

J. F. HANRAHAN.

DRIER.

APPLICATION FILED FEB. 8, 1911.

Patented Dec. 12, 1911

2 SHEETS—SHEET 1.

1,011,780.

Fig. 1.

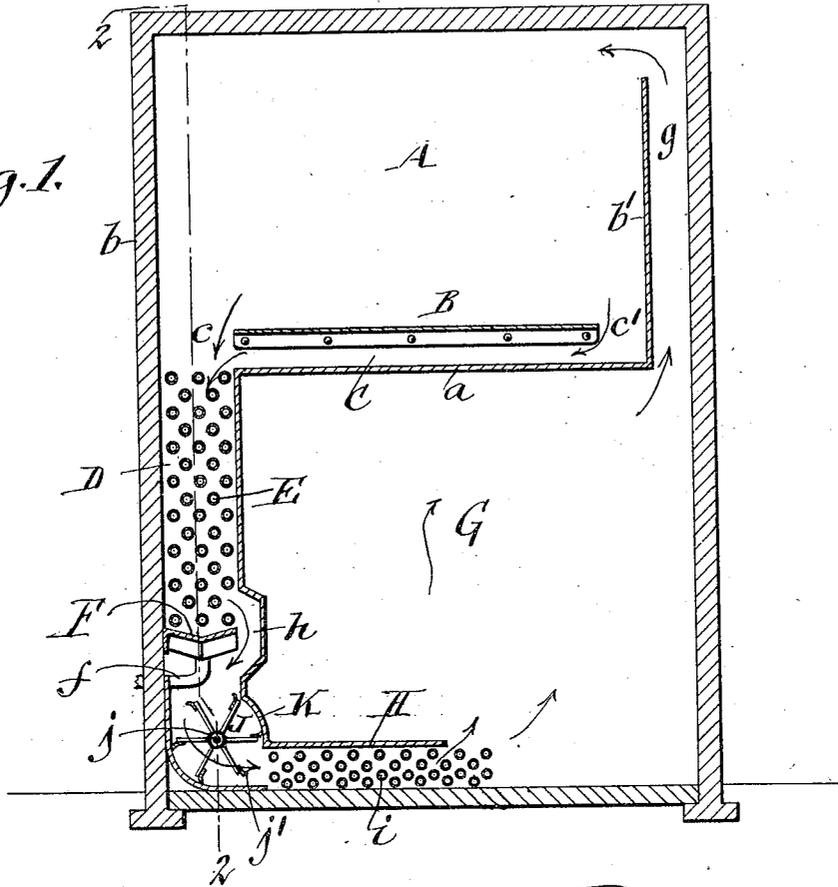
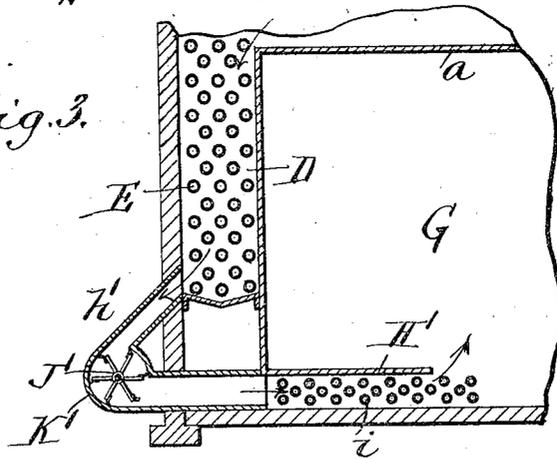


Fig. 3.



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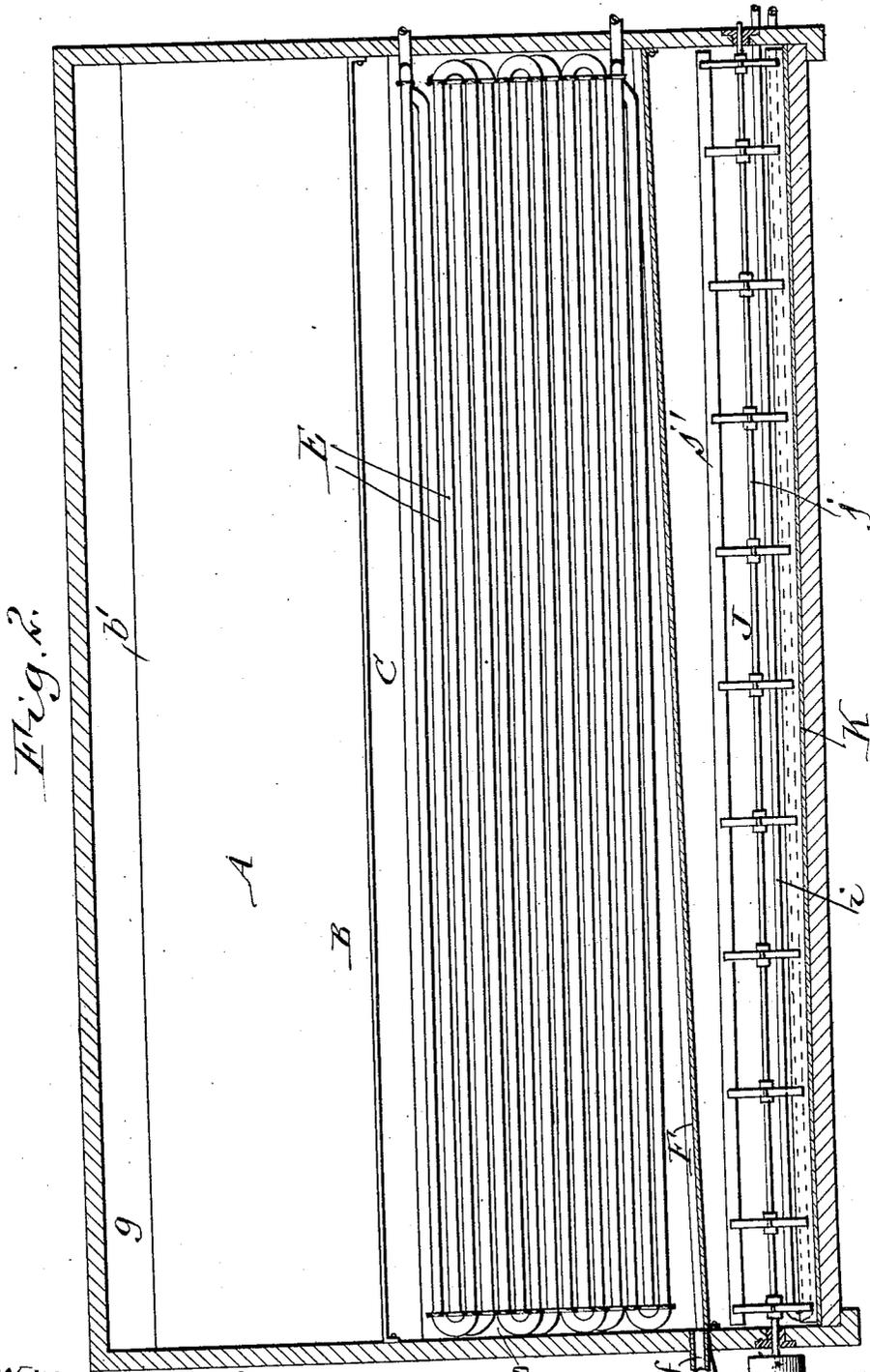


Fig. 2.

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UNITED STATES PATENT OFFICE.

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DRIER.

1,011,780.

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Application filed February 8, 1911. Serial No. 607,241.

To all whom it may concern:

Be it known that I, JOSEPH F. HANRAHAN, a citizen of Canada, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Driers, of which the following is a specification.

This invention relates to a drier which is designed for drying products which throw off a vapor or gas or for drying products at very low temperatures, but which is more particularly designed for drying products containing a solvent which throws off a vapor or gas which is heavier than air.

The object of this invention is the production of a drier of this character which is simple in construction, which can be operated at low cost and which will effectually recover the bulk of the solvents which have been employed in the treatment of the article to be dried and enable the same to be used over again, thereby materially reducing the cost of producing the articles in connection with which the solvents are employed.

In the accompanying drawings: Figure 1 is a vertical transverse section of one form of drier embodying my invention. Fig. 2 is a vertical longitudinal section of the same in line 2—2, Fig. 1. Fig. 3 is a fragmentary vertical transverse section showing a slightly modified form of the drier embodying my invention.

Similar letters of reference indicate corresponding parts throughout the several views.

Referring to Figs. 1 and 2, A represents the evaporating chamber in which is placed the material which is to be dried, such for instance as leather or other fabric which has been coated with a lacquer containing a solvent such as naphtha which throws off a vapor that is heavier than air. This evaporating chamber is comparatively wide and is provided above its bottom *a* with a horizontal diaphragm B which fits at its side edges against the adjacent side walls of the evaporating chamber while its front and rear edges are separated from the adjacent front and rear walls *b*, *b'* of the evaporating chamber, thereby forming a horizontal flue C between the diaphragm and the floor *a* which communicates at its front and rear ends by means of passage *c*, *c'* with the evaporating chamber at the front and rear ends thereof.

D represents an upright condensing chamber which is arranged below the evaporating

chamber and communicates at its upper end with the lower end of the evaporating chamber adjacent to the front end of the flue C and the front passage *c*. This condensing chamber extends the full length of the evaporating chamber but is comparatively narrow in a direction fore and aft of the drier. Within this condensing chamber is arranged a condensing device which preferably consists of a plurality of horizontal coils E through which water or other cooling medium is circulated. These coils are arranged in tiers one above the other so as to form an upright column of cooling coils which is comparatively narrow and the several coils or pipes are so arranged that each pipe of one horizontal row is located opposite the space between two adjacent pipes of an adjacent horizontal row by which staggered arrangement the vapors or gases passing downwardly through the condensing chamber are caused to take serpentine or zig-zag paths, thereby intercepting most of the gases or vapors by means of the cooling element and increasing the condensing efficiency of the condenser accordingly. At its lower end the condensing chamber is provided with a trough-shaped bottom F which slopes lengthwise toward one of the sides of the building and is provided with a drip or discharge pipe *f* whereby the condensate which falls upon the same from the cooling or condensing pipes is carried away.

G represents a heating chamber arranged below the bottom of the evaporating chamber and in rear of the condensing chamber and extending the full length of the evaporating and condensing chambers. The heating chamber is connected at its lower end with the lower end of the condensing chamber and at its upper end with the upper end of the evaporating chamber. The connection between the upper ends of the heating chamber and evaporating chamber preferably consists of an upright flue *g* arranged behind the rear wall *b'* of the evaporating chamber and communicates at its lower end with the upper rear corner of the heating chamber while its upper end communicates with the upper rear corner of the evaporating chamber. The communication between the lower end of the heating chamber and the condensing chamber is preferably effected by means of a conduit comprising a horizontal section H extending the full length of the heating chamber adjacent to

the lower front corner thereof and opening at its rear end into the central part of the heating chamber, and an inwardly deflected upright by-pass *h* extending from the rear wall of the condensing chamber above the drip pan to the front end of the lower conduit H, this by pass section being of the same length as the heating chamber and condensing chamber.

Within the lower conduit H is arranged the heating element or means whereby the gas or vapor and air are heated preparatory to entering the heating chamber. This heating device may be of any suitable construction but that shown in the drawings, as an example, comprises a plurality of coils or pipes *i* which are arranged in the form of a horizontal column and staggered relatively to each other so as to intercept the air and gases for more effectually heating the same. The coils are heated by steam, hot water or other heating medium which is circulated through the same for raising the temperature of the vapors, gases and air coming in contact with the outer sides of the heating coils.

The vapors and gases which are given off by solvents such as naphtha in the case of drying lacquer coated leather hides for producing patent leather descend by gravity in the evaporating chamber and the air and vapors in the condensing chamber also descend by gravity because of their greater density and weight, while the warm air and vapors in the heating chamber which are lighter and less dense rise from the heating chamber through the rear flue and into the upper end of the evaporating chamber, thereby maintaining a constant circulation within the apparatus. As the solvent vapors or gases pass downwardly through the condensing chamber the bulk of the same are condensed by contact with the outer surface of the condenser coils while the remaining uncondensed vapors or gases which have passed the cooling coils without having been acted upon are expanded or heated by the heating coils in the lower or return flue H and delivered in this condition into the heating chamber from which latter they are again delivered by the flue *g* to the top of the evaporating chamber and then passed again downwardly through the condensing chamber for removing by condensation a further quantity of the vapors or gases which are suspended in the air. This circulation in the apparatus is maintained until practically all of the gases or vapors which are thrown off by the solvent of the material under treatment have been recovered. As the air and vapors pass from the evaporating chamber downwardly through the passage *c* to the condensing chamber a vacuum is produced in the flue C which causes the air to pass from the evaporating

chamber downwardly through the passage *c*¹ and to be delivered to the condensing chamber, thereby equalizing the drying action over the entire evaporating chamber.

When more rapid drying of the material is desired than is possible by means of the condensing coils and heating coils the circulation of the air and vapors may be accelerated or hastened. The means whereby such acceleration of the circulation within the drier may be effected may be variously constructed but the means for this purpose which are shown in the drawings comprise a rotatable paddle wheel J arranged within a casing K of cylindrical form and having a horizontal longitudinal shaft *j* and an annular row of blades or paddles *j*¹ mounted upon the shaft within the casing. This casing forms a portion of the return conduit between the by-pass *h* and the heating conduit H. This accelerator extends the full length of the heating chamber and condensing chamber.

Instead of arranging the accelerator within the main building of the drier and immediately below the condensing chamber wheel J¹ and casing K¹,—this accelerator may be located in front of the main building and forwardly from underneath the condensing chamber and the inlet of the casing may be connected by an inclined by-pass *h*¹ with the front side of the condensing chamber above the bottom thereof and the outlet of the casing may be connected with the conduit H¹ of the heater, as shown in Fig. 3.

Although this drier may be used for drying various products it is very efficient in recovering the solvents which have been used for treating different articles and which throw off a gas that is heavier than air. This apparatus is therefore particularly suitable for recovering such solvents as naphtha, gasolene, kerosene, ether, alcohol and the like. Owing to the great density and weight of the vapors or gases thrown off by these solvents they are heavier than air and have heretofore been either lost altogether or only partly recovered, thereby involving considerable loss especially in the case of high priced solvents. My improved drier permits of recovering nearly all of the solvent vapors or gases in as rich or strong a condition as the original solvent, thereby enabling the same to be used over again and effecting a corresponding saving in the cost of manufacturing the articles which have been treated with these solvents.

I claim as my invention:

1. A drier comprising an evaporating chamber, an intermediate condensing chamber arranged below the evaporating chamber and connected at its upper end with the lower part of said evaporating chamber, a

condensing coil arranged in said condensing chamber, a heating chamber arranged below the evaporating chamber and having its lower end connected with the lower end of the condensing chamber and its upper end connected with the upper end of the evaporating chamber, and a heater arranged at the bottom of said heating chamber.

2. A drier comprising a comparatively wide evaporating chamber having a bottom, a comparatively narrow condensing chamber connected at its upper end with the lower end of the evaporating chamber at one side thereof, a condensing coil arranged in the condensing chamber, a heating chamber connected at its lower end with the

lower end of the condensing chamber and at its upper end with the upper end of the evaporating chamber, and a diaphragm arranged in the evaporating chamber near the bottom thereof and separate at one end from the side wall of the evaporating chamber adjacent to the upper end of the condensing chamber and also separated at its opposite end from the adjacent side wall of the evaporating chamber.

Witness my hand this 7th day of February, 1911.

JOSEPH F. HANRAHAN.

Witnesses:

THEO. L. POPP,
ANNA HEIGIS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."