E. A. RUMMLER.

DRY KILN.

APPLICATION FILED DEC. 15, 1911.

1,055,359.

Patented Mar. 11, 1913.

Fig. 1.

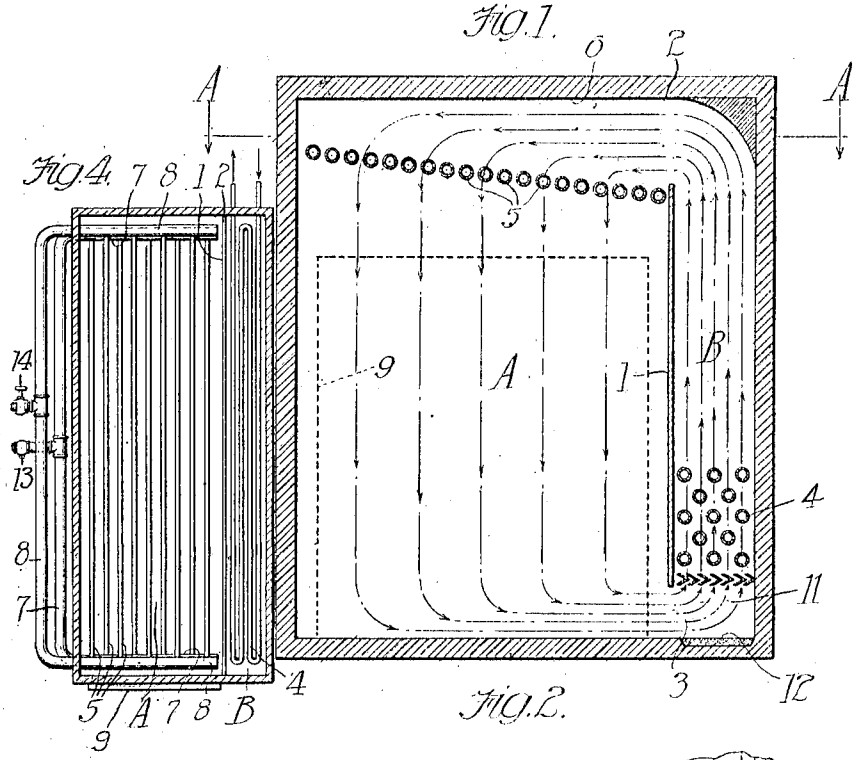


Fig. 4.

Fig. 2.

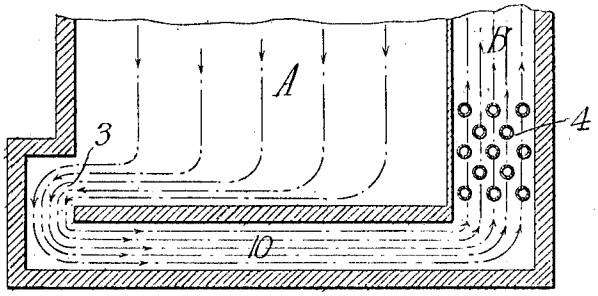
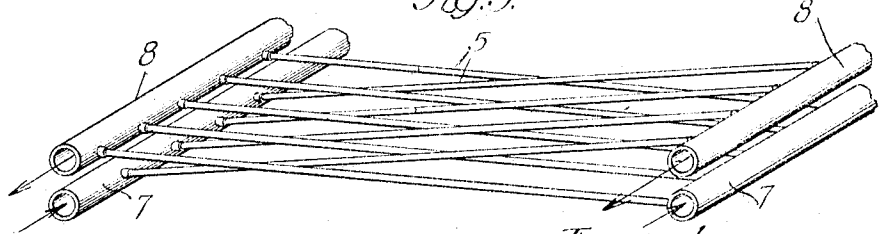


Fig. 3.



Witnesses

Martin H. Olsen.

Edwin Phelps

Inventor

Eugene A. Rummler,

By Rummler & Rummler, Atty's.

UNITED STATES PATENT OFFICE.

EUGENE A. RUMMLER, OF WINNETKA, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE WENBORNE-KARPEN DRYER CO., A CORPORATION OF WEST VIRGINIA.

DRY-KILN.

1,055,359. Specification of Letters Patent. Patented Mar. 11, 1913.

Application filed December 15, 1911. Serial No. 665,923.

To all whom it may concern:

Be it known that I, EUGENE A. RUMMLER, a citizen of the United States of America, and a resident of Winnetka, county of Cook, State of Illinois, have invented certain new and useful Improvements in Dry-Kilns, of which the following is a specification.

The main objects of this invention are to provide an improved form of drying kiln of the type described in Patent No. 918,621, issued to Charles A. Wenborne April 20th, 1909, particularly adapted for accelerating the drying of coatings of oil, paint, varnish, and kindred substances, after they have been applied to articles of wood, metal or other materials, for rapidly drying articles and substances that will not withstand the application of temperatures much above ordinary temperatures, or temperatures varying materially throughout the extent of the articles or substances that are being dried; and for drying substances which dry by chemical or physical changes other than the mere evaporation of moisture. These objects are accomplished by the construction shown in the accompanying drawings, in which:—

Figure 1 is a somewhat diagrammatic transverse section of a drying kiln embodying this invention, the supports for the partition 1 and the manifolds and other pipe connections in the background being omitted for the sake of clearness. Fig. 2 is a similar section illustrating a modification of the lower portion of the kiln, the upper portion being broken away as it may be similar to that of Fig. 1. Fig. 3 is a perspective view illustrating a preferred arrangement of a condenser or cooling coils. Fig. 4 is a horizontal section on the line A—A of Fig. 1.

In the construction shown in Fig. 1, the kiln comprises a substantially rectangular building, having walls suitably insulated to prevent the loss of heat, and any openings in the interior walls are provided with air-tight doors or closures. The interior of the kiln is subdivided by a partition 1 into a main drying compartment or chamber A and a comparatively narrow hot air duct B. The duct B extends throughout the entire height and length of the drying chamber A, and the partition 1 is so constructed and supported as to provide an air inlet 2 at the top of the kiln, extending substantially throughout the entire length of the drying chamber, and an air outlet 3 at the bottom, also extending substantially throughout the length of the drying chamber. The partition 1 is insulated so as to prevent heat from passing through it and materially affecting the temperatures at opposite sides of it.

Heating coils 4 are arranged in the duct B and extend substantially throughout the length of the kiln. These are located above the outlet opening 3, and are preferably concentrated in the lower part of the duct as shown. In order to prevent the air current at the outlet 3 from being disturbed through the heating of the floor in the vicinity thereof by radiation from the heating coils 4, a radiation intercepting screen 11 is provided below the heating coils 4. This is made up of slats V-shaped in cross-section and nested together or otherwise suitably shaped and arranged to intercept all radiation from the coils while at the same time providing for free flow of air through the screen.

Cooling coils 5 are distributed across the upper part of the drying chamber A below the opening 2 and spaced below the ceiling 6 a sufficient distance to provide ample room for undisturbed distribution of air. In order that the cooling coils will cause the air to flow downwardly in a uniformly distributed current throughout the entire horizontal area of the drying chamber, it is important that the air coming in contact with the cooling coils will be reduced to the same temperature at all points throughout the extent of the drying chamber. To this end, the cooling coil is made up of two separate sets of pipes, similarly distributed, and each set extending throughout the entire area of the drying room, and so connected with the source of cooling medium that the cooling medium will flow in opposite directions through the adjacent pipes of different sets, and thus the mean temperature of the combined coils will be uniform throughout the entire horizontal area. In the form shown in Fig. 3, the inlet manifolds 7 are located at opposite ends of the drying chamber A

and respectively connected to opposite ends of the respective sets of pipes 5. The outlet manifolds 8 are located at opposite ends of the kiln, respectively above the inlet manifolds of the opposite sets of coils 5. Thus, each set of coils 5 is inclined upwardly slightly from its inlet to its outlet end. This provides suitable draining of the pipes 5 and also insures that as the water becomes heated by contact with the walls of the pipes 5 and rises, it will flow toward the outlet. As the flow is in opposite directions in any two adjacent pipes of different sets, the sum of the temperatures of such two pipes is the same at all points throughout their length, and the treatment of the air passing both pipes is accordingly the same at all points. In wide kilns, where on account of the great distance which the air must travel horizontally above the cooling coils, the air flowing to the side of the kiln which is distant from the inlet loses some of its velocity, the loss of velocity may be offset by inclining the coil as a whole so that its distant side is higher than its near side. This increases the height of the column of cool air and accordingly increases the head, which produces the movement of the air, in proportion to the distance from the hot air duct.

The door for ingress to and egress from the drying chamber should preferably be in one end of the kiln, as indicated by the dotted lines 9, Fig. 1, since this will permit the door to be opened for the purpose of inspection of the contents during the progress of the drying operation with minimum disturbance of the air currents in the kiln.

In the form shown in Fig. 2, the outlet 3 is at the opposite side of the kiln from the inlet 2, and communicates with the air duct B by means of a flue 10 below the floor of the drying room. This form may be preferred in some installations.

In varnish drying, it has been found that a certain amount of humidity in the air in the drying chamber is desirable. It improves the drying of the coating and at the same time prevents injury to the glued joints of wooden articles. As the air in the drying chamber during operation is at a temperature considerably above that of the air which is admitted to the kiln before commencing the operation, it is relatively drier, and moisture should be added. This may be done by placing water in the kiln in any way which will distribute it evenly throughout the length of the kiln. If it is applied within the hot air duct, a predetermined measured quantity should be supplied and an excess must be avoided as it would condense on the cooling coils and cause trouble. It is preferred to supply the water from an open trough 12, preferably filled with sand or other porous material, and running lengthwise of the kiln at the entrance to the hot air duct. At this point the air is unable to take up such an excess of moisture as would condense upon the cooling coils. Ordinarily, it is enough if water is supplied once a day to the trough 12, as much water as will disappear in the sand. A sprinkling can with a flattened spout serves well for this purpose.

The operation of the device shown is as follows:—It is preferred that the condenser be always kept full of water, and to this end the inlet valve 13 has its handle removed so that it is not manipulated in the ordinary operation of the kiln, the flow of water being controlled by the outlet valve 14. On starting the kiln, steam is turned into the heating coils, and the water outlet valve 14 is allowed to remain closed until the temperature in the hot air duct has risen to a suitable temperature, say 240° Fahr. The heat will apparently stay in the hot air chamber for some time. In the meantime, the drier can be loaded. When this is done, the door is closed, and the discharge valve of the condenser is opened to let the heated water out, and is then shut off completely. Then, the discharge valve of the condenser is opened a little at a time until the flow of water through the condenser is such as to maintain throughout the drying chamber the temperature that is required. Increasing the flow of water by opening the discharge valve will lower the temperature in the drying chamber, and decreasing the flow will raise the temperature. The rate of flow depends upon the area of the return duct B and the difference in weight per unit of area of the columns of air at opposite sides of the partition 1. As the air on both sides of the partition 1 above the level of the coils 5 is of the same temperature as the air in the flue B, and as the air on both sides of the partition 1 below the heating coil 4 is of the same temperature as the air in the drying chamber A, these portions of the height of the columns of air may be disregarded in calculating the velocity of the air movement for any given set of temperature conditions, and the head which produces the flow of air may be taken as that due to the difference in height between the top of the cooling coils at the low side and the bottom of the heating coil. In such a calculation, the elevation of the opposite side of the cooling coil may be disregarded as it is made such as to give sufficient head to approximately overcome the friction which the air encounters in reaching that side of the coil. The height of the opening 2 is preferably equal to the width of the air duct B. The height of the opening 3 may be somewhat less on account of the contraction of the air after contact with the cooling coils 5.

Although but one specific embodiment of

this invention is herein shown and described, it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention, as defined by the following claims.

I claim:—

1. A kiln of the class described, comprising a drying chamber, an air inlet communicating with said chamber at one side and near the top thereof, an air outlet communicating with said chamber at one side and near the bottom thereof, a return air duct connecting said inlet and outlet, means for heating the air in said duct, and cooling coils distributed across the upper part of said drying chamber and spaced below the top of the kiln to provide a distributing chamber above them, said cooling coils serving as the dividing wall between said drying and distributing chambers and being arranged to allow the heated air entering from said inlet to spread across the top of the kiln and to cause such air to flow by gravity in a uniformly distributed current downwardly through said drying chamber.

2. A kiln of the class described, comprising a drying chamber, an air inlet communicating with said chamber at one side and near the top thereof, an air outlet communicating with said chamber at one side and near the bottom thereof, said inlet and outlet extending throughout substantially the length of said drying chamber, a return air duct narrower than said drying chamber connecting said inlet and outlet, means for heating the air in said duct, and cooling coils distributed across the upper part of said drying chamber and comprising two sets of pipes alternately arranged with respect to each other, separate pairs of manifolds connecting the opposite ends of the respective sets of pipes, and means for connecting a source of cooling medium with one of the manifolds of each set of pipes at respectively opposite ends of the pipes, whereby the cooling medium in passing through said pipes will flow in opposite directions in alternate pipes and insure a substantially uniform mean cooling temperature throughout the entire horizontal area of said drying chamber.

3. A kiln of the class described, comprising a drying chamber, an air inlet communicating with said chamber at one side and near the top thereof, an air outlet communicating with said chamber at one side and near the bottom thereof, said inlet and outlet extending throughout substantially the length of said drying chamber, a return air duct narrower than said drying chamber connecting said inlet and outlet, means for heating the air in said duct, two sets of cooling coils each uniformly distributed across the upper part of said drying chamber throughout substantially the entire horizontal area thereof, and means for connecting a source of cooling medium with respectively opposite sides of said two sets of coils, whereby the cooling medium will flow in opposite directions through the coils of different sets and thereby insure that the mean temperature of the two sets will be uniform throughout the entire horizontal area thereof and cause a substantially uniformly distributed downward flow of air through said drying chamber.

4. A kiln of the class described, comprising a drying chamber, an air inlet communicating with said chamber at one side and near the top thereof, an air outlet communicating with said chamber at one side and near the bottom thereof, said inlet and outlet extending throughout substantially the length of said drying chamber, a return air duct narrower than said drying chamber connecting said inlet and outlet, means for heating the air in said duct, and two symmetrically arranged sets of cooling coils, each set being equally distributed throughout substantially the entire horizontal area of the drying chamber, each set comprising inlet and outlet manifolds oppositely arranged with respect to those of the other set, the inlet manifolds of both sets being connected together and to a common source of cooling medium, whereby the flow of cooling medium will be in opposite directions in adjacent parts of the two sets and thereby insure uniform cooling effect throughout the entire horizontal area of the drying room.

5. In a device of the class described, the combination of a drying chamber having an inlet opening at one side near the top thereof and having an outlet opening at one side near the bottom thereof, a hot air duct connecting said inlet and outlet openings, and cooling coils distributed across the upper part of said drying chamber, the side of said cooling coils adjacent to said hot air duct being located below the level of said air inlet, and the opposite side of said cooling coils being elevated above said first mentioned side.

6. In a device of the class described, the combination of a drying chamber, an air duct at one side of said drying chamber and communicating therewith at openings located respectively near the top and bottom of said drying chamber, and coils distributed horizontally across said drying chamber between said openings for the purpose of changing the temperature of the air passing said coils to induce a vertically directed air current in said drying chamber, the side of said coils which is adjacent to said air duct being at a substantially different level than the side which is distant from

said air duct, whereby said coils will tend to produce a more rapid air current at the side of the drying room which is distant from said air duct and thereby off-set the resistances met by the air in traveling across the drying room between said air duct and said distant side.

Signed at Chicago this 13th day of December 1911.

EUGENE A. RUMMLER.

Witnesses:
MARY H. BIXEL,
EDWIN PHELPS.