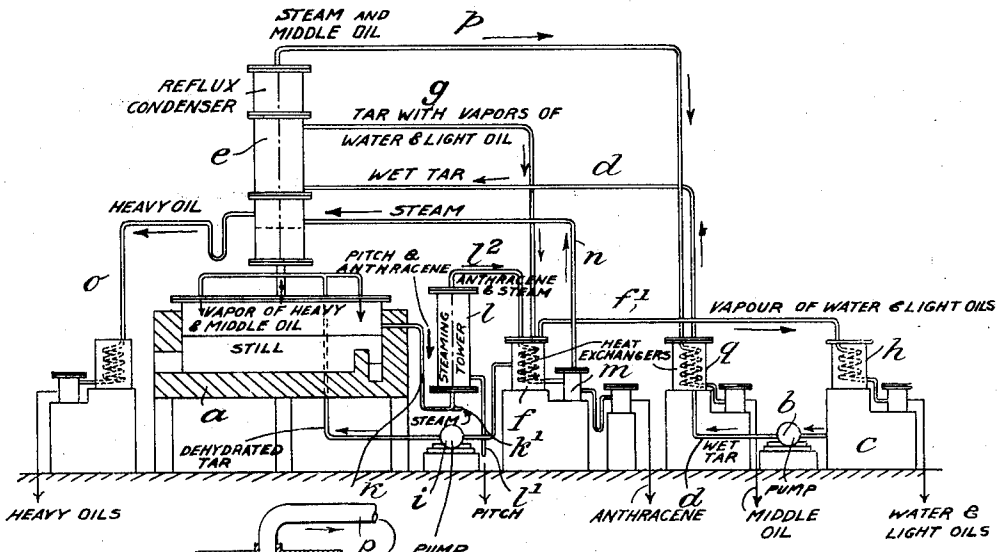
March 29, 1927. 1,622,964

J. S. MORGAN

METHOD OF DISTILLATION

Filed Jan. 30, 1923

FIG. 1.



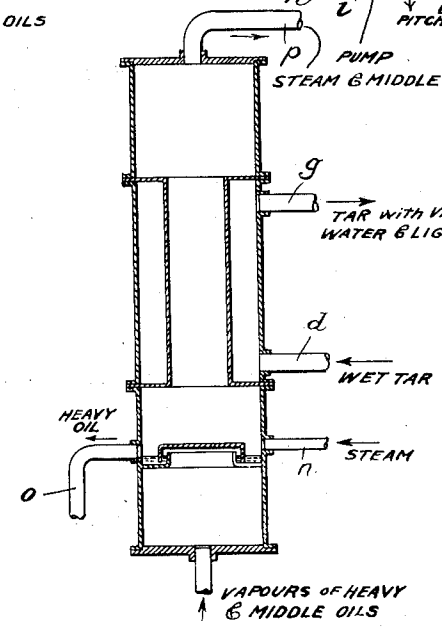


FIG. 2.

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UNITED STATES PATENT OFFICE.

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METHOD OF DISTILLATION.

Application filed January 30, 1923, Serial No. 615,963, and in Great Britain November 13, 1922.

This invention relates to an improved method of distilling a liquid mixture containing more than two constituents for the purpose of separating the constituents more or less completely.

According to this invention, the liquid mixture is first distilled to obtain a suitable lower boiling fraction, the residue is then distilled with superheated steam, and the mixture of steam and vapor is cooled to a temperature adapted to condense the vapor alone; the steam, separated from the condensed vapor, is then passed through the lower boiling fraction of the first distillation, to vaporize a portion of this fraction; and the mixture of steam and vapor may then be treated to condense the vapor. During the distillation of the higher boiling residue with superheated steam, the lower boiling fraction may have been in the meantime subjected to a distillation to produce a further fraction which may then receive the steam as aforesaid. The steam may be reheated and used again as often as may be desired, and may finally be condensed under such conditions that its latent heat serves to preheat liquid to be distilled.

The process is, of course, facilitated if the several portions of the mixture are kept at a temperature about the boiling point of the constituent of highest boiling point among the constituents to be distilled.

The process is most conveniently conducted at ordinary atmospheric pressure, but may be applied at suitable pressures higher or lower than this.

The process is particularly suitable for the distillation of coal tar in a manner which may be described as follows:—

Tar is pumped through a series of heat interchangers which on the one hand heat the tar and on the other condense the various fractions as they leave the distilling zone. At the end of this interchange the tar is generally at such a high temperature that water and light spirit will in many cases have been entirely removed. The tar thus dehydrated is then heated, such as by being pumped under a bath of molten lead, to a temperature at which the remaining volatile substances, with the exception of the anthracene, are vaporized.

The pitch and anthracene are then broken up into a spray by means of a jet of superheated steam, which removes the anthracene completely. The mixed vapours are led into a condenser where the anthracene only is condensed, giving up its latent heat to the previously pre-heated tar. The uncondensed steam is led out of the condenser which is preferably reflux in type and is caused to mix with the volatiles which are given off by the action of the lead bath or other source of heat. These vapours in the case of tar are often known as light oil and heavy oil or light and heavy creosotes. They, together with the steam, are led into a reflux condensing column and it is so arranged that the vapours leaving the top will consist of light oil and steam while the heavy oil will run back down the column and be discharged at the base. The temperature in the column may be controlled by a jacket of preheated tar.

The light oil and the re-used steam are now condensed by the cold incoming tar which will be raised very considerably in temperature by this means and if sufficient steam is used the tar will have been dehydrated at this point.

The foregoing will be rendered still more clear by the following description of the accompanying drawings, in which:

Fig. 1 is a diagrammatic representation of a suitable plant for the distillation of tar, and

Fig. 2 is a detail view of a part of the plant shown in Fig. 1.

Referring to Fig. 1, *a* is a lead bath still. A pump *b* draws wet tar from a tank *c* and forces it through pipe *d* into the jacket of a reflux condenser *e* where it becomes heated sufficiently to vaporize its water and light oils; the latter are separated from it in a vessel *f* into which it flows by way of pipe *g*; the separated vapours pass by pipe *f'* to a condenser *h*. The tar thus dehydrated is withdrawn by pump *i* from the vessel *f* and is forwarded to the still *a*. This is kept at a temperature which expels all volatile constituents, except the anthracene oil, into the reflux condenser *e* (shown in vertical section in Fig. 2). The residue from the still flows by pipe *k* to an injector operated by steam admitted at *k'* from a superheater (not shown). The steam atomizes the residue in the tower *l*, vaporizing the anthracene oil and leaving a pitch to flow away by pipe *l'*. The mixture of steam and vapour leaves the tower by pipe l^2 and flows through a worm

in the vessel *f*. The temperature here is such that the anthracene oil is condensed and is separated from the steam in trap *m*. The steam is carried by pipe *n* into the inner chamber of the reflux condenser *e* where it mixes with the oils which are condensing. These oils are chiefly creosotes and are separated by the steam into a heavy oil which leaves the condenser by pipe *o* and a middle oil which passes as vapour, together with the steam, through pipe *p*, both being condensed in a condenser *q* through which the wet tar passes on its way to the jacket of condenser *e*. In this manner the heat in the steam and vapour is largely recovered.

Crude mineral oil may be fractionated on similar lines.

Having thus fully described the nature of the said invention and the best means I know of carrying the same into practical effect, I claim:—

1. A method of fractionally distilling a liquid mixture containing more than two constituents, which consists in distilling from the mixture and condensing a lower boiling fraction, passing superheated steam through the higher boiling fraction remaining, cooling the mixture of steam and vapor which leaves the liquid mixture to a temperature adapted to condense the vapor, and then passing the steam through the condensed lower boiling fraction to thereby vaporize a portion of the latter

2. A method of fractionally distilling a liquid mixture containing more than two constituents, which consists in distilling from the mixture and condensing a lower boiling fraction, passing superheated steam through the higher boiling fraction remaining, cooling the mixture of steam and vapor which leaves the liquid mixture to a temperature adapted to condense the vapor, then passing the steam through the condensed lower boiling fraction to vaporize a fraction of the latter, and finally condensing the steam and pre-heating by the latent heat of condensation and the liquid mixture which is to be distilled.

3. A method of fractionally distilling coal tar, which consists in preheating the tar to a temperature adapted to vaporize water and light oils and condensing the vapors evolved, heating the preheated tar to a temperature adapted to vaporize the middle and heavy oils and leave a residue comprising anthracene and pitch and condensing the vapors of the middle and heavy oils, treating the said residue with steam at a temperature adapted to vaporize the anthracene, condensing the anthracene from the mixture of vapor and steam, bringing the steam which remains into contact with the condensed mixture of middle and heavy oils to vaporize the middle oils, and condensing the mixture of steam and vapor of the middle oils.

4. A method of fractionally distilling coal tar, which consists in pre-heating the tar to a temperature adapted to vaporize water and light oils and condensing the vapors evolved, heating the preheated tar to a temperature adapted to vaporize the middle and heavy oils and leave a residue comprising anthracene and pitch and condensing the vapors of the middle and heavy oils, treating the said residue with steam at a temperature adapted to vaporize the anthracene, condensing the anthracene from the mixture of vapor and steam, bringing the steam which remains into contact with the condensed mixture of middle and heavy oils to vaporize the middle oils, condensing the mixture of steam and vapor of the middle oils, and preheating the tar which is to be treated by means of the latent heat evolved during the three last-named condensations.

In testimony whereof I have signed my name to this specification.

JOHN STANLEY MORGAN.