No. 704,989. Patented July 15, 1902.

LA FAYETTE D. VORCE.

PROCESS OF EXTRACTING OIL.

(Application filed Oct. 29, 1900.)

(No Model.)

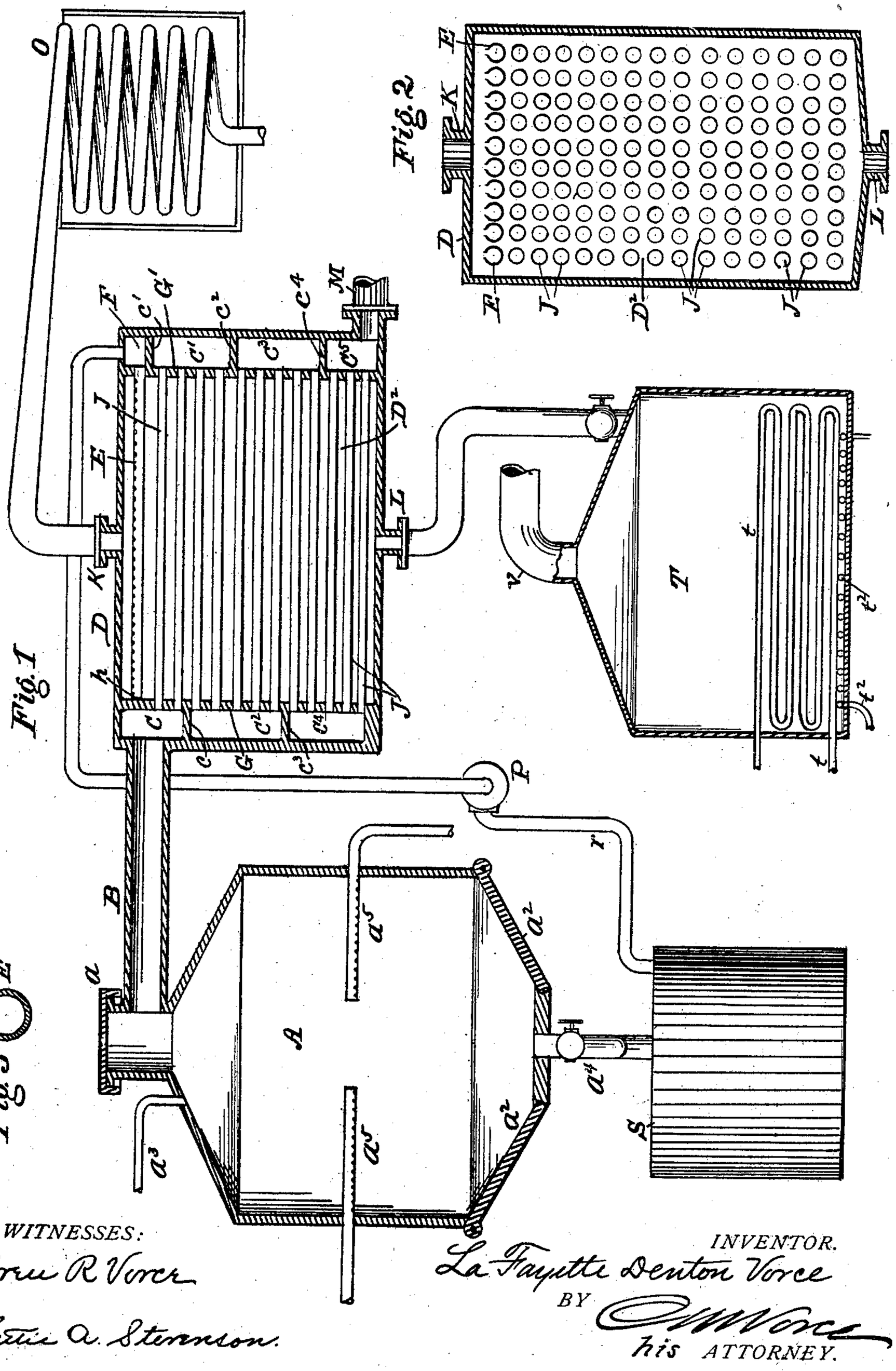

Fig. 1

Fig. 2

Fig. 3

WITNESSES:

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PROCESS OF EXTRACTING OIL.

SPECIFICATION forming part of Letters Patent No. 704,989, dated July 15, 1902.

Application filed October 29, 1900. Serial No. 34,688. (No specimens.)

To all whom it may concern:

Be it known that I, LA FAYETTE DENTON VORCE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Processes of Extracting Soluble Matters and Recovering the Solvent Therefrom; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to the process of extracting oils and other extractive matters from seeds and other substances by the use of solvents and the recovery of the solvent from the extracted matter.

The object of the invention is to increase the economy and efficiency of the process heretofore in use; and it consists in the novel steps and mode of procedure, as hereinafter fully described, and specifically set forth in the claims.

In the process in use for extracting oils, &c., by use the use of solvents prior to my invention the material was charged into large tanks, commonly called "percolators" or "macerators" and which are usually provided with a manhole at the top for charging in the ground seed or other material and with swinging doors at the bottom for discharging the spent residuum. When the percolator has been filled and tightly closed, the solvent, which is usually some light hydrocarbon, such as gasolene or benzin, (although bisulfid of carbon has also been used,) is pumped into the percolator, so as to saturate the material therewith. The solvent is in some cases left to macerate for a time, and the solution is then drawn off and fresh solvent added successively until all the extractive matter is dissolved out, and in other cases the solvent is run through continuously, and the solution is either received in a storage-tank or conducted to a second percolator and passed through a fresh charge of material, thus becoming further enriched with the extractive matter. In any case in the process heretofore in use after the oil or other extractive matter has been extracted from the oil-bearing substances or other material the excess of solvent is drawn from the percolator, and to remove the residual solvent mechanically held by the percolated mass steam is forced into the containing-chamber, whereby the solvent is vaporized and together with the steam carried from the percolator through a suitable vapor-pipe, terminating in a condenser, in which the steam and solvent are condensed the latent heat of both steam and solvent being taken up by water circulating around the condensing-pipes. The recovery of the oil or other extracted matter from the solvent so as to reclaim the latter for use over again has been effected by subjecting the solution to distillation by the use of steam heat in various forms of apparatus.

In the above-described operation of steaming out the residual solvent from the exhausted material in the percolator and recovering the solvent thus driven out by condensation a very large amount of heat has been lost, as the steaming out has to be continued for a considerable time, often several hours, and a very large amount of highly-heated steam has to be used to secure the complete elimination of all traces of the solvent from the exhausted material, which is essential.

My process is devised to utilize the latent heat of the steam and naphtha vapor during the operation of steaming out the residual naphtha from the exhausted material for separating the solvent from the extracted oil, which separation has been prior to my invention an entirely distinct and separate operation from the process of steaming out and usually carried out at a different time.

My invention is not dependent upon any special form of apparatus, and my improved process can be carried out by means of various forms of apparatus. Also it is immaterial to my process whether the extraction be carried on in one or more percolators separately or in two, three, or more percolators connected in series. The apparatus illustrated diagrammatically in the accompanying drawings has been found efficient in practical work for the carrying out of my improved process.

Figure 1 is a vertical longitudinal section showing the arrangement of the percolator and the separator. Fig. 2 is a vertical transverse section through the separator, showing the preferred arrangement of pipes. Fig. 3 is a cross-section of one of the pipes E, showing more clearly the perforations therein for the escape of the oily solution.

A represents a percolator or macerator (or a series of them) of any suitable construction, in which the action of the solvent upon the material is carried on by any of the well-known methods and which is commonly provided with a manhole having a tight cover a, with one or more doors a^2 for discharging the spent material, with a solvent-inlet pipe a^3, with an eduction-pipe a^4 for conducting away the solution containing the extracted matters, and with any suitable or preferred steam-inlet pipes, as a^5, for intromitting steam into the mass of exhausted material in the percolator.

B represents a vapor-offtake pipe, through which the steam and vaporized solvent pass from the percolator A to a separating apparatus D, comprising a closed chamber D^2, in the upper part of which are a number of pipes E, which communicate with a vat or chamber, as F, from which they are supplied with the solution of solvent and extracted matter, which may be pumped from the receiving-tank S to which the solution from the percolators is conducted. The pipes E are closed at their ends h and are slotted or perforated on their upper side and placed horizontally, so that the mixture of solvent and extracted matter will fill them for their entire length and then overflow uniformly and drip down upon a series of pipes J, which are arranged in vertical lines beneath and through which the steam and vaporized solvent escaping from the percolators by the offtake B are caused to pass, heating the solution and vaporizing the solvent, which escapes in the form of vapor from the chamber D^2 by an outlet, as K. In the particular form of separator shown the central chamber D^2 is separated by partitions G G′ from a series of chambers C C′ C^2 C^3, &c., which occupy the ends of the separator and are separated from each other by partitions c c' c^2 c^3, which extend from the partitions G G′ to the end walls of the separator D. The offtake B enters one of the chambers, as C. The pipes J are open at both ends and extend through both partition-plates G and G′, so that the steam and naphtha vapors entering chamber C from the vapor-pipe B may pass unrestrained through chambers C′ C^2 C^3 C^4 C^5 successively and in passing give up their latent heat to the mixture of solvent and oil which is flowing over the outside of the pipes, thereby vaporizing the volatile solvent, which, rising, passes out of the chamber D^2 through the outlet K into any suitable condensing apparatus (indicated by O) with or without the assistance of a vacuum-pump. In the meantime the oil or other extracted matter, freed in part or wholly from the solvent, passes down to the bottom of chamber D^2 and is drawn off from the bottom thereof through pipe L by gravity in case no vacuum-pump is used for the eduction of the volatilized solvent and by means of a suction-pump if a vacuum-pump is used for removing the naptha vapors. The steam and naphtha vapors passing from pipe B through the apparatus to the chamber C^5 in giving up their heat to the solution flowing over the pipes J become partially or wholly condensed and then pass, partly or wholly condensed, from the chamber C^5 through the pipe M either to an auxiliary condenser or, if wholly condensed, to a separating-tank, from which the solvent is pumped back to a storage-tank or other receptacle for further use in extracting, and the condensed steam is either allowed to flow away or is used for any available purpose, as for boiler-feed water, &c.

The volatilizing-chamber may be constructed of any suitable material, but I have found cast-iron the best material for the walls and division-plates and copper the best material for the tubes J, and I prefer to so construct the chamber that the steam and naphtha vapor shall pass several times back and forth under the pipes E, thus giving the solvent and oil more time to pass from the top of the apparatus to the bottom than if the steam and naphtha vapor made but few passes from one end to the other.

Where operations are conducted upon a large scale, the amount of oily solution to be treated is ordinarily too great to be completely freed from the solvent by the hot vapors produced in the "steaming out" of the residual meal or other material, and an additional quantity of steam has to be used direct from the boilers or from a superheater to effect the complete and perfect elimination of the last traces of solvent from the solution in the same manner that the entire separation has been heretofore performed. This final treatment may be conveniently performed by conducting the partially-separated solution which flows from the outlet L of the separator D to a closed tank, as T, Fig. 1, which is provided with a steam-coil t, through which steam is passed to heat the solution sufficiently to drive off the last traces of the solvent, the vaporized solvent passing away through the outlet v to a condenser.

The process above described is applicable to the extraction of oil from seeds or any other oil-bearing substances—such as tankage, garbage, offal, wool, and waste—and to the extraction of other extractive matters—such as essential oils from vegetable matters, &c.; but the use to which I have applied it is the extraction of oil from flax-seed, and the extraction of oil from cotton-seed, corn, nuts, and other seeds and grain is to be conducted in the same manner. The percolaters and other apparatus aside from the separator may be such as are already in extensive use in the manufacture of linseed-oil by the solvent process.

No part of the apparatus herein described is claimed in this application, as the same forms the subject-matter of my pending application, Serial No. 35,007, filed October 31, 1900.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The process of extracting and recovering soluble matters from material containing the same, which consists in subjecting the material in a closed extraction-chamber to the action of a volatile solvent, educting the solution thus obtained and subsequently passing it into a volatilizing-chamber, then passing into the exhausted material in the extraction-chamber a volatilizing agent, such as steam, and volatilizing the residual solvent left in the material, conducting said heating agent and vapor into the volatilizing-chamber and there utilizing their heat to volatilize more or less of said solvent from said solution, and conducting said partially-condensed vapors thence to a condenser or separator.

2. The process of extracting and recovering soluble matters from material containing the same, which consists in subjecting the material in a closed extraction-chamber to the action of a volatile solvent, educting the solution thus obtained, then passing into the exhausted material in the extraction-chamber a heated volatilizing agent, such as steam, and volatilizing the residual solvent in the mass, conducting the heating agent and vaporized solvent into a volatilizing-chamber and heating the same thereby, conducting the solution of solvent and extracted matter into the volatilizing-chamber and there exposing it to the heat of said vaporized solvent and heating agent, whereby more or less of the solvent is volatilized from said solution and said heating-vapors are partially or wholly condensed, and conducting said partially-condensed vapors to a condenser or separator.

3. The process of extracting and recovering soluble matters from material containing the same, which consists in subjecting the material in a closed extraction-chamber to the action of a volatile solvent, educting the solution thus obtained and then passing into the exhausted material in the extraction-chamber a heated volatilizing agent, such as steam, and volatilizing the residual solvent left in the material, conducting said heating agent and vapors into a volatilizing-chamber through closed pipes, passing the educted solution into the volatilizing-chamber and causing the same to therein flow in thin layers over the pipes containing the heating agent and vapors, thereby more or less completely volatilizing the solvent from said solution and partially or completely condensing said heating agent and vapors, and conducting said partially-condensed vapors to a condenser or separator.

4. The process of extracting and recovering soluble matters from material containing the same, which consists in subjecting the material in a closed extraction-chamber to the action of a volatile solvent, educting the solution thus obtained and subsequently passing it into a volatilizing-chamber, then passing into the exhausted material in the extraction-chamber a volatilizing agent, such as steam, hot air, gas or other heating agent and volatilizing the residual solvent left in the material, conducting said heating agent and vapors into the volatilizing-chamber and there utilizing their heat to volatilize more or less of said solvent from said solution, conducting said partially-condensed vapors thence to a condenser or separator, and then completing the volatilization of the solvent from the solution by the application of heat from a different source.

5. The process of extracting and recovering soluble matters from material containing the same, which consists in subjecting the material in a closed extraction-chamber to the action of a volatile solvent, educting the solution thus obtained, then passing into the exhausted material in the extraction-chamber a heated volatilizing agent, such as steam, and volatilizing the residual solvent in the mass, conducting the heating agent and vaporized solvent into a volatilizing-chamber and heating the same thereby, conducting the solution of solvent and extracted matter into the volatilizing-chamber and there exposing it to the heat of said vaporized solvent and heating agent, whereby more or less of the solvent is volatilized from said solution and said heating-vapors are partially or wholly condensed, conducting said partially-condensed vapors to a condenser or separator, and then completing the volatilizing of the solvent from the solution by the application of heat from another source.

6. The process of extracting and recovering soluble matters from material containing the same, which consists in subjecting the material in a closed extraction-chamber to the action of a volatile solvent, educting the solution thus obtained and then passing into the exhausted material in the extraction-chamber a heated volatilizing agent, such as steam, and volatilizing the residual solvent left in the material, conducting said heating agent and vapors into a volatilizing-chamber through closed pipes, passing the educted solution into the volatilizing-chamber and causing the same to therein flow in thin layers over the pipes containing the heating agent and vapors, thereby more or less completely volatilizing the solvent from said solution and partially or completely condensing said heating agent and vapors, conducting said partially-condensed vapors to a condenser or separator, and then completing the volatilization of the solvent from the solution by the application thereto of heat from a different source.

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

LA FAYETTE DENTON VORCE.

Witnesses:
JNO. T. DE MILLE,
WILLIAM IRWIN.