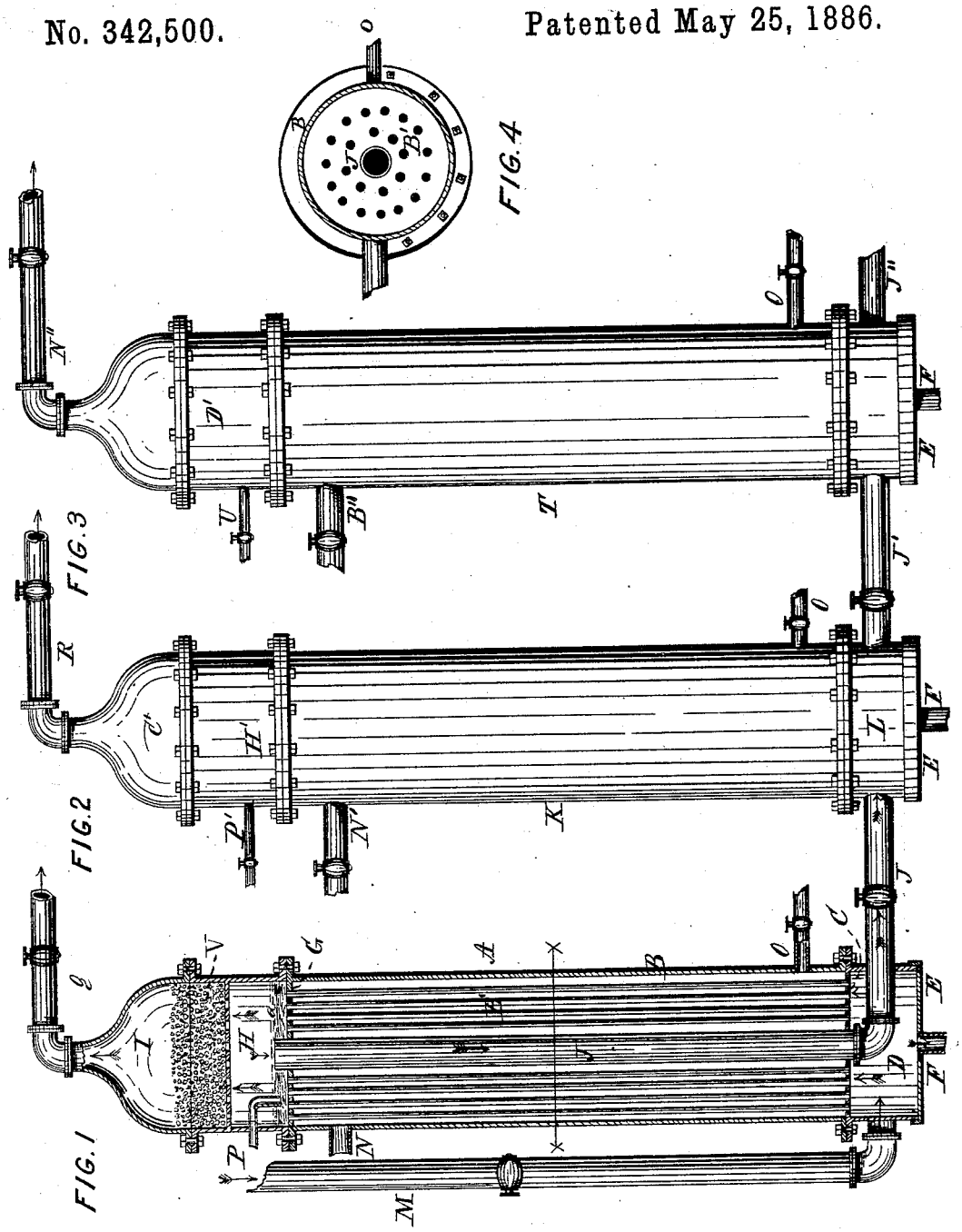
(No Model.)

# R. DEAN.

## APPARATUS FOR DISTILLING HYDROCARBON OILS.

No. 342,500. Patented May 25, 1886.

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## APPARATUS FOR DISTILLING HYDROCARBON OILS.

SPECIFICATION forming part of Letters Patent No. 342,500, dated May 25, 1886.

Application filed August 20, 1885. Serial No. 174,881. (No model.)

*To all whom it may concern:*

Be it known that I, RICHARD DEAN, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new and Improved Apparatus for Distilling Hydrocarbon Oils; and I do hereby declare that the following is a clear and full description thereof.

In the distillation of hydrocarbon oils for obtaining therefrom separate and various grades of distillates ranging from the light or first run down to the residuum or tar it is essential, in order to obtain complete results, that the process of such fractional distillation should be continuous and subject to a continual increment of heat for elimination of each successive distillate. It is also desirable that the oil undergoing distillation should be broken up into small streams or shallow bodies and be kept continuously passing through the apparatus instead of being in mass and without much activity. The said process relates to the mode of deodorizing the oil, which is effected by passing the oil when in a vaporous state through an agent or material in a chamber of the still. After passing through the material the vapor passes therefrom to a condenser, where it is reduced to deodorized oil.

That the above-specified objects may be realized is the purpose of the said improved apparatus, which consists of a series of upright cylinders, of any desirable number and capacity, communicating one with the other, and having in each one a collection of small tubes, the upper and lower ends of which terminate in chambers respectively. Centrally in each of the cylinders, and surrounded by the tube alluded to, is a pipe by which the series of cylinders are in open relation one with the other, as above mentioned.

For a further and more full description of the apparatus and process aforesaid reference will be had to the annexed drawings for illustrating the same, and forming a part of this specification, in which—

Figure 1 represents a vertical transverse sectional view of one of the cylinders of the said apparatus. Figs. 2 and 3 are external views of two cylinders and duplicates of Fig. 1. Fig. 4 is a transverse section through the line *x x* in Fig. 1, which also represents a transverse section of Figs. 2 and 3 in the same line.

Like letters designate like parts in the drawings.

The several cylinders with their attachments form stills, constituting the aforesaid apparatus, and are substantially duplicates; hence a description of one will be descriptive of all the others that may comprise the plant.

As shown in the drawings, the body of the still A, Fig. 1, consists of a steam-tight cylinder, B, which may be of any suitable length and diameter as the working capacity of the apparatus may require. Within the cylinder is a group of oil-tubes, B′, the lower ends of which are secured in a diaphragm, C, and are in open communication with an oil-chamber, D, forming the lower end of the cylinder or still, of which E is the bottom, provided with an outlet-pipe, F. The upper end of the tubes B′ are in like manner secured in a diaphragm, G, and are in open relation with a vapor-chamber, H, in which they terminate. The roof of the said chamber H consists of a foraminous plate forming a bottom of a deodorizing-chamber, I, terminating in the upper end of the still.

It is not essential that the deodorizing-chamber be a part of or within the cylinder, as the chamber may be a separate thing and connected to the vapor-chamber by suitable pipe-connection.

Centrally in the cylinder A is the oil-eduction pipe J alluded to, surrounded by the group of oil-tubes before mentioned. The upper end of the pipe J passes through the diaphragm G and terminates in the chamber H, a little above the diaphragm, as seen in Fig. 1. The lower end of the pipe passes through the diaphragm C into the chamber D, thence through the side of this chamber to the still K, into the chamber L at the lower end of still K.

M, Fig. 1, is a feed-pipe. The lower end of it terminates in the oil-chamber D, whereas the opposite end extends to and terminates in an oil reservoir or tank. (Not shown in the drawings.)

N is a steam-pipe terminating in the cylinder, between the two diaphragms C and G, as seen in Fig. 1. The opposite end of said pipe is connected to a steam generator. (Not shown.)

O is a steam-exhaust pipe, and P an auxiliary steam-pipe, which extends from the steam-generator alluded to and terminates in the chamber H of the cylinder B, as seen in Fig. 1.

The upper end of the still A is put in communication with a condenser by the pipe Q. Said condenser is not shown, as it may be of any suitable construction.

The stills K T, Figs. 2 and 3, with their exterior attachments only, are shown in the drawings, but which, as above mentioned, may be more or less in number, to constitute a plant or system of stills, and that in Fig. 1 is a duplicate of the others.

The operation of the apparatus is as follows: By means of the pipe N the still A is charged with steam, which fills the entire space or spaces between the numerous oil-tubes B′ and the central oil-eduction pipe, J, thereby heating them accordingly, and sufficiently to eliminate the lighter or most volatile element of the oil filling the tubes B′. The oil is conducted into said tubes by the pipe M, which it discharges in the chamber D. The oil ascends therefrom through the heated tubes B′ to the chamber H. The body of oil conducted into the chamber D is broken up into small streams or currents by the numerous tubes B′, and is therefore rapidly and sufficiently heated for the lighter elements of the oil to be eliminated on reaching the chamber H, from which the distillate passes upward through the deodorizing-chamber I to the pipe Q, and is conveyed thereby to a condenser. The unvaporized portion of the oil fills the chamber H up to the end of the oil-eduction pipe J, down which it flows and out of the still A through the pipe J, into the chamber L of the still K. The partially-vaporized oil on reaching the chamber H, as above described, receives an increment of heat by a current of fresh steam conveyed into it by the pipe P, which facilitates the escape of the eliminated vapor to the condenser, (not shown,) and at the same time increasing the temperature of the unvaporized oil pasing down the pipe J to the still K. The oil entering the still K is in a heated condition, and ascends the small tubes therein, by which it is broken up into small streams, as in the former instance described in connection with Fig. 1. The tubes in the said still K are heated by an inflow of fresh steam through the pipe N′, which raises the temperature of the oil passing up the tubes, thereby causing an elimination of a heavier grade of vapor than run off in the still A. This second distillate in like manner passes upward through the chamber C′ of the still K to the pipe R, and is conveyed thereby to a condenser, while the remaining heavy unvaporized portion of the oil flows down the eduction central pipe of the still K, and is conducted by the pipe J′ to the still T in a further heated state, caused by the increment of heat it received in the still K by means of the steam conducted into the oil in the chamber H′ by the auxiliary steam-pipe P′, substantially as described of the operation in the still A. The volume of highly-heated unvaporized oil flowing into the still T is again divided or broken up into small currents by the numerous oil-tubes therein, which are heated by a fresh inflow of steam through the pipe B″ into the still about the tubes. The oil on passing from the tubes into the chamber D′ is raised to a yet higher temperature by a volumn of steam conducted therein by the auxiliary steam-pipe U. A third distillate of a slightly-increased gravity is the product of this still, which is run off through the pipe N″ to a condenser. This process may by carried on through any number of stills used until the residuum or tar is reached. The vapor eliminated in each still is or may be deodorized by being subjected to the action of a deodorizing agent—as charcoal, lime, &c.—(indicated at V, Fig. 1,) before noted. If the lighter products only are desired to be retained, the process of distillation may be arrested at any particular still from the first onward, or the medium and the heavier products may be eliminated and united by connecting the proper pipes of the stills for that purpose, or, the several products may be mixed after being condensed. The eliminated vapors in passing from the chamber H to the pipe Q pass through the deodorizing-chamber I, which may be charged with any suitable deodorizing material, and thereby correct the odor of the vapor before it reaches the condenser, thereby avoiding the use of an agitator, acids, and washings usually employed for that purpose after the eliminated vapor has been condensed, thus shortening the process of producing the different products of distillation for use.

From the above-described process of distillation and the means of conducting the same it will be apparent that different grades of distillates may be separated from the oil and separately retained, and that the several vapors eliminated may be commingled either before or after condensation, and furthermore, that the process is continuous from the lightest to the heaviest product, and that the process may be arrested at any particular point without disturbing in any way the order and competency of the stills or plant of stills.

The heat employed for the above-specified purpose being steam, the measure of heat necessary for the elimination of various gravity vapors can be readily graduated for each specific element or distillate, and in the event the process is continued to the fullest extent the residuum is not burned or scorched; hence the product of the residuum will require no bleaching.

The amount of oil flowing into and through the still or plant of stills, and the velocity of the same, is a matter controlled by suitable valves or cocks in the feed-pipe M and vapor-discharging pipes Q R N″, which mainly depend on the quality of the oil being used. So, also, the supply of steam for gradually increasing the temperature of the oil in the pro-

cess of distillation is accordingly graduated as each successive distillate may require more or less for its elimination.

In practice the pipes F are provided with stop-cocks, and so also are all the induction and eduction pipes used in the still to control the steam, oil, and vapors.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. For the fractional distillation of hydrocarbon oils, a series of stills forming a plant, each of said stills consisting of a steam-tight cylinder having therein an oil-eduction pipe and induction oil-tubes, the lower ends of which tubes terminate in an oil-chamber in the lower end of the next succeeding cylinder, and the upper ends of the tubes and the upper end of said oil-eduction pipe terminating in a vapor-chamber in the upper part of the cylinder, said chamber being in communication with a deodorizing-chamber provided with a vapor-discharging pipe, oil-feed pipe terminating in the lower chamber of the cylinder, with a steam-pipe arranged to induct steam into said cylinder, and a pipe for exhausting steam therefrom, substantially as herein described, and for the purpose set forth.

2. In combination, respectively, with the vapor-chambers of the plant of stills herein described, auxiliary steam-pipes for the induction of steam into each of the said chambers, for the purpose specified, and substantially as set forth.

3. For the fractional distillation of hydrocarbon oils, a series of stills consisting of a suitable number and duplicates of the still A, constructed as described, the one still in communication with the next succeeding by eduction oil-pipes extending from the vapor-chamber of the one still to the oil-receiving chamber of the other, respectively, throughout the consecutive series of stills forming the plant, whereby is maintained a continuous flow of oil through the plant of stills, causing a continuous distillation of different gravity vapors, substantially as and in the manner set forth.

In testimony whereof I affix my signature in presence of two witnesses.

RICHARD DEAN.

Witnesses:
J. W. BURRIDGE,
P. SCHREINER.