W. ATWOOD.

Distillation of Oils.

No. 226,151 Patented April 6, 1880.

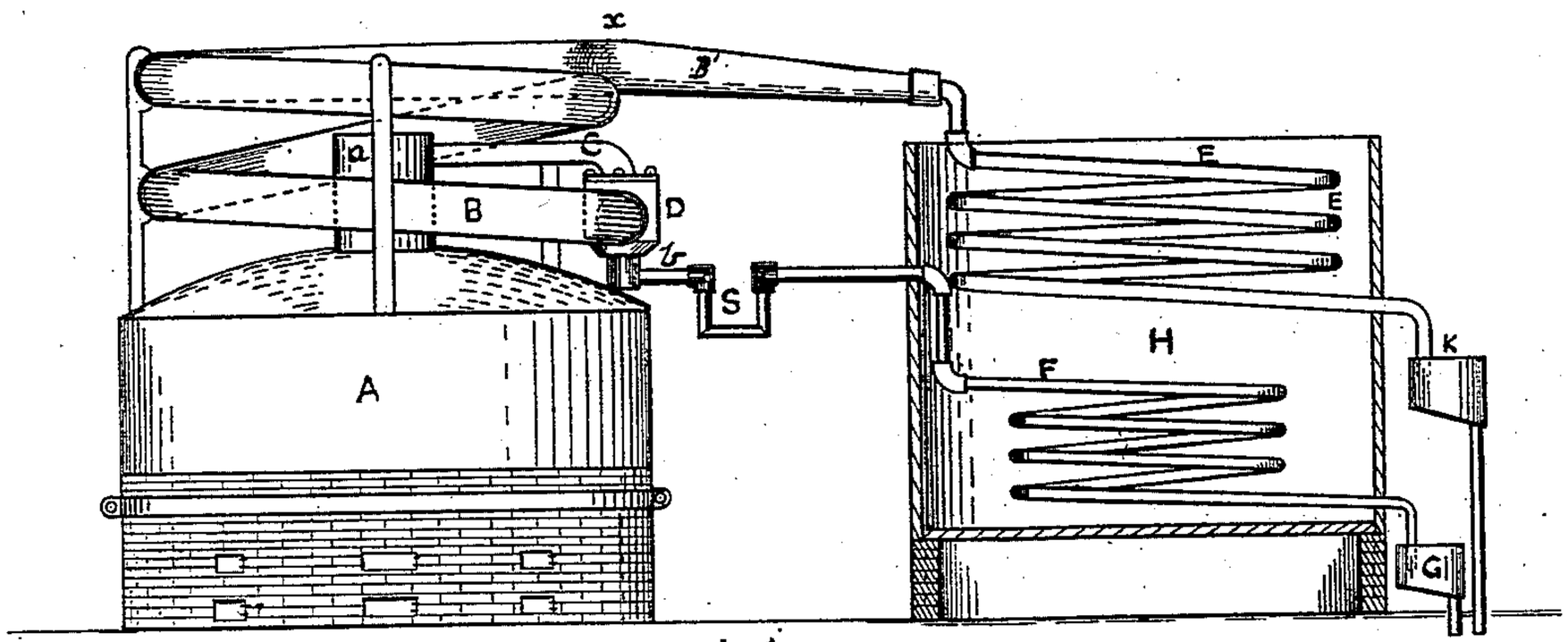

fig. 1.

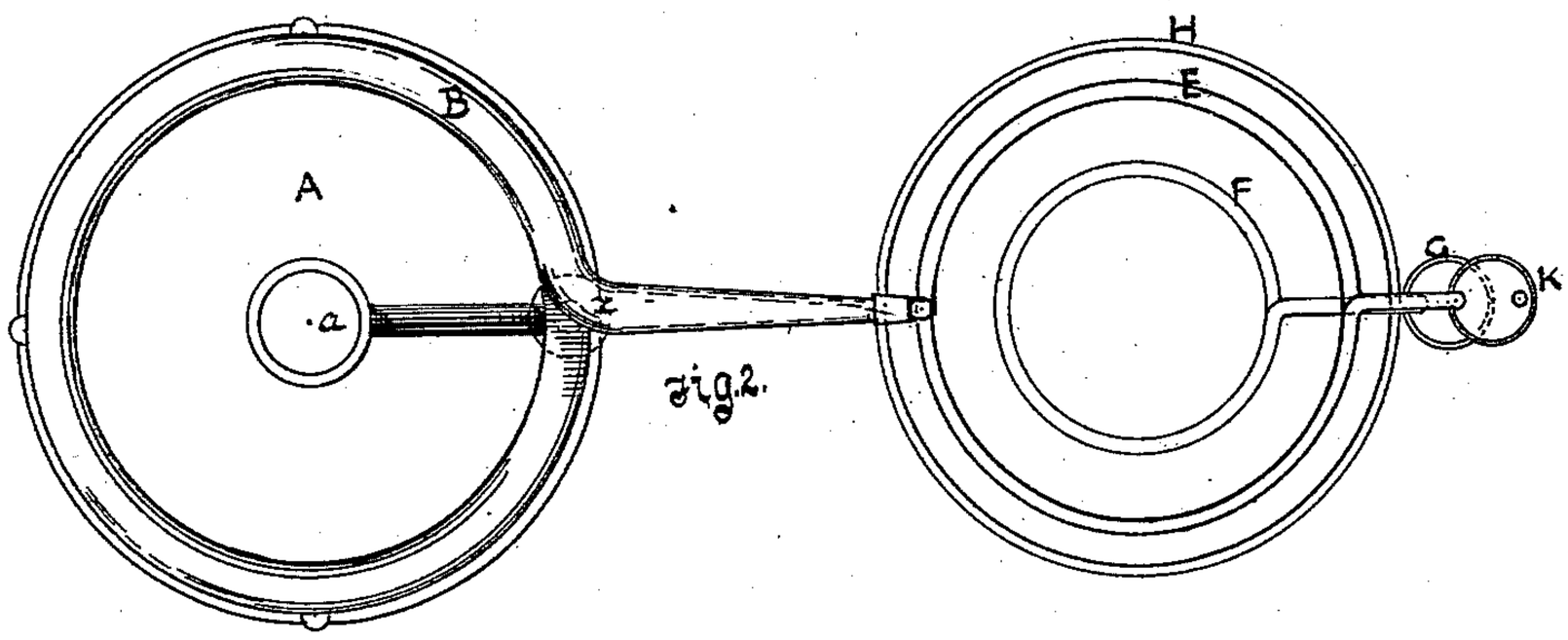

fig. 2.

Witnesses.

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WILLIAM ATWOOD, OF BROOKLYN, NEW YORK.

DISTILLATION OF OILS.

SPECIFICATION forming part of Letters Patent No. 226,151, dated April 6, 1880.

Application filed September 1, 1879.

To all whom it may concern:

Be it known that I, WILLIAM ATWOOD, of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improved Process for the Distillation of Hydrocarbon Oils and Apparatus therefor; and I do hereby declare the following to be a full, clear, and exact description thereof, which will enable others skilled in the art to make use of the same.

My improvement is specially designed for and adapted to the production of petroleum distillates of heavy gravity suitable for lubricating purposes, and of high fire-test and boiling-point, suitable for illuminating purposes, both being substantially free from the characteristic and offensive odor usually accompanying the heavier products of fire-distillation of petroleum.

It is not difficult, by the practice of the ordinary process of fire-distillation and by a careful fractional separation of the distillate at different stages of the process, to procure oils of almost any required gravity suitable in respect of their gravity either for illuminating or lubricating purposes; but owing to the tendency of hydrocarbon oils, and especially of petroleum, when exposed to sufficient degree of heat for distillation to form light products of low fire-test and essential oils of very offensive odor, which mingle with and impart their dangerous or offensive properties to the heavier distillates, it has been found difficult to procure the heavier gravities of petroleum distillates substantially free from the contamination of these lighter oils and offensive odors.

Various plans have been proposed and methods practiced for effecting the distillation of petroleum for securing the heavier distillates free from the more inflammable and dangerous light oils, and free also from the light oil which forms the vehicle or is the cause of the peculiar offensive odor referred to, the chief of which are, first, either to conduct the distillation at as low a degree of heat as possible, so as to prevent the cracking of the oil or its separation into lighter products, and thus also prevent the generation of the light essential and odorous oil; or, second, to subject the distillate of the ordinary fire process to further treatment, by which the lighter oils and the offensive odor referred to are vaporized and distilled over, leaving the required product in the still as a residuum.

My improved process differs essentially from each of these modes of treatment and obviates many of the objections incident to their practice, its essential characteristic being the condensation of the vapor of heavy-gravity distillates at a temperature above that at which the lighter-gravity oil and odorous vapors will condense, so as to effect the desired separation, not by a regulation of the degree of heat employed in the vaporization, but by a regulation of the degree of heat employed in condensation. This I effect by separating from the combined vapors arising from the still during a process of rapid distillation a distillate of the required gravity by condensing its vapor at the highest degree of heat at which it will condense, and at which the vapors of the lighter oils, as well as the volatile particles which constitute or form the vehicle of the offensive odors, will not condense, but will pass off to another part of the apparatus, where they are exposed to a lower temperature, and, being condensed, are conveyed to a different receptacle.

My invention also relates to certain improvements in apparatus by which my improved process or method of operation is carried into effect.

In the accompanying drawings, Figure 1 is a vertical elevation, partly in section, of a still and condensing apparatus adapted to my improved process; and Fig. 2 is a plan or top view of the same, like letters referring to the same parts in both.

A is the still, of any ordinary or desired construction, with a furnace underneath, and adapted to secure a rapid evaporation of the petroleum or petroleum distillate, as the case may be, which is placed therein for treatment. A steam-pipe may, if preferred, be introduced into the still with a perforated coil, for the introduction of live-steam into the oil, so as to speed the process by hastening the vaporization of the oil. This, however, is not necessary to the successful practice of my invention.

From the top of the still rises a low dome, *a*, which, with the pipe C, forms the goose-neck of the still. The dome *a* should be so low as to prevent the condensation of the oil-vapors therein and their return to the still, which would result in the cracking or breaking up of the oil into lighter products, and which I seek to avoid by my process. The pipe C dips into a T head or receptacle, D, located preferably as near as possible to the still. From this receptacle a pipe, *b*, extends to the refrigerator or cooler, H, where it terminates in the worm F. Between the worm F and the receptacle D, and outside of the refrigerator H, is a trap or fluid-seal, S, which prevents any uncondensed vapor from passing into or through the refrigerating-worm F. From the worm F the pipe passes out of the refrigerator into a receptacle, G, for the heavy distillate. From the T head or receptacle D the air-condenser B, which is formed of pipe of large diameter, extends upwardly to a point, *x*, where it connects with a downwardly-inclined pipe, B′, of smaller diameter, which terminates in the condensing coil or worm E in the tank H.

The tank H of the condensing-worm is supplied with a constant stream of influent cold water, and from the outer extremity of the condensing-worm E a pipe leads off the condensed vapors or distillate to a separate suitable receptacle, K.

The air-condenser, as shown in the drawings, is a short coil of pipe, which inclines upward throughout its entire length, so as to cause the products of distillation which may condense therein to flow back through the ascending hot vapors into the receptacle D. This air-condenser may be placed immediately above the still, so as to be heated thereby, as well as by the hot vapors passing through it, and, if found advisable, may be inclosed, so as to retain the heat and check a too rapid condensation of the vapors of distillation passing up the air-condenser.

Instead of a coil, a straight pipe or other equivalent device may be used as an air-condenser, so placed, however, as to have a descent from the point *x* toward the receptacle D.

In speaking of these several parts of apparatus hereinafter I shall refer to them as the still A, the air-condenser B, the condensing-worm E, the trap S, and the cooling-worm F. It is obvious, however, that the apparatus I have described is susceptible of various modifications of construction and arrangement which might be equally well adapted to the practice of my improved process.

I will now proceed to describe my improved process as applied to the production of heavy-gravity lubricating-oil possessing the requisite degree of viscidity and practically free from the offensive odors of fire-distilled oils, and in so doing I shall speak of specific degrees of gravity for the purpose of greater clearness, without designing, however, to limit my invention thereby.

The still being charged is heated up as rapidly as possible, the vaporization being aided by steam, if desired, or even by use of a vacuum through the still and condensing-worm, if preferred, although neither of these adjuncts is necessary.

The operation of the apparatus hereinbefore described is very simple and obvious. The vapor rising in the dome *a* passes through pipe C into receptacle D. Any vapor which requires the full heat of the still to hold it in vapor (which, however, will be a small proportion) is immediately condensed on reaching pipe C and receptacle D, and passes through the pipe *b* and trap S into the worm F, where it is cooled out of contact with the atmosphere. If preferred, the vapor, before entering the receptacle D, may be passed through an atmosphere of live-steam contained in any suitable vessel.

This cooling of the distillate out of contact with the atmosphere is ordinarily necessary, because the vapor condensed in pipe C and receptacle D is so hot that if exposed to the atmosphere without cooling it would be very liable to spontaneous ignition. From this it will be observed that the worm F is not a condenser, but a cooler, and, as no uncondensed vapors are allowed to pass the trap S, all that passes that point and the cooler must have been condensed either in the air-condenser B, the pipe C, or the head D.

From the construction and arrangement of the air-condenser B, as before described, it will be seen that the vapor not condensed before leaving the head D passes up the pipe B, and, if condensed at any point below *x*, the condensed oil will flow back (meeting the hot current of vapor from the still) into the receptacle D, and thence through the cooling-worm F into the trough G.

This return of the condensed vapors through the pipe B so as to meet the ascending hot vapor from the still serves an important purpose, as the ascending hot vapors take up any light vapors or essential oil which might have a tendency to cling to the condensed oil flowing down the pipe B, and prevents these lighter uncondensed oils or odorous particles from mingling with the condensed heavy oil, and thus being carried through the cooling-worm, where they would be condensed and contaminate the distillate flowing into the trough G.

Of course a larger proportion of vapors is condensed in the air-condenser than in the goose-neck C and receptacle D, and all the vapors which remain uncondensed in the air-condenser B, and which pass beyond its highest point *x*, are carried through the condensing-worm E, where they are condensed together, and, flowing into the trough K, are collected in a separate receptacle. The effect of my process, then, is that the lighter vapors escape through the air-condenser B into the condensing-worm E, carrying with them those light vapors or essential oils which constitute or are the vehicle of the offensive odors characteristic of fire-distilled oils, and that this separation is

effected by condensing the heavier oil vapors at the highest heat at which they will condense, and causing them to flow back through the ascending hot vapor, so as to secure the elimination of the more volatile particles, which require a lower degree of heat for their condensation.

If my process, as described, be applied to a petroleum distillate of, say, 28° Baumé, the first run through the cooling-worm F will be of as high gravity as from, say, 60° to 40° Baumé, owing to the fact that the still is not yet fully heated up; and this product will be illuminating-oil of high fire-test, and substantially free from offensive odor, as the lighter vapors and offensive odors will pass entirely through the air-condenser and into and through the condensing-worm E. As the operation progresses the gravity will be reduced and the fire-test increased of the oil that flows from the cooling-worm F, that ranging from 40° down to 30° being about 300° fire-test illuminating-oil. As the gravity of the oil flowing from the cooling-worm decreases, say, from 30° to 26° Baumé, it may be collected separately, yielding lubricating-oil of, say, 28° Baumé. Then the product, ranging from 26° to 21° Baumé, gives lubricating-oil of, say, 24° Baumé, and as the run continues a petroleum distillate is procured of very low gravity, averaging from 20° to 18° Baumé, of great viscidity, and substantially free from offensive odor, and which is a new product, of very valuable qualities as a lubricant, for which I have made another application for Letters Patent as a new article of manufacture. The oil thus treated, if a distillate before treatment, may be chilled and pressed to remove the paraffine before being introduced into the still, and may also be refined with acid and alkali treatment before being charged into the still; or, if preferred, the pressing out of the paraffine and the refining by acid and alkali may be done after distillation by my process.

Crude petroleum may also be treated by my process, the result being that the naphthas would first pass over through the condensing-worm, and the light burning-oils through the cooling-worm, and as the process progressed the lighter burning-oils would begin to flow through the condensing-worm and the high-fire-test burning-oil through the cooling-worm, until at the latter end of the process the burning-oils would flow through the condensing-worm and the heavy-gravity or lubricating oils through the cooling-worm. In all cases, however, the distillate flowing from the cooling-worm F would be substantially free from offensive odor, and be of heavier gravity than that flowing from the condensing-worm E.

Having thus described my improved process, what I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with a still for vaporizing hydrocarbon oil, of a condenser inclined upward from the dome or goose-neck of the still, to cause the vapors condensing therein to flow back through the upward current of uncondensed hot vapors, a refrigerator or cooler connecting with the lower end of the inclined condenser by a pipe provided with a trap to prevent the passage of uncondensed vapor or gases through the refrigerator, substantially as and for the purpose described.

2. In the distillation of hydrocarbon oils, the process for obtaining an inodorous heavy oil, which consists, first, in condensing the vapors of distillation at their highest condensing temperature; second, eliminating from the condensed product the light and offensive vapors by causing it, when condensed, to return through the ascending current of hot vapor; third, trapping off such condensed and deodorized product, so as to prevent the admixture with it of the lighter and offensive vapors; and, fourth, cooling such deodorized products out of contact with the atmosphere, substantially as hereinbefore described.

In testimony whereof I, the said WILLIAM ATWOOD, have hereunto set my hand.

WM. ATWOOD.

Witnesses:
R. W. BURKE,
CHAS. W. MORSE.