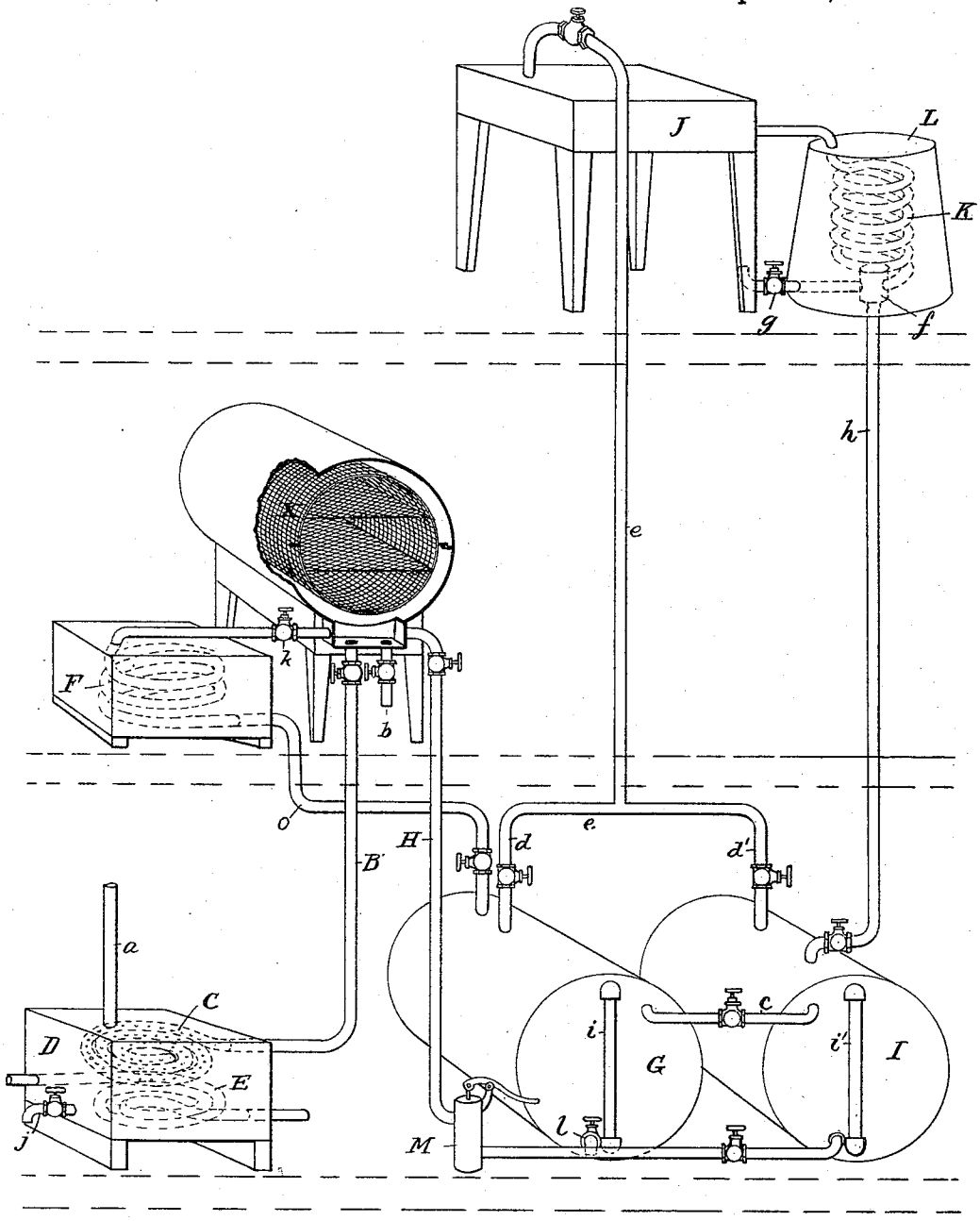
(No Model.)

J. R. WHITING & W. A. LAWRENCE.

METHOD OF RECOVERING VAPORIZED SOLVENTS.

No. 450,501. Patented Apr. 14, 1891.



WITNESSES:
J. Henry Thebrath.
E. M. Clarke

INVENTORS.
J. R. Whiting
W. A. Lawrence
BY
Munn & Co.
ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JAMES R. WHITING, OF NEW YORK, AND WILLIAM A. LAWRENCE, OF WATERVILLE, NEW YORK.

METHOD OF RECOVERING VAPORIZED SOLVENTS.

SPECIFICATION forming part of Letters Patent No. 450,501, dated April 14, 1891.

Application filed May 24, 1890. Serial No. 353,023. (No model.)

To all whom it may concern:

Be it known that we, JAMES R. WHITING, of New York city, in the county and State of New York, and WILLIAM A. LAWRENCE, of Waterville, in the county of Oneida and State of New York, have invented a new and useful Improved Method for the Recovery of Vaporized Solvents, of which the following is a specification, reference being had to the accompanying drawing, which is a diagrammatic representation of an apparatus employed in carrying out our method.

Our invention relates to an improvement upon the method for the use and recovery of vaporized solvents described in Letters Patent No. 170,424, granted to us November 23, 1875, and is an improvement upon all methods heretofore existing and known to us, which is used for the extraction of the active principles and valuable contents of hops by bringing the hops in contact with petroleum, ether, or any of the suitable lighter products of the destructive distillation of coal or petroleum as solvents; and our invention relates simply to its use in the process of the extraction of hops and when employed in the recovery of the above-mentioned solvents.

That the object and usefulness of our invention may more clearly appear it is necessary to be understood that in the method of extracting hops, owing to the great bulk of the leaves of the hops remaining in the extractor after the extract has been removed by the use of the above-mentioned solvents and the liquid solvents containing the extract have been drawn off, there remains entangled among the leaves of the refuse hops a valuable remainder of vaporized solvent, and, furthermore, it is necessary to be understood that the contact of steam with the extract of hops, with the resulting continued presence of water in the extract and consequent oxidation of the essential oil of hops, is very detrimental to the subsequent preservation, quality, and value of the extract.

The object of our invention is to remove and recover for use more rapidly and completely than by any previously-existing method the above-mentioned vaporized solvents remaining in the extractor among the refuse hops after the solvents containing the extract have been drawn off, and to accomplish this object by the use of steam and also to preclude the steam at any and all times from contact with the extract.

In order to a full and clear understanding of our method, we will first proceed to describe its relation to the preceding method for the extraction of the hops by reference to the accompanying diagram.

The extractor A consists in the present case of a cylindrical vessel of suitable construction and size, provided with the cage X for containing the hops. The extractor communicates through the pipe B with a pipe C, located within the evaporating-chamber D. The pipe C is perforated, and in the bottom of the chamber D is arranged a steam-coil E, passing through the chamber D and in position to receive upon the coil the liquid solvent containing the extract as it is drawn off from the extractor A through the pipe B and is dropped from the perforated pipe C. The solvents used and already named, being very volatile, are driven off in the form of vapor to a condenser of any suitable construction through the pipe *a*, condensed, and thence conducted to receivers for further use, while the extract of the hops, being less volatile than the solvent, falls to the bottom of the chamber D, whence through the pipe *j* it is drawn off from time to time for use. The extractor A having now been emptied of its liquid solvent containing the extract into the chamber D, there remains in the extractor A a large mass of the leaves and woody fiber of the hops, and this mass is permeated throughout with a valuable remainder of vaporized solvent, which at this stage of the process of extracting hops we remove and recover for use by our invention.

The apparatus employed for carrying out our method is as follows: A coil-condenser F is connected with the extractor A by the pipe and valve *k*, as shown, and communicates, as shown, with a receiver G. The extractor A is furnished with a steam-inlet pipe *b*. The lower part of the extractor communicates by means of the valved pipe H with the force-pump M and with the lower part of the receiver I. The upper part of the receiver G communicates with the upper part of the re-

ceiver I through the valved pipe *c*. The receivers G I communicate through the pipes *d*, *d'*, and *e* with the condenser J, and the condenser J discharges into the condensing-coil K, which is contained in the refrigerating-casing L. The coil K terminates in an air-pocket *f*, provided with an escape-valve *g*. The pipe *h*, connected with the pocket *f*, leads to the receiver I. The receivers G I are provided with liquid-gages *i i'*, by means of which the level of the liquids and the position of the dividing-line between the water and the solvent may at any time be seen.

Having completed the method of extracting the hops, as already described, to the point at which the extractor A is discharged of the liquid solvent containing the extract and now contains only the great mass of extracted and refuse hops permeated throughout with a valuable remainder of vaporized solvent, we now carry out our improved method of removing and recovering this vaporized solvent by means of our invention, as follows: The valve in the pipe B is closed, thereby preventing all access of steam to the extract in the evaporating-chamber D. The valve *k* in the pipe leading to the condenser F is opened, allowing such portion of the vaporized solvent in the extractor A as will escape of its own pressure to pass into the condenser F, and thence in a condensed and liquid form to the receiver G. After a suitable time being given for the escape of a part of the vaporized solvent in this manner the valve *k* is about nine-tenths closed, and superheated steam is admitted through the pipe *b* to the extractor and its mass of refuse hops for about twenty-five minutes. The steam is then shut off, the valve *k* is fully epened, and in a short time the vaporized solvent is found to be entirely removed from the extractor A and its mass of refuse extracted hops, and it is ready to be discharged and recharged with fresh hops and the method repeated. By the admission to the condenser of such portion of the vaporized solvent as will pass from the extractor into the condenser by the action of its own pressure and the vacuum caused in the condenser by the condensation of this vapor the process is carried out with greater rapidity than by the immediate admission of steam. The partial closing of the valve *k*, as described, creates a pressure in the extractor, and the steam is forced by this pressure into the mass of refuse hops, and thereby reach and render mobile the vaporized solvent entangled mechanically in the hops, so that when the valve *k* is fully opened a rapid current is produced and the vaporized solvent speedily removed. The solvent condensed in the condensing-coil F, together with the water condensed from the steam, is carried to the receiver G. When the receiver G is nearly filled with the solvent and the water, the valve in the pipe *c* is opened, allowing the solvent, which floats upon the water, to pass by gravity from the receiver G into the receiver I. Any vapor which passes the condensing-coil F is carried by the pipes *d d' e* to the condenser J, where its temperature is reduced by water surrounding the condensing-coil. It is then conveyed by gravity through the refrigerating-coil *k*, where it is still further condensed. The air and a very small portion of the vaporized solvent is allowed to escape from time to time through the valve *g*, while this final portion of the condensed solvent is returned to the receiver I through the pipe *h*. The recovered solvent is drawn from the receiver I for use whenever required by means of the pump M. The water delivered to the receiver G is removed from time to time through the valve *l*.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. The method herein described of recovering the vaporized solvent remaining in the refuse hops in the extractor after the extract has been drawn off, consisting in removing and condensing that portion of the vaporized solvent in the extractor which will escape of its own pressure, then admitting steam into the extractor among the refuse hops to thoroughly permeate the hops and drive off the vaporized solvent mechanically held in the hops, removing and condensing the escaping vaporized solvent and steam, and finally separating the solvent from the water of condensation, as specified.

2. The method herein described of recovering the vaporized solvent remaining in the refuse hops in the extractor after the extract has been drawn off, consisting in removing and condensing that portion of the vaporized solvent in the extractor which will escape of its own pressure, then admitting steam into the extractor, retarding the escape of the steam from the extractor for a short time, then allowing it to escape freely, condensing the escaping steam and vaporized solvent, and finally separating the solvent from the water of condensation, as set forth.

J. R. WHITING.
WILLIAM A. LAWRENCE.

Witnesses:
EVERETT L. SACKETT,
EDW. M. CLARK.