

Oct. 23, 1923.

J. F. HANRAHAN

1,471,602

DRY KILN

Filed Dec. 16, 1918

3 Sheets-Sheet 1

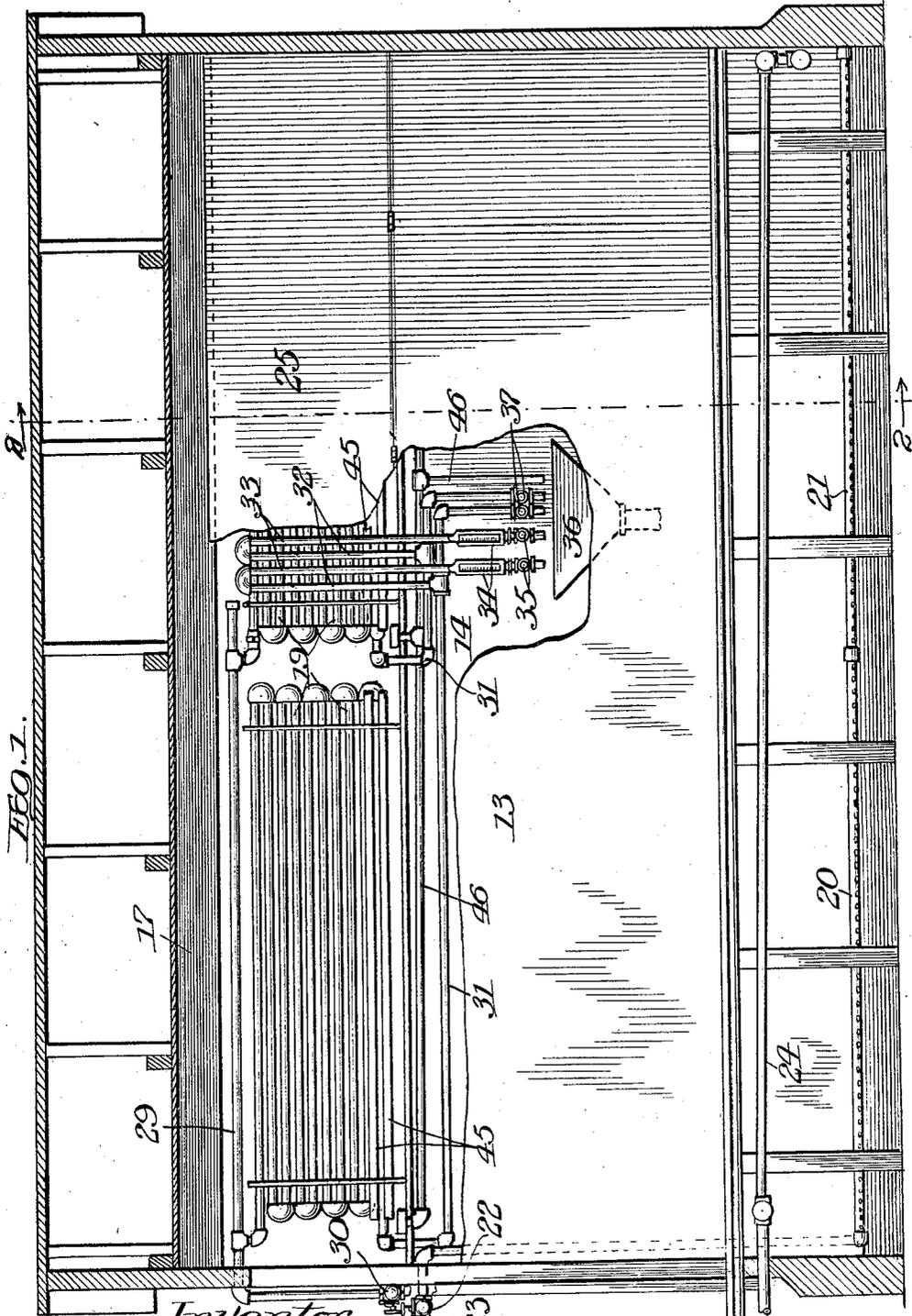


FIG. 1.

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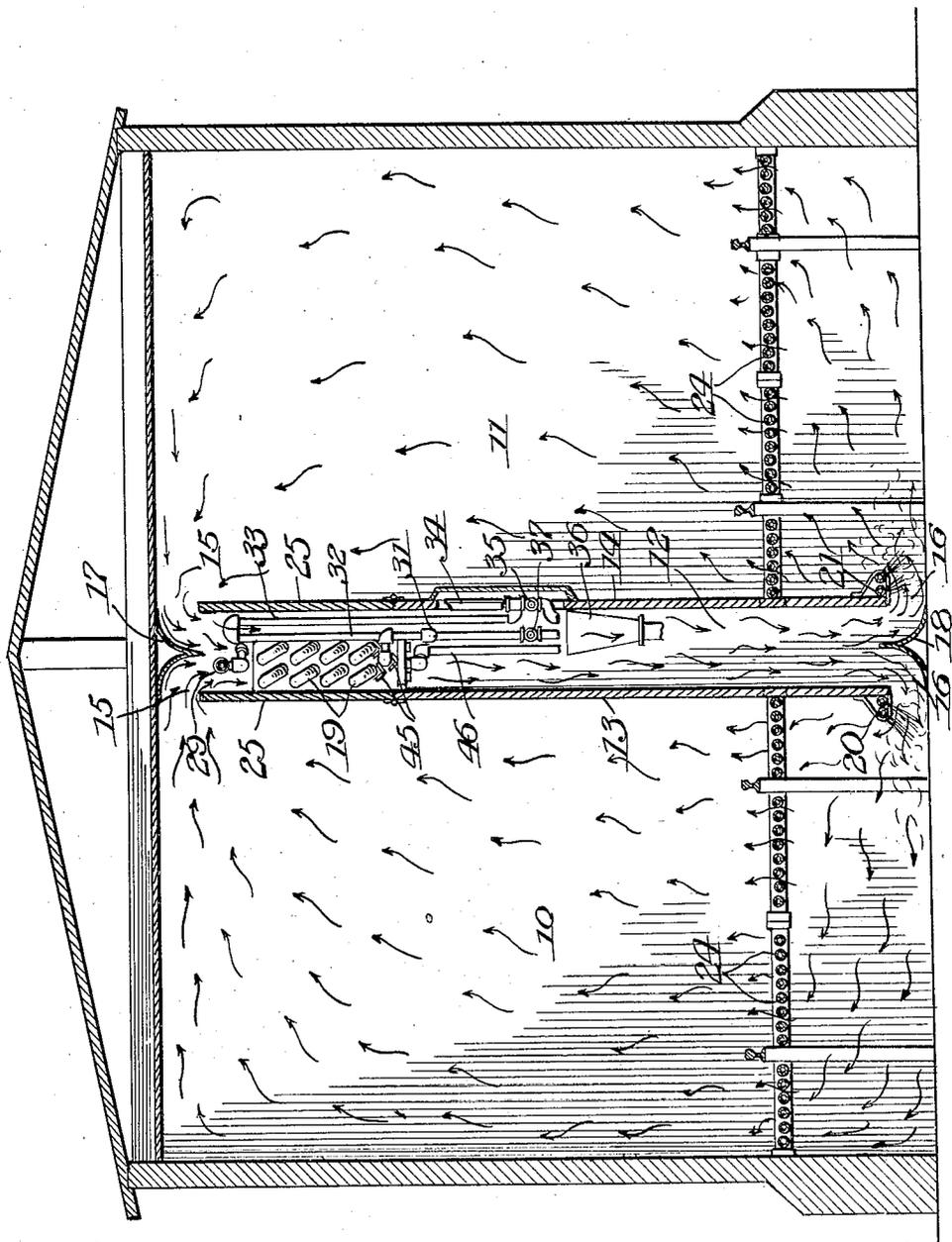


Fig. 2.

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3 Sheets-Sheet 3

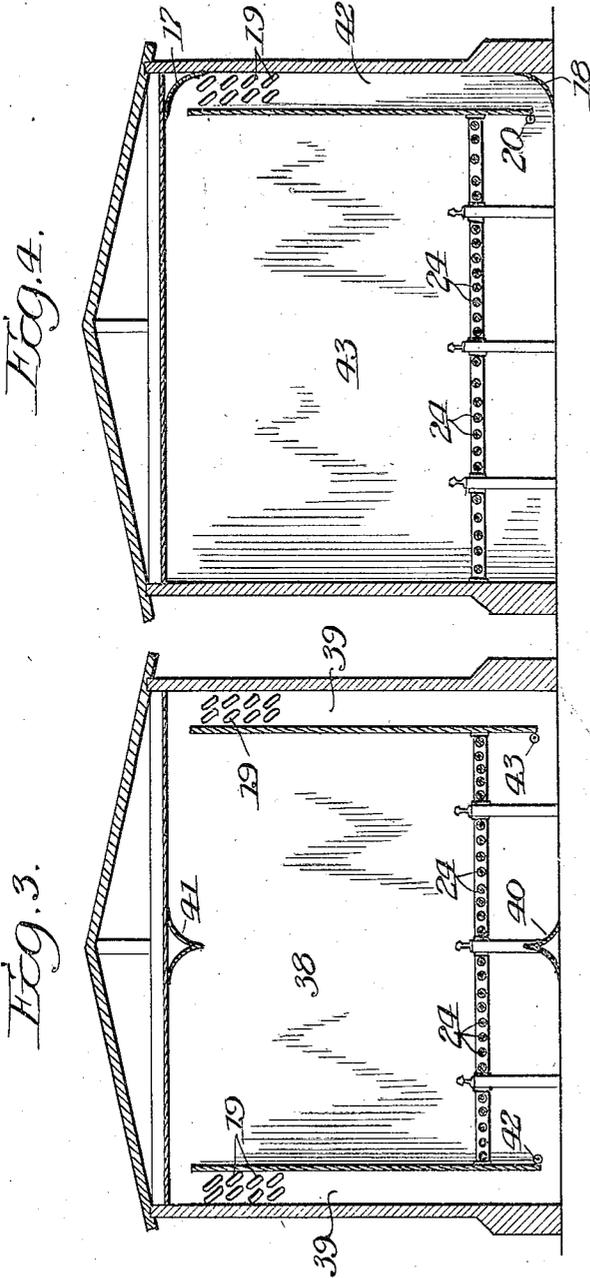


Fig. 4.

Fig. 3.

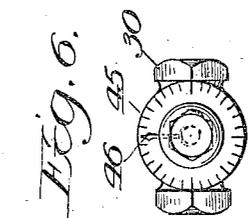


Fig. 6.

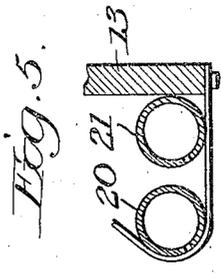


Fig. 5.

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UNITED STATES PATENT OFFICE.

JOSEPH F. HANRAHAN, OF CHICAGO, ILLINOIS.

DRY KILN.

Application filed December 16, 1918. Serial No. 266,928.

To all whom it may concern:

Be it known that I, JOSEPH F. HANRAHAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Dry Kilns, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

The invention relates to dry kilns and has as its object the production of an arrangement whereby the air currents circulating in the kiln are directed in their course so as to cause the same to be properly brought under the influence of the means employed to cause this circulation, without resulting in the air currents colliding with each other or with other portions of the kiln during their circulation.

The invention has a further object the provision of an arrangement whereby the relative humidity of the air in the kiln may be varied and maintained, which results in that the pores nearest the outer surface of the product being dried are held open during the process of drying so that the core, as well as its surface may be relieved of its moisture without causing the commodity to become split or checked, which would in some instances materially reduce the commercial value thereof.

It is a further object of the invention to arrange the means employed for humidifying the atmosphere in the kiln at a point at which its proper operation is insured, which will thus naturally increase the efficiency of the kiln.

The invention has among other objects the provision of an arrangement whereby the filling of the condensing means with the condensing fluid is insured, thereby insuring its proper operation.

The construction also contemplates the use of a simple and effective arrangement whereby the condenser may be flushed to remove any sediment or other foreign matter therefrom without impairing its operation during this period.

It is a further object of the invention to provide certain valves with an indicating

means so that the device may be accurately controlled.

The invention will be explained in the following description with reference to the drying of wood, although the arrangement will be found equally effective in the drying of various other products, either of the soil or those found in the arts or industries. It is understood that the manner of operating of the kiln will vary according to the product to be dried, depending upon its porosity, density, mass or form. The arrangement has been found to effectually and economically dry leather, fruits, vegetables and other products, without impairing their color, flavor, or aroma.

The invention has these and other objects, all of which will be explained in detail with reference to the accompanying drawings in which,—

Fig. 1 is a longitudinal central section of a kiln embodying the invention;

Fig. 2 is a cross section on line 2—2 of Fig. 1;

Figs. 3 and 4 are cross sectional views of kilns showing modified arrangements which may be resorted to;

Fig. 5 is a sectional detail of the humidifying pipes; and

Fig. 6 is a detail of an indicating valve used in the construction.

In the drawings the condensing apparatus is shown arranged respectively in the center of the drying chamber, upon both sides, and at one side only thereof, any one of which may be utilized depending upon either the material to be dried or other conditions which may arise. These various arrangements may be resorted to without departing from the spirit of the invention.

The invention as illustrated in Figs. 1 and 2 will be explained in detail, it being obvious that the structures therein shown may be variously combined with other structures of kilns, for instance such as shown in Figs. 3 and 4.

In the embodiment of the invention shown in Figs. 1 and 2, drying chambers 10 and 11 are shown separated by a condensing chamber 12 which is herein illustrated as composed of the separated walls 13 and 14,

which terminate a suitable distance from the ceiling and the floor of the kiln, forming spaces 15 and 16 through which the air will enter the condensing chamber and pass therefrom during its circulation.

At the inlet and outlet of the condensing chamber are arranged the deflecting members 17 and 18 which extend the full length of the condensing apparatus in the kiln and are preferably curved or otherwise shaped to direct the air currents in their proper course. The uppermost one of these members as 17, is arranged as shown in Fig. 2 at a point where the air currents would naturally collide with each other as they circulate towards the condensing apparatus from the drying chambers. The condenser is in this instance arranged in the center of the kiln between the drying chambers. The lowermost one of these deflectors such as 18, is provided for the purpose of preventing the air which descends by virtue of its being cooled by the condensing coils generally designated 19, from abruptly colliding with the floor of the kiln and also to properly direct this cooled air into the path of the means employed for increasing the humidity of the air contained in the chambers 10 and 11. The means herein employed whereby the humidity in the drying chambers may be increased contemplates the use of steam conveyed by one or more perforated pipes 20 and 21, which in the structure shown in Figs. 1 and 2 are arranged upon each side of the condensing chamber and at the juncture of the condensing chamber and the drying chambers 10 and 11. The pipes 20 and 21 may be arranged at any other suitable position relative to the condensing apparatus. As illustrated one of these pipes extends only throughout part of the length of the chamber, the other extending the whole length thereof, each feeding a portion of the kiln. These pipes may each be provided with a valve such as 22 having any suitable indicator 23 cooperatively arranged therewith so that the operator may determine and regulate the flow of fluid therefrom and thereby regulate the humidity in the chambers 10 and 11.

Each of the chambers 10 and 11 is further provided with heating pipes 24—24 which are elevated a suitable distance above the floor of the kiln and somewhat above the pipes 20 and 21, thus forming another chamber in which the cooled air and steam emitted from the condensing chamber and pipes 20 and 21 may be temporarily confined before it comes in contact with the heating pipe 24—24, which causes same to ascend into the drying chambers 10 and 11. The perforations in the pipes 20 and 21 are arranged so as to properly direct the steam towards the chamber below the heating pipes 24—24 and into the path of the cooled air

as it is emitted from the condensing chamber. From the foregoing description it can readily be seen that the air contained in the drying chambers 10 and 11 will be caused to rise by virtue of the heating means 24—24 and as same comes into contact with the condensing coils 19, it is cooled and relieved of some of its moisture. This relative difference of temperature causes this air to descend towards the space or opening 17 where it is directed by the deflector 18 towards the chamber below the heating pipes 24—24, and consequently into the path of the steam emitted from the pipes 20 and 21, and again brought into contact with the heating pipes 24—24, heated and caused to again ascend. This circulation of air is continued until the commodity is sufficiently relieved of its moisture to be in condition for the use to which it is to be put.

As before stated the coils 19 may be arranged between walls such as 13 and 14, or not, as seen fit. When walls are employed, the uppermost portion thereof as 25, will be hingedly or otherwise secured so as to permit of access to the coils 19, should this at any time be found necessary.

These coils 19 will preferably be arranged nearest the top of the kiln, and below the uppermost deflector, so that the heated air will be properly brought into contact with the coils and relieved of its moisture and caused to descend, creating the desired circulation to accomplish the end sought.

The coils 19 are fed with any desired cooling medium through the feed pipe 29 having the indicating valve 30, whereby the flow and consequent temperature of the cooling medium may be regulated. This valve may be arranged either within or without the kiln as found convenient or desirable.

A pipe 31 leads from each of these sets of coils and each is provided with a pipe connection 32 which extends upwardly above the uppermost pipe of the coils 19, and thence again downwardly, as indicated at 33. This last mentioned pipe connection is provided with a thermometer 34 to determine the temperature of the condensing liquid in the coils 19 and a valve 35 to control the flow of liquid from the coils. The ends of these pipe connections 33 are arranged so that they may empty into the funnel 36 and carry off the liquid to any suitable drain.

The structure including the pipes 32 and 33 forms a simple and effective arrangement whereby it may readily be determined whether the coils 19 are completely filled with liquid or not, as it is evident that no liquid will flow from the pipe 33 unless all of the pipes forming the coils 19 are completely filled, because of the fact that the uppermost portion of these pipes 32 and 33 terminate above the uppermost pipe form-

ing the coils. The pipe connections 31 also empty into the funnel 36 and are each provided with a valve 37 which is normally closed and only opened when it is desired to flush the coils 19 to remove any sediment or foreign matter which may have collected therein. It is evident that when these valves are opened the fluid in the coils may pass therethrough without any restriction, which will remove any matter which has previously accumulated in the coils. Furthermore, the section may be flushed or cleansed without in any way interfering with the operation of the kiln. The pipes forming the coils 19 bear a staggered relation to each other when viewed from an end, and form vertical tiers of pipes arranged one above the other. The lowermost one of each tier has arranged below it a trough 45 which extends the full length thereof to receive the condensation from the pipes and to convey it to another trough having the pipe connection 46 which in turn empties into the funnel 36.

When the structure shown in Figs. 1 and 2 is utilized then one of the walls as 14, will be provided with an opening adjacent the thermometer 34, and valves 35 and 37. This opening will have a closure which will permit of access to said valves or thermometer, to control and determine the operation of the coils 19.

In the structure shown in Fig. 3 the drying chamber 38 is arranged between the condensing chambers 39—39 as are the deflectors 40 and 41. The pipes 42 and 43 for increasing the humidity in the drying chamber occupy the same relative position to the condensing chamber as similar pipes shown in Figs. 1 and 2. In the structure shown in Fig. 3 the same elements are utilized and only differ in that they are positioned differently with relation to each other. The structure illustrated in Fig. 4 shows the condensing chamber 42 and the humidifier arranged upon one side of the structure, and the drying chamber 43 arranged upon the other. Various other arrangements may be resorted to, depending upon the conditions which may arise. The indicating valves 22 and 30 may be of any suitable design. That herein shown contemplates the use of a disc 45 having degrees of a circle indicated thereon. This disc is fastened to any suitable stationary portion of the valve and positioned to permit the indicating finger 46 to cooperate therewith. This finger will be secured to some portion of the valve handle so that it will move therewith to indicate the degree which the valve is opened or closed.

By the arrangement of the deflectors it can readily be seen that the air currents are prevented from colliding with each other during their circulation, and that the same

are directed in their proper course, which naturally increases the efficiency of a drying apparatus, also that the means for supplying the humidity is arranged at a point at which it will be properly introduced into the drying chamber. The material to be dried may be introduced into the kiln upon trucks, or in any other suitable manner depending upon the particular article to be dried. For instance, when leather is being dried, same may be supported within the chamber upon supports either permanently arranged in the kiln or not, as seen fit.

It is obvious that the invention is susceptible of various combinations and arrangements which may be resorted to, without departing from the spirit of the invention or the scope of the appended claims.

Having thus shown and described the invention, what I claim and desire to cover by Letters Patent, is:

1. In a dry kiln the combination of a pair of drying chambers, heating means arranged adjacent the lowermost portion of said drying chambers, another chamber arranged between the first mentioned chambers and in communication therewith, a condenser arranged in and adjacent the uppermost portion of the second mentioned chamber, air current deflectors arranged at the opposite ends of said second mentioned chamber and a humidifier arranged below the heating means at the juncture of said drying chambers and the second mentioned chambers.

2. A dry kiln having a condenser, means for filling the condenser with fluid, a connection leading from the lowermost portion of the condenser, said connection permitting the fluid to pass from the condenser only when said condenser is filled, said condenser having a connection whereby the first mentioned connection and the condenser may be flushed.

3. In a dry kiln the combination of a drying chamber, a condensing chamber having condensing means therein, heating means and a humidifier, the humidifier arranged between the condensing and heating means, all cooperatively arranged to cause a circulation of air currents from the drying chamber to the condensing chamber, and said humidifier having means for regulating the same.

4. In a dry kiln, the combination of a drying chamber, a condensing means, and a heating means cooperatively arranged to cause a circulation of air currents from the heating means through the chamber and towards the condenser, and a humidifier arranged to direct a jet of steam towards the space in which the heating means is confined, said humidifier being arranged at a location at which the air currents leave the condenser and pass towards the heating means.

5. In a dry kiln, the combination of a dry-

ing chamber, a condensing means, and a heating means cooperatively arranged to cause a circulation of air currents from the heating means through the chamber and towards the condenser, and a humidifier arranged to direct a jet of steam in the path of the air currents between the condenser and the heating means said humidifier being positioned to direct the steam towards the space in which the heating means is confined. 10

In witness whereof, I hereunto subscribe my name this 13th day of December, A. D., 1918.

JOSEPH F. HANRAHAN.