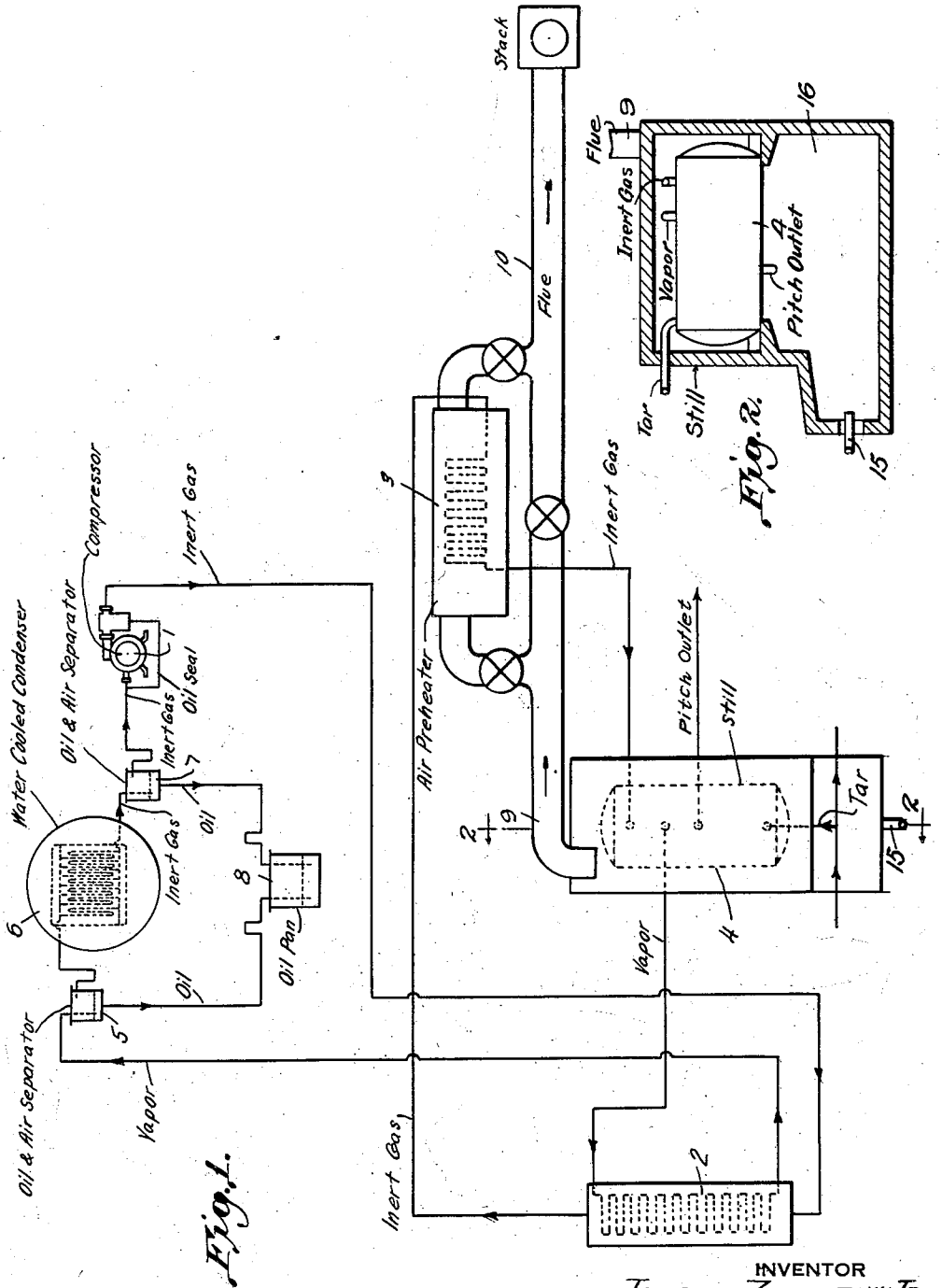
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TAR DISTILLATION

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TAR DISTILLATION

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This invention relates to the distillation of tars or pitches, and more particularly to a process and apparatus for distilling coal tar or coal tar pitches involving the circulation of preheated gas through the tar or pitch during distillation. The invention herein is in the nature of an improvement on the invention of the patent to J. M. Weiss No. 1,418,893, issued June 6, 1922.

In the distillation of tar to recover valuable oils therefrom a progressive decomposition takes place as evidenced by the formation of a material high in carbon content and commonly known as "free carbon". In the distillation of tar the greater the formation of free carbon the less the yield of distillate oil and the greater the quantity of residual pitch. As oil has in general a higher market value than pitch it is advantageous to obtain as high a yield of oil as possible. Further, for many purposes it is desirable to produce pitches of high melting point, i. e., above 280° F. In the ordinary distillation of tar it has been found advisable to discontinue distillation when a pitch of 280° F. melting point is formed, as above this point coking of the still bottom with consequent danger of blistering same takes place. The aforementioned patent to Weiss discloses a process for distilling tar involving the recirculation of an inert gas therethrough during the distillation operation. By the practice of the invention of the Weiss patent a greater yield of distillate oils and higher melting point pitches are obtained than result from distillation treatments in which inert gas is not utilized.

One object of this invention is to provide a process for the distillation of tars whereby the yield of oil from a given quantity of tar distilled is increased as compared with the prior art processes. Another object of the invention is to provide a process for the distillation of tars and pitches in which the time required for distillation is reduced and the capacity of the distilling apparatus is correspondingly increased. Still another object is to provide a process and apparatus for distilling tar in which the otherwise waste heat from the still and the vapors coming off from the tar are effectively utilized in the distillation operation. Other objects of the invention will in part be obvious and will in part appear hereinafter.

I have found that the yields of distillate oils obtained in the practice of the process of the Weiss patent may be still further improved by preheating the inert gas to a temperature equal to or exceeding the temperature of the tar in the still. I have further found that this can economically be accomplished by utilizing the otherwise waste heat of the distillation operation, i. e., the heat of the vapors and inert gas leaving the tar in the still and the heat of the flue gas from the still.

It has been found that when air or other inert gas comes in contact with hot tar or pitch in the still, the relatively cool gas must be heated by the contents of the still to the same temperature as the tar. The heat required for this purpose is derived from hot gases playing on the outside of the still and has, hence, to pass from the still shell to the tar or pitch and then to the air. Tar and pitch being poor conductors of heat, it requires a considerable period to heat the air or other inert gas and, consequently, the tar or pitch must be maintained at the operating temperature for a period of time, long enough to result in appreciable decomposition of the still contents.

In accordance with this invention inert gas, in place of being passed to the tar still while cold, is preheated to about the same temperature as the tar or even higher. Accordingly, no heat is taken from the tar to heat the gas and the rate of vaporization of the tar in the still is increased, thereby reducing the time cycle of operation and the period during which the tar is exposed to temperatures of decomposition. The net result is an increase in the yield of valuable oil obtained from the tar or pitch distilled.

The invention will be further described in connection with the accompanying drawing, Fig. 1 of which is of a somewhat diagrammatic character and shows an arrangement of apparatus adapted for the practice of the process of the invention; and Fig. 2 of which is a vertical section taken in a plane passing through line 2—2 of Fig. 1 and shows a section through the tar still. It is intended and will be understood that the drawing is illustrative of one arrangement of apparatus for practicing the invention and that the invention is not limited thereto.

In the accompanying drawing, the compressor 1 pumps the cool inert recirculated gas, which may be recirculated air, nitrogen, carbon dioxide, carbon monoxide, or other inert gas, in comparatively large amounts through the heat interchanger 2; then through the preheater 3 into the tar still 4 where the gas passes upward through the liquid in the still. As shown in Fig. 2, the tar still may involve a refractory combustion chamber 16 having an oil or other burner 15 or other source of hot gases for supplying heat to the distillation vessel 4. The hot inert gas carrying distillate oils removed from the tar leaves the still 4 and flows through the heat interchanger 2 counter-current to the cool inert gas which is

on its way to the still 4. Here some of the vapors are condensed and the hot gas is partially cooled, while at the same time the temperature of incoming gas in increased. The partially cooled inert gas and the uncondensed vapors, with the oil, flow to the oil separator 5 where the oil is separated from the gas and the vapor. The gas and the remaining vapors then leave the separator 5 and flow to the water-cooled condenser 6 where the remaining vapors are condensed and the inert gas is cooled to a temperature at which it can be efficiently compressed. The cool inert gas and the oil flow to another separator 7 where the oil is separated from the gas. The separated oil from separators 5 and 7 is collected in an oil pan 8. The cool inert gas then flows back to the suction end of the air compressor 1 to re-enter the operating cycle.

The heat interchanger 2 functions to recover the heat contained in the vapors and the hot inert gas leaving the still, by heating the cool inert gas which has been compressed by the air compressor 1. In order to obtain maximum efficiency, the flow of the vapors and hot inert gas is counter-current to that of the cool compressed inert gas.

The partially heated inert gas from the interchanger 2 is passed to the preheater 3 in counter-current flow to the waste flue gases leaving the still 4. The flue gases may be formed by combustion of oil supplied by burner 15 or by the combustion of coal or other medium as is common practice in the distillation art, the products of combustion functioning to heat the still, and are then discharged therefrom as waste flue gas.

The preheater 3 is similar in construction to the heat interchanger 2. The waste gases leaving the still setting 4 through flue 9 pass through the preheater 3 in counter-current relation to the partially heated inert gas coming from the interchanger 2. By suitably manipulating the valves in flues 9 and 10 the total volume of the waste gases may be diverted through the preheater 3 to heat the partially heated inert gas on its way to the still, or any desired proportion of the flue gases may be by-passed by the preheater direct to flue 10 which connects with the stack. This admits adjustment of the temperature of the inert gas introduced into the still 4.

The following is given as one specific example of the conditions maintained in the practice of this invention in the distillation of the 285° F. melting point pitch to produce a 380° F. melting point pitch.

The temperature of the flue gas under the still 4 was about 1600° F., and the temperature of the pitch in the still was about 720° F. The pitch was charged intermittently into the still and the end product, hard pitch, continuously withdrawn therefrom. The inert gas entering the heat interchanger 2 was at a temperature of 150° F., and the temperature thereof was raised to about 525° F. by heat exchange with the mixture of vapors and inert gases leaving the still 4. The temperature of the inert gases was increased in the heat interchanger 3 to approximately 720° F. by heat exchange with the flue gases coming from the still 4. The temperature of the inert gas entering the still was approximately equal to that of the tar in the still.

A rate of distillation of 915 gallons of oil per hour was thus obtained. This compares with a rate of 765 gallons per hour obtained in the same equipment under the same conditions, except that the inert gas circulated through the tar was not preheated. In the example above given a pitch of 380° F. melting point was obtained. The total oil yield, based on the quantity of pitch distilled, was 15.7%. Under like conditions with the recirculation of non-preheated inert gas an oil yield of 11.5% was obtained.

By operating in accordance with the invention as above described, it was found that distillation takes place at a lower still temperature. This results in a longer life for the still. It was also found that the rate of distillation per square foot of heating surface was increased, and the time cycle, i. e., the intervals elapsing between the introduction of successive charges, reduced, thus resulting in a greater output per unit of apparatus.

Tar and pitch are poor conductors of heat and are subject to decomposition when maintained at temperatures above 600° F. Preheating the inert gas to a temperature approximately equal to that of the tar in the still, avoids heating of the inert gas by heat extracted from the pitch and thus reduces the time interval during which the pitch is subjected to decomposition temperatures. Preheating the entering inert gas also avoids decomposition resulting from the redistillation when vapors are condensed by the cold inert gas entering the still and again distilled before eventually leaving the still.

The process of this invention, it will be noted, results in large economy of fuel required for the distillation. By returning the otherwise waste heat from the hot inert gases and from the vapors leaving the still unit in the form of hot inert gas, much less fuel is required to conduct the distillation. The invention herein utilizes the otherwise waste heat of the distillation operation to preheat the inert gas to a temperature approximately equal to and preferably not less than the temperature of the tar in the still, and results in economy of fuel, improved oil yields and production of a hard pitch of desired high melting point.

The term "inert gas" as used in the specification and claims is intended to include any gas or vapor which does not act chemically upon the tar. This term includes air, which, while not inert to the tar when first admitted, rapidly becomes so by the chemical removal of the oxygen which it contains and of which, after recirculation, only a residue of inert gas, substantially largely nitrogen, remains. It also includes steam which, at the temperatures prevailing in the distillation of hard pitches and tars, is chemically inert with respect thereto and remains in the vapor phase.

The term "tar" as used in the specification and claims is intended to include all varieties of tar such as coal tar, water gas tar, oil gas tar, blast furnace tar, lignite tar, as well as pitches obtained therefrom.

Since certain changes in carrying out the above process may be made without departing from its scope, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A process of distilling without substantial decomposition tar of the class consisting of coal tar, water gas tar, oil gas tar, blast furnace tar, lignite tar, and pitches obtained therefrom, which comprises heating the tar to a temperature of approximately 720° F. to drive off the volatile oils therefrom, introducing an inert gas at a temperature not less than approximately 720° F. into the tar and passing said gas through said tar during the distillation of said tar.

2. A process for the distillation of tar of the

class consisting of coal tar, water gas tar, oil gas tar, blast furnace tar, lignite tar, and pitches obtained therefrom, in a still, comprising heating the tar by heat-exchange with products of combustion to a temperature of approximately 720° F. to drive off vapors therefrom, removing the products of combustion, passing an inert gas in heat-exchange relation with the vapors and with said products of combustion, thus heating the inert gas to a temperature of approximately 720° F., and passing the thus heated inert gas into and through the tar undergoing distillation.

3. A process of distilling tar of the class consisting of coal tar, water gas tar, oil gas tar, blast furnace tar, lignite tar, and pitches obtained therefrom in a still by heat-exchange with products of combustion, which comprises heating the tar to drive off the volatile oils therefrom, passing an inert gas at a temperature approximately equal to the temperature of the tar through the tar during the distillation of said tar, passing the mixture of volatiles and inert gas into a condenser, condensing the volatiles and separating the inert gas therefrom, and recirculating the inert gas through said tar, said inert gas being heated to a temperature approximately equal to that of the tar by being passed into heat-exchange relation with the mixture of vapors and inert gas and with the products of combustion employed to heat the still before being introduced into the tar still.

4. A process for the distillation of coal tar in a tar still heated by products of combustion, comprising the repeated circulation of an inert gas through the tar being distilled, said gas being preheated to a temperature approximately equal to that of the tar by heat transfer contact with the vapors and gases leaving the tar and with the combustion gases employed to heat the tar still.

5. A process of distilling without substantial decomposition tar of the class consisting of coal tar, water gas tar, oil gas tar, blast furnace tar, lignite tar, and pitches obtained therefrom, which comprises heating the tar to a temperature of not substantially less than approximately 720° F. to drive off the volatile oils therefrom, introducing an inert gas at a temperature not substantially less than approximately 720° F. into the tar, and passing said gas through said tar during the distillation of said tar.

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