

1,059,820.

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UNITED STATES PATENT OFFICE.

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METHOD OF DRYING DAMP MATERIALS.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, EDUARD RUDOLPH BESEMFELDER, a subject of the German Emperor, and residing at Charlottenburg, Germany, have invented certain new and useful Improvements in Methods of Drying Damp Materials, of which the following is a specification.

The hitherto known suggestions for quickly drying wood or other materials that contain moisture were, in consequence of the apparatus and materials required, so complicated and expensive that they did not find any, or only an exceptional, introduction to practice. Therefore the rather slow method of drying by natural means was generally resorted to, namely by leaving the materials to be dried in the air, to dry by themselves. When, for instance, freshly hewn timber must be quickly gotten ready for use, seasoned, the method of drying it in a well-ventilated space always remained the most reliable and best, particularly when the wood was intended for the finer classes of work. It is, however, considered necessary that parquetry wood must dry in this manner for years, and it is evident that a method which will achieve the same result within a couple of days, and so almost entirely avoid the enormous costs, caused by interest on the purchase price of the lumber for many years, storage rent, wages, insurance premiums, and the like, will represent a great improvement in the art.

A very effective and rapid method of drying wood and other damp materials forms the subject matter of the present invention. This method consists in that the materials to be dried are exposed in suitable closed vessels to a current of vapors of liquids, with the exception of water vapor. Materials which may be subjected to this rapid drying process besides wood, are for example, leather, caoutchouc, india-rubber, damp textile goods, such as artificial silk, damp cellulose or nitrocellulose products, as well as wet photographic paper and the like.

Vapors adapted for use according to the present method are—vapors of liquids which will not mix with water, such as benzene, benzol, naphthalene, ethylene-trichlorid, carbon-bisulfid, carbon-tetrachlorid and others; also vapors of alcohol, ether, and the like.

The mixture of steam and vapors pro-

duced in the treatment of the wet materials can be drawn in any desired manner from the drying vessels.

Hereinafter is given an example of the manner in which the method may be carried out, reference being had to the accompanying drawing which illustrates a suitable apparatus for drying lumber, parts thereof being shown in section. For example, the fresh wood, *f* is placed on a grate *e*, in a closed jacketed vessel *d*. Then a current of vapors of the kind above set forth, say carbon-tetrachlorid, is sent through the vessel *d*, by means of a perforated pipe *c* located beneath the grate. These vapors are produced in a vessel *a* provided with a suitable vaporizing coil *a'* and are led to the pipe *c* by means of a pipe *b*. The vessel *d* is connected by means of a pipe *g* to an efficient condenser *h* in which the mixture of vapors and steam is condensed, and from which the product of the condensation flows by means of a pipe *i* provided with a two-way cock *k* into a separating vessel *l*, for example a Florentine flask or the like. Here the water, while at rest, is separated from the condensed drying medium according to their respective specific gravities, and the condensed drying medium may, if desired, flow of itself by gravity back to the vessel *a* in which it is again converted into vapor. That portion of the drying medium which will have been condensed in the drying vessel *d* containing the material under treatment may also be conducted to the separator *l* by a suitable drain pipe *l'*. The aqueous liquid collecting in the separator *l* and originally contained in the treated material *f* overflows from the separator *l* into a collecting vessel *o* by pipe *n* for future treatment, while the condensed drying medium passes through valved pipe *m* to the vaporizing chamber *a* and is again vaporized and sent through the drying vessel *d* until the completion of the drying process is recognized by the fact that no more aqueous liquid is separated, and also by the fact that the temperature in the drying vessel *d* begins to rise. The resinous and other substances which will be removed from the wood by the drying medium will collect both in the above-mentioned collecting vessel *o* and also in the vaporizing vessel *a* and may be removed from the latter for further treatment after the drying medium has been distilled off. It will, of course, be understood that

the points of connection of pipes *m* and *n* with the separator *l* will depend upon the specific gravity of the vaporizing material used. If this material is lighter than water *n* will be connected to *l* near the bottom of the latter and will be provided with a suitable valve, while *m* will be connected to *l* at a higher level. After the drying process has been completed that portion of the drying medium which may have been retained in the wood is driven out of the latter by sending steam of a suitable temperature into the jacket of the vessel *d* and, if necessary, while the vessel is under a more or less high vacuum, or air or inert gas may be sent through the vessel to displace the retained vapors of the substance used, and the medium is then recovered in a well known manner. The steam or inert gas is admitted through the pipe *x*. By this method, which can be carried out with a simple plant, the wood will be dried within a comparatively short time without losing its valuable properties. Besides, valuable substances coming from the dried materials, such as resins and others which were hitherto lost, may be recovered from the aqueous liquid in the collecting vessel *o* and from the residues in the vaporizer *a*.

The above-described method may be employed in all cases in which any damp materials have to be dried in a rapid and careful manner. It avoids the danger of oxidation experienced in the air-drying method, and in cases where the value of the liquid employed for producing the vapor currents does not admit of allowing the mixture of steam and vapor to escape into the atmosphere, the losses may be reduced to a minimum by condensing such mixtures.

As will be obvious, the method according to the present invention may be performed with comparatively small quantities of drying medium, as the latter may be condensed after it leaves the drying vessel, be separated from the water and other substances, and be circulated through the drying plant until the required degree of dryness has been reached.

According to the quality of the materials to be dried, it may, under certain circumstances, be of advantage to carry out the treatment with the drying medium, (the vapors) in such a manner that the drying process is commenced with a liquid of a low boiling point, and continued with a liquid of a higher boiling point, or vice versa. Furthermore, it may, in drying certain materials, be advisable, with regard to the substances to be removed therefrom, to commence the drying process with a vapor of the aforementioned kind, and to continue it with the addition of the vapor of a liquid having a lower boiling point, or to substitute another kind of drying vapor for the

first drying vapor employed, and so on. Lastly, mixtures of different vapors may be employed. For example the vapor from a mixture of benzene and benzol may be introduced into the drying chamber and then if necessary the vapor from a mixture of ethylene-trichlorid and carbon-bisulfid. It is of course obvious that in some instances the vapors of mixed liquids will produce a quicker and better drying of the substances to be dried than the vapors of a single liquid and their use is determined by the character of the substance to be dried and the nature of the material to be removed from the substances to be dried.

In practising my invention it has been found that different vapors or mixtures of vapors may be used to advantage for drying different species of wood, and also for drying young and old wood of the same species. Consequently the particular vapor adapted for drying in the best manner any particular kind of wood should be determined by experiment, the age of the wood (determined by the diameter of the tree) being always borne in mind.

I claim—

1. A method of drying materials, which comprises exposing the material to the vapor of a liquid other than water and not miscible therewith, and thereafter exposing the material to the vapor of another liquid of the same character but of a different boiling point.

2. A method of drying materials, which comprises exposing the material to the vapor of a liquid other than water and not miscible therewith, and thereafter exposing the material to the vapor of another liquid of the same character but of a lower boiling point.

3. A method of drying materials, which comprises exposing the material in a closed chamber to a current of vapor of a liquid other than water, and thereafter exposing the material in a closed chamber to a current of vapor of another liquid of the same character at atmospheric pressure, and conducting from said material the resulting vapor mixtures.

4. A method of drying materials, which comprises subjecting the material in a closed chamber to a current of vapor of a liquid other than water and non-miscible therewith, then to a current of vapor of another liquid of the same character at atmospheric pressure, and conducting from said material the resulting vapor mixture.

5. A method of drying materials, which comprises exposing the said materials successively to a current of the vapors of several liquids other than water and not miscible therewith.

6. A method of drying material, which comprises exposing the material to a current

of vapor of a liquid other than water, and then to a current of vapor of another liquid of like character but lower boiling point and at atmospheric pressure, and conducting the resulting vapor mixtures from the material.

7. A method of drying material, which comprises subjecting the material at atmospheric pressure first to a current of vapor of a liquid other than water and non-miscible therewith, and then to the vapor of a liquid of similar character but lower boiling point, and conducting the resulting vapor mixtures from the material.

8. A method of drying materials, which comprises subjecting the material successively to currents of vapor of different liquids other than water, and conducting the resulting vapor mixture from the material.

9. A method of drying materials, which comprises subjecting the material at atmospheric pressure to successive currents of vapors of different liquids other than water and non-miscible therewith, and conducting the resulting vapor mixtures from the material.

10. A method of drying materials, which comprises subjecting the material at atmospheric pressure to successive currents of vapors of different liquids other than water

and of different boiling points, and conducting the resulting vapor mixtures from the material.

11. A method of drying materials, which comprises subjecting the material at atmospheric pressure to successive currents of vapors of different liquids other than water and non-miscible therewith, and of different boiling points, and conducting the resulting vapor mixtures from the material.

12. A method of drying materials, which comprises subjecting the material at atmospheric pressure to the action of a current of vapor of mixed liquids other than water and conducting the resulting vapor mixture from the material.

13. A method of drying materials, which comprises subjecting the material at atmospheric temperature to the action of a current of vapor of mixed liquids other than water and non-miscible therewith, and conducting the resulting vapor mixture from the material.

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

EDUARD RUDOLPH BESEMFELDER.

Witnesses:

WOLDEMAR HAUPT,

HENRY HASPER.