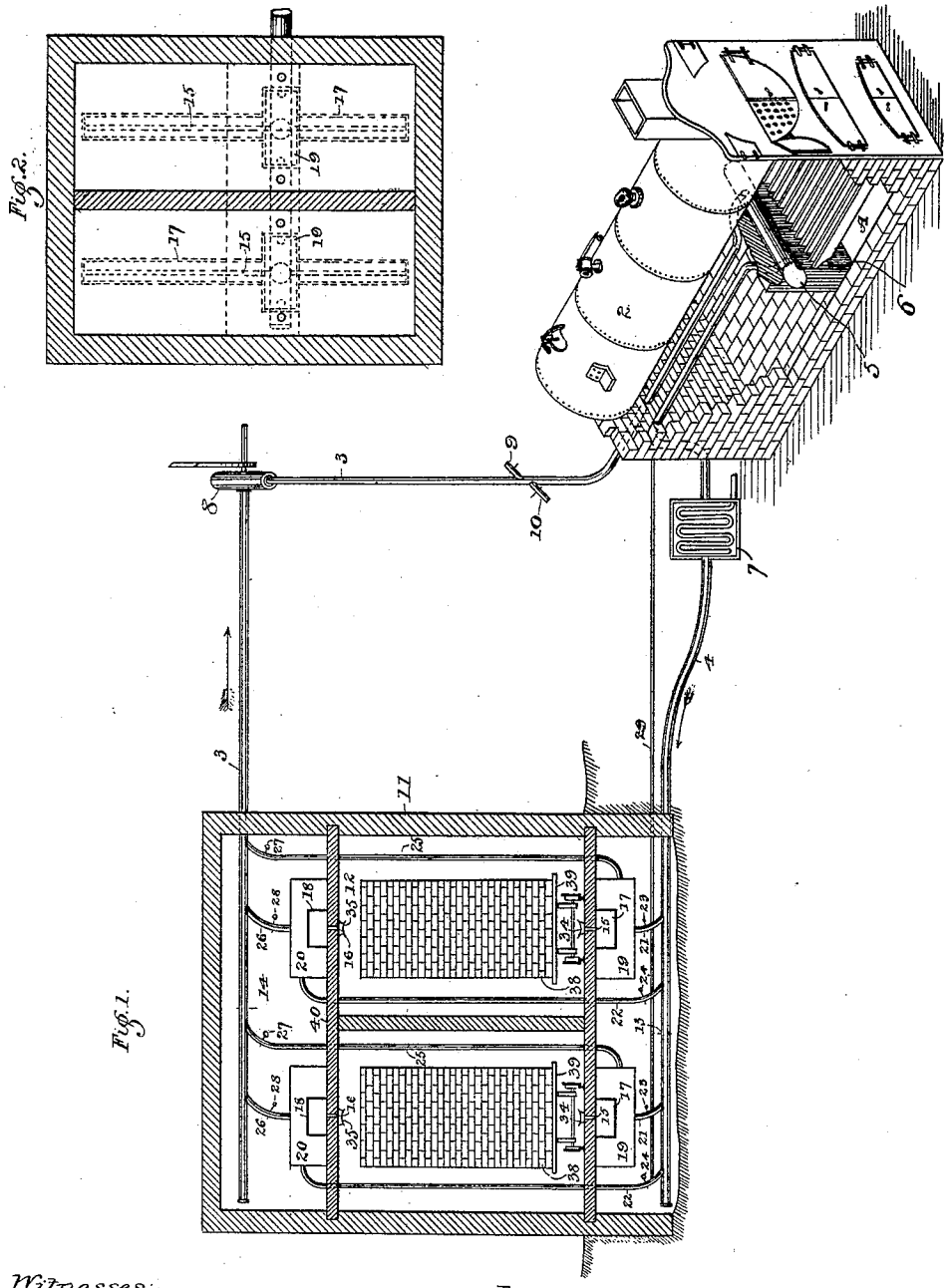
(No Model.) 2 Sheets—Sheet 1.

C. J. DION.

DRYING KILN.

No. 480,253. Patented Aug. 9, 1892.



Witnesses:
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C. L. Caldwell.

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

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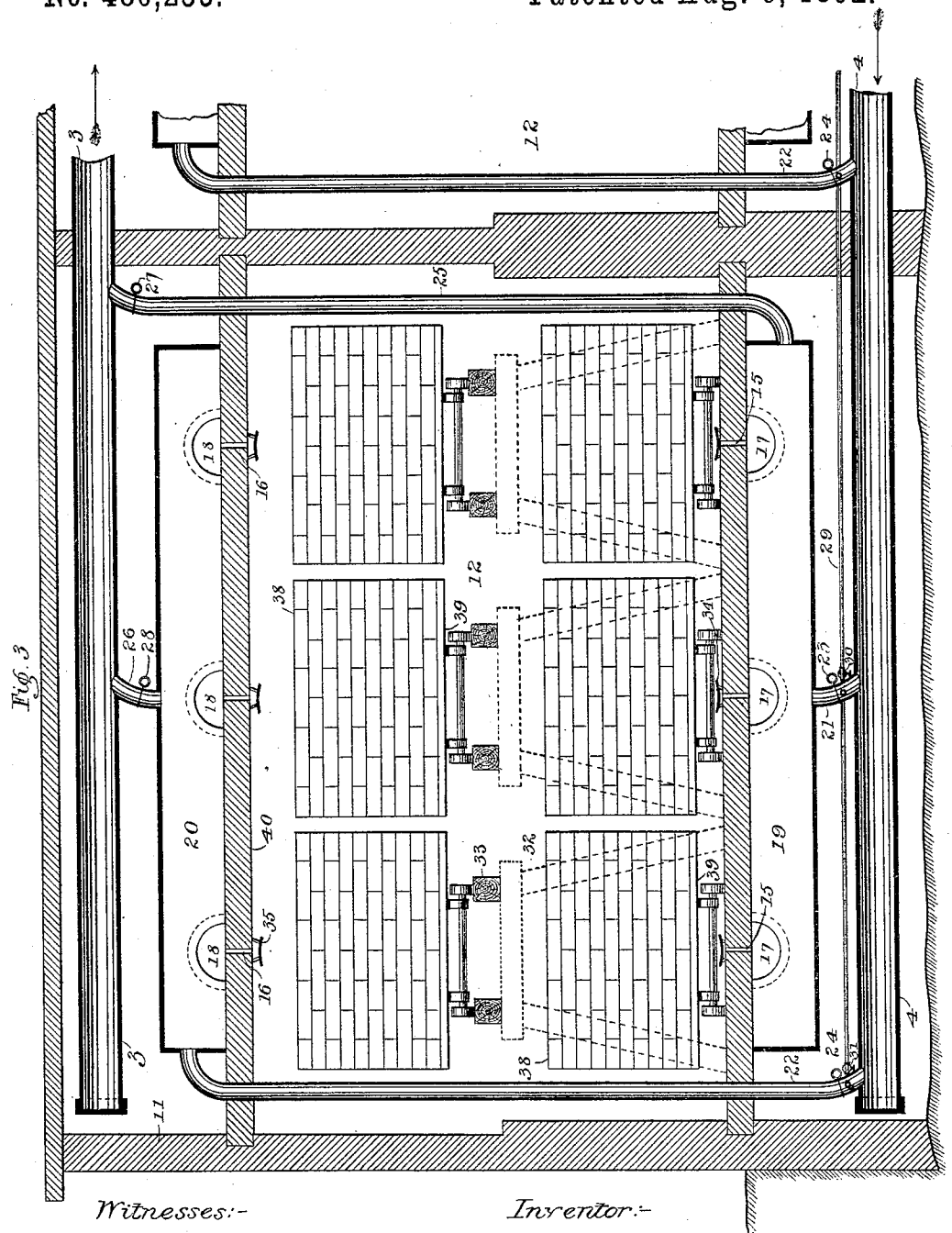

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UNITED STATES PATENT OFFICE.

CHARLES J. DION, OF ST. PAUL, MINNESOTA.

DRYING-KILN.

SPECIFICATION forming part of Letters Patent No. 480,253, dated August 9, 1892.

Application filed September 12, 1890. Serial No. 364,761. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. DION, of St. Paul, Ramsey county, Minnesota, have invented certain Improvements in Drying-Kilns, of which the following is a specification.

My invention relates to improvements in the construction of drying-kilns and in the means or apparatus for heating the same, particularly kilns employed in the drying of brick, its object being to economize the waste heat of the furnace employed in connection with the works to heat the air for the kiln and in so controlling the inlet, outlet, and circulation of the air in the kiln that the material to be dried may be first raised to a high temperature while in its moist state and then gradually dried by reversed currents of hot air, so as to absolutely prevent checking or warping or other injury to the material, the temperature and also the degree of moisture of the heated air being controlled and regulated to accomplish the most efficient results.

To this end my invention consists in arranging separate and independent drying-chambers having independent connections with the main heating air-pipes, so arranged that the air may be passed upward or downward through each chamber independently. The air for drying purposes is preferably heated by passing it through a tube or chamber in the bridge-wall of the furnace used to generate steam for the engine in connection with the works, it being forced through the pipe by means of a blower. Where additional heat is required, it may be furnished by means of a steam-coil box, through which the air-pipe is passed. The pipe connections are so arranged that a circulation of the air may be kept up without change or fresh outer air may be taken into the pipes, according to the degree of dryness required in the various stages of the process. When it is necessary to increase the normal moisture of the air in the main pipe, I prefer to do it by injecting steam into the branch pipe leading into the particular chamber, so that the moisture of the air passing through is controlled independent of the other chambers. The air from the main heating-pipes is introduced to each air-chamber through a slot in the floor and expelled through a corresponding slot through the roof or ceiling, or vice versa, according to the direction in which it is necessary to carry the air, suitable valves in the pipe regulating the circulation of the air through the chambers and the inlet of the steam and inlet and outlet of air.

My invention further consists in the construction and combination hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, forming part of this specification, Figure 1 is a sectional elevation of my improved drying-kiln and sectional perspective view of the furnace, showing the manner in which the air is conducted through the furnace and steam-coil box and to and from the chambers of the kiln and the connections by which its circulation through the chambers is directed and controlled. Fig. 2 is a sectional plan view of the kiln; and Fig. 3 is a sectional elevation of a kiln-chamber, showing the pipe connections and two sets of cars to be supported on tracks one above the other.

In the drawings, A represents an ordinary steam-boiler furnace, such as may be employed for furnishing steam to an engine for running the machinery in connection with the works. The main heating-air pipes 3 and 4 of the system are carried, preferably, underneath the boiler 2 of the furnace, through the combustion-chamber, and connected, respectively, with the ends of a pipe or chamber 5, which is arranged in the bridge-wall 6, so that the air flowing through the pipes 3 and 4 will be heated by its passage through the chamber 5, the heat thus absorbed from the furnace being almost wholly waste heat. The air, if necessary, is further heated by carrying the pipe 4 through the steam-coil box 7. In order to force the air through the pipes, a blower 8 of any preferred form may be used, the pipe 3 being also provided with an inlet-valve 9 and an outlet-valve 10, by the adjustment of which any desired amount of the air in the pipe may be discharged and outer air substituted, or the valves may be entirely closed and the air in the pipes caused to circulate without change.

11 represents the outer wall of the kiln, which, as shown, I prefer to divide up into series of compartments or chambers 12 of any desired number, each chamber being so arranged as to be an independent drying room

or kiln. The pipe 4, leading from the furnace, is carried, preferably, underneath the kiln, as shown, and the pipe 3 is carried from the top of the kiln to the furnace.

The construction and operation of each of the chambers 12 is the same, and the description of one is applicable to all. Valves 13 and 14 may be arranged in the pipes 3 and 4, so so as to shut off communication beyond them. The floor of each of the chambers 12 is provided with a central longitudinal slot 15, a similar slot 16 being arranged in the ceiling, through which slots only the air is introduced and expelled. A pipe or box 17 extends the entire length of the slot 15, and a similar pipe or box 18 is arranged over the slot 16.

Communicating with the pipes or boxes 17 and 18 are the chambers 19 and 20, respectively, which are of capacity equal to all of the connected slots 15 and 16 and into which the pipes 17 and 18 open where they abut against the sides of said chambers 19 and 20, as indicated in Fig. 2. These chambers 19 and 20 are connected, respectively, with the main 4 by means of branch pipes 21 and 22. These branch pipes are fitted with valves 23 and 24, by means of which the flow of air from the main 4 may be directed to either of the branches 21 or 22 at will. Outlet branch pipes 25 and 26 respectively connect the chambers 19 and 20 with the main 3, valves 27 and 28 controlling the flow of air therethrough. It will thus be seen that the air may be carried through the chamber 12 either upward or downward from the main 4 to the main 3. In order to increase the normal moisture of the heating-air for any chamber, I prefer to arrange a steam-pipe 29, connected with any suitable source of supply and having valve-controlled connections 30 and 31 with the branch pipes 21 and 22, whereby live or exhaust steam may be injected to increase the moisture of the air entering the chamber to any desired degree, as may be determined by hygrometer placed in the chamber.

As shown in Fig. 1, the kiln is formed with two chambers having tracks for one car each, while in Fig. 3 is shown a chamber having floor-tracks for several cars and elevated tracks formed of the stringers 33, supported on frames 32, for other cars above the first. By this means the cars can carry smaller loads, which oftentimes is a great advantage. Part of another chamber 12 with its pipe connections is shown at the right of Fig. 3. Arranged immediately above the slots 15 and extending the whole length of the same are curved deflectors 34, similar deflectors 35 being arranged underneath the slots 16. These deflectors serve to divide and deflect in opposite directions the currents of air entering through the slots and thus to convey the heated air uniformly throughout the chamber, so as to prevent the unequal heating or drying of the material nearest the same, thus securing uniformity in the process. The pipes and air-chambers both above and below the chambers of the kiln are preferably so arranged that sufficient space is provided around them for convenient access thereto for regulation or repairs.

Operation: In use any chamber of a kiln may be shut off from communication from the main pipes and thrown open without interfering with the drying in any of the other chambers. The material—such as bricks 38—to be dried may then be conveyed into the chamber, as by means of cars 39, the cars standing directly between the floor and ceiling slots. The doors of the chamber then being closed air is introduced from the main 4 to the chamber, at first preferably through the branch pipe 22, so as to carry it downward through the chamber, the valve 27 in the outlet-pipe 25 being opened to permit circulation of the air therethrough. Usually at first it is also desirable to charge the air with an additional amount of moisture to prevent any drying until the material has been thoroughly heated, in which case the valve 31 of the steam-pipe 29 is opened and steam injected into the pipe 22. When a sufficiently-high temperature of the brick has been secured, as may be determined by a thermometer placed in the chamber, the steam-valve 31 is closed and the inlet and outlet air-valves 9 and 10 are partially opened, so as to admit gradually some of the drier outer air and discharge a portion of the moist air from the pipe. The drying process is thus commenced in the kiln and carried on by the same means as is necessary for most efficient results. The air in the drying process is also preferably caused to circulate first downward, so as to prevent condensation of the moisture upon the ceiling 40, whence it would drip back upon the brick. As the work of drying goes on the circulation is from time to time reversed by the turning of the valves 23, and 24, and 27, and 28, so that the process may be carried on uniformly and checking or warping of the brick may be prevented. By means of the long inlet and outlet slots in floor and ceiling and deflectors next the same there are no currents of air perceptible in the chamber to cause unequal heating or drying, but the whole body of inclosed air seems to rise or fall together, whereby all parts of the chamber and its contents are subjected to substantially the same influences. When the operation is completed and the material has been sufficiently dried, the valves connecting the chamber with the mains are closed and the material removed and other material substituted therefor and the operation repeated. It will thus be seen that the apparatus is under complete control both as to direction and rapidity of circulation of the air and degrees of heat and moisture.

I claim—

1. In a device of the class described, the combination of a drying-chamber having slotted openings in both its floor and ceiling, main inlet and main outlet pipes located one at the bottom and the other at the top of said cham-

ber, valved connections between said slots and main pipes at both the ceiling and the bottom of the chamber, and valved pipes, one leading from the lower main pipe and having a connection with the slotted openings in the ceiling and the other leading from the upper main pipe downward and having a connection with the slotted openings in the floor of the chamber, whereby air may be introduced into said chamber at will from either the bottom or ceiling and caused to circulate, as set forth, substantially as and for the purposes described.

2. In a device of the class described, the combination, with the drying-chamber and the inlet and outlet air-pipes thereof located one at the top and the other at the bottom of the chamber, of narrow slotted openings extending substantially the entire width of both floor and ceiling, valve-controlled connections between said slotted openings and both inlet and outlet pipes, and curved deflectors arranged adjacent to said slots on the inside of said chamber in such manner as to divide and oppositely deflect the currents of air entering the same, substantially as and for the purposes set forth.

3. The combination, with the drying-kiln and its main air-pipes, of inlet and outlet valves in said pipes, a blower for forcing the air through said pipes, means for heating the air as it passes through said pipes to said kiln, slots extending substantially the width of the kiln through both floor and ceiling, branch pipes connecting said slots with both inlet and outlet main air-pipes, valves in said branch pipes, and valve-controlled steam-pipe connections with said branch pipes, substantially as and for the purposes set forth.

In testimony whereof I have hereunto set my hand this 8th day of September, 1890.

CHARLES J. DION.

In presence of—
T. D. MERWIN,
A. MAE WELCH.