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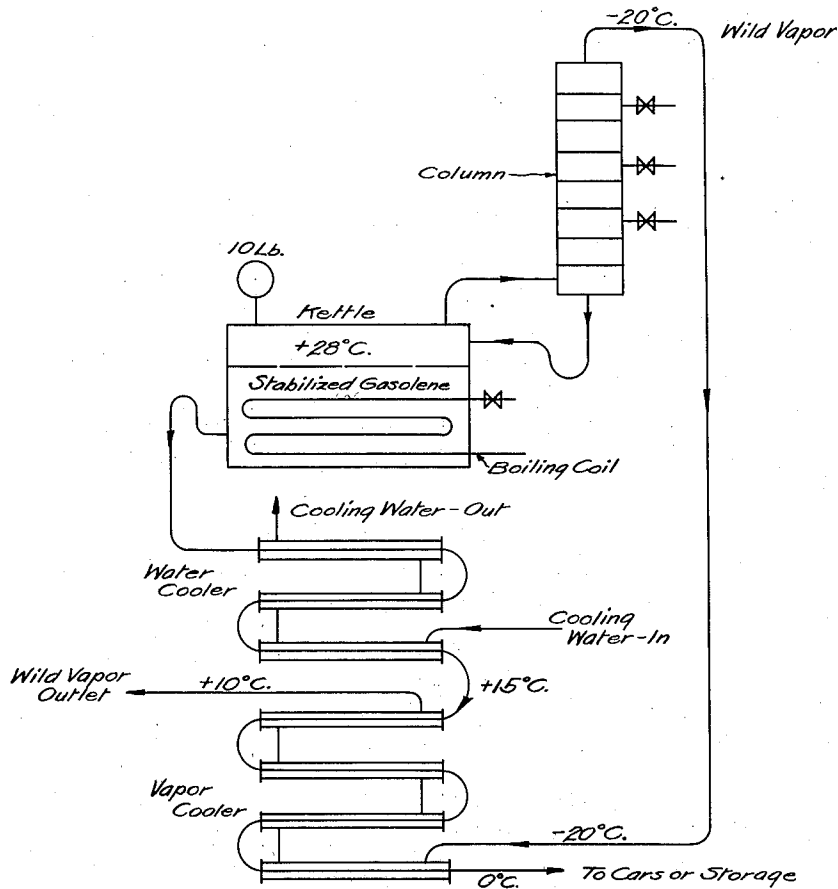
1,695,162

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MANUFACTURE OF NATURAL GASOLINE

Filed April 12, 1924

2 Sheets-Sheet 1



Continuous Process of Cooling Stabilized Gasolene.

Fig. 1.

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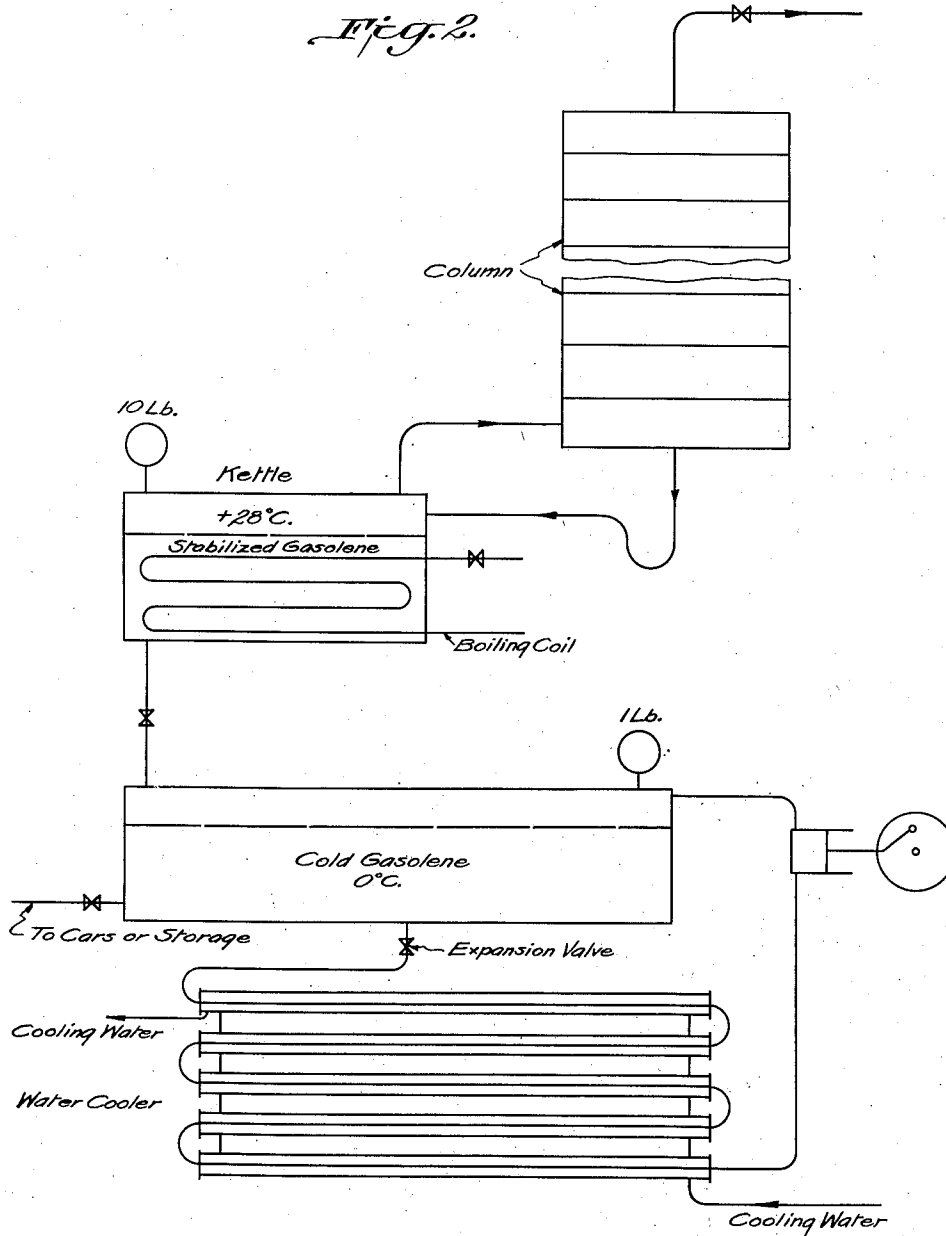
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UNITED STATES PATENT OFFICE.

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MANUFACTURE OF NATURAL GASOLINE.

Application filed April 12, 1924. Serial No. 706,167.

This invention relates to the manufacture, from natural gas, of liquid mixtures of hydrocarbons adapted for use as motor fuel and for other purposes. An example is the liquid

commonly known as natural gas gasoline, natural gasoline, casing-head gasoline, etc.

In Patent 1,429,175, issued to me on Sept. 12, 1922, I have described processes comprising the following series of operations: There is initially prepared from natural gas a liquid containing those hydrocarbons which are suitable constituents for natural gasoline, but containing also more volatile hydrocarbons, such as propane and ethane, so that the vapor pressure of the liquid is so high as to unfit it for the use contemplated. This initial "wild" product is then separated by rectification into a more stable (i. e. less volatile) liquid fraction, and a vaporous fraction containing hydrocarbons which it is desired to exclude from the final product.

In many cases it is convenient to conduct this separation under pressure, for example a pressure of the order of one atmosphere, gage. The gasoline is of course at its boiling point in the kettle of the rectifying apparatus. In all cases where the rectification is carried out under pressure and the pressure on the gasoline is released by discharging it from the kettle into open or vented storage or shipping receptacles, the gasoline will boil away until the absorption of heat by evaporation has reduced its temperature to its normal boiling point, i. e. its boiling point under atmospheric pressure. This boiling point is usually below the maximum atmospheric temperatures of the locality and season, and there will be a further evaporation sufficient to balance the heat taken up by the gasoline from its surroundings.

When the rectification is carried on at atmospheric pressure, the gasoline will leave the kettle at its normal boiling point, while if there is a partial vacuum in the rectifying apparatus, the stabilized gasoline will be at a temperature below its normal boiling point. Gasoline stabilized at or below atmospheric pressure may nevertheless be subject to one of the losses already referred to, because the atmospheric temperature frequently rises above its boiling point. The use of heat-insulated vessels will obviously decrease the loss due to this cause, but it cannot affect the evaporation due to reduction in pressure when pressure rectification is used.

According to the invention, the gasoline is subjected to an initial cooling to decrease evaporation losses, whenever the rectification is carried out at or above atmospheric pressure, or so little below atmospheric pressure that further cooling of the material is desirable to counteract the effect of atmospheric temperatures above its boiling point.

Under any of the conditions mentioned, the vaporous fraction from the initial product will be discharged from the rectifying column at a temperature below that of the kettle. There is a temperature gradient in the column, and when rectification is carried out under pressure, the vapors are cooled still further when released from the column. The cold vapors from the column may be used to cool the gasoline. An arrangement of apparatus suitable for this purpose is shown in Fig. 1, from which the operation will be apparent. In the example, rectification is carried out under slight excess pressure.

The gasoline from the kettle at a temperature of 28° C., for example, passes through a first cooler in which heat is absorbed by water. The temperature of the gasoline when discharged from this cooler will approach that of the available cooling water and may be 15° C., more or less. The gasoline then passes through a second cooler in which heat is absorbed by the cold vapors from the rectifying column. These vapors may have a temperature of the order of -20° C. With coolers of fair efficiency it is possible to cool the gasoline to or below the centigrade zero. When thus cooled, there will be no evaporation loss when the pressure on the gasoline is reduced to atmospheric pressure.

In Fig. 2 I have shown another arrangement by which the freshly-made gasoline may be cooled without loss of material. In this modification the vapors from the column are not used, but vapors evolved from the stabilized gasoline are passed through a refrigeration cycle wherein they are compressed to a suitable pressure, cooled by water, and expanded. Compression may be to 15 pounds per square inch, for example. The cold expanded material is returned to the vessel containing the batch of gasoline to be cooled, more vapors from the gasoline being meanwhile passed through the cycle. This modification may be worked as a batch process, or warm gasoline may be continuously led to and cold gasoline from the cooling apparatus.

As already stated, the invention contemplates the cooling of the gasoline to a temperature materially below its boiling point at atmospheric pressure, so that not only are the losses attendant upon release of the pressure avoided, but the losses in storage and shipment are greatly reduced. If sufficiently cooled and then placed in a heat-insulated container, the heat taken up from the container plus that abstracted from the air surrounding the container will only bring the gasoline up to its boiling point after a protracted interval, even when the air is at a temperature considerably above the boiling point of the gasoline. Even under unfavorable conditions, the gasoline may be stored for several days without serious loss.

Various modifications of the invention will readily suggest themselves, and the foregoing specifically described modifications are to be regarded as merely illustrative examples.

I claim:—

1. In the manufacture of natural gasoline, the steps of forming a liquid mixture of hydrocarbons; producing therefrom a liquid gasoline and a vaporous portion bringing the vaporous portion to a temperature below the normal boiling point of the liquid gasoline; and cooling the liquid gasoline by means of the vaporous portion.

2. In the manufacture of natural gasoline, the steps of producing the gasoline under pressure and at the corresponding temperature; and then cooling the gasoline below its normal boiling point by withdrawing vapors from a confined space containing the gasoline, compressing, cooling, and expanding the vapors, and returning the cold expanded material to the space containing the gasoline.

In testimony whereof, I affix my signature.
HAROLD E. THOMPSON.