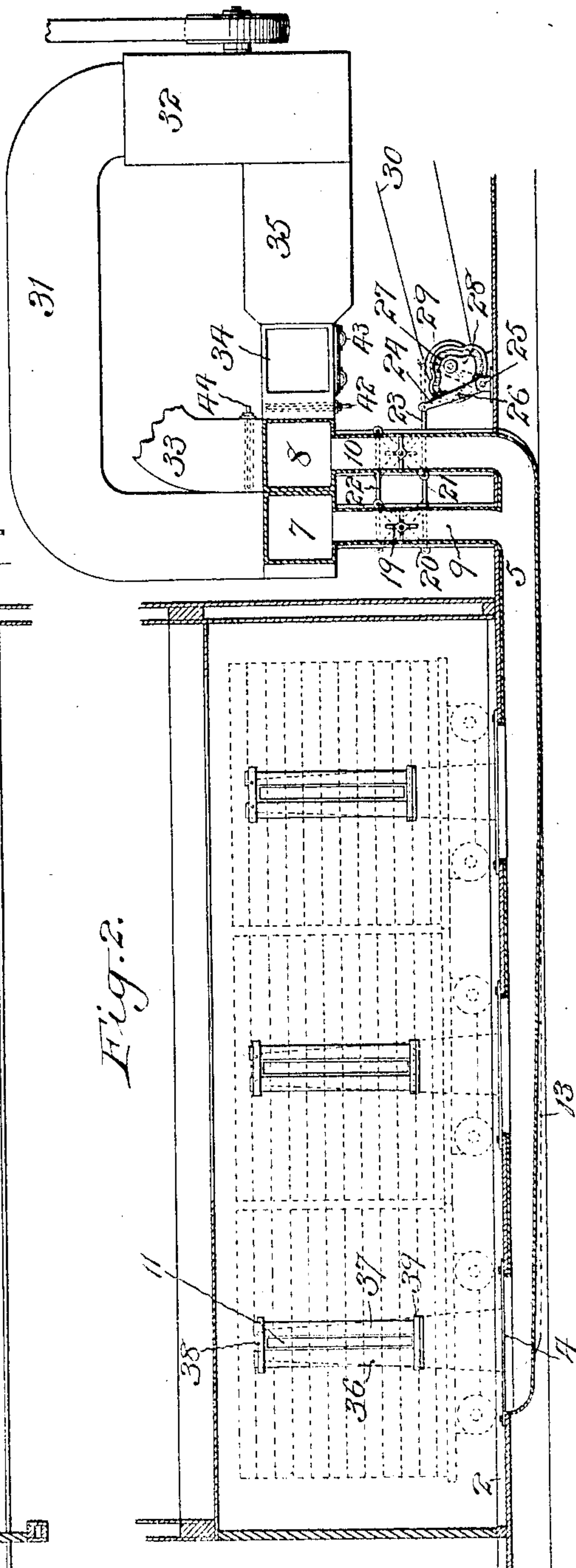
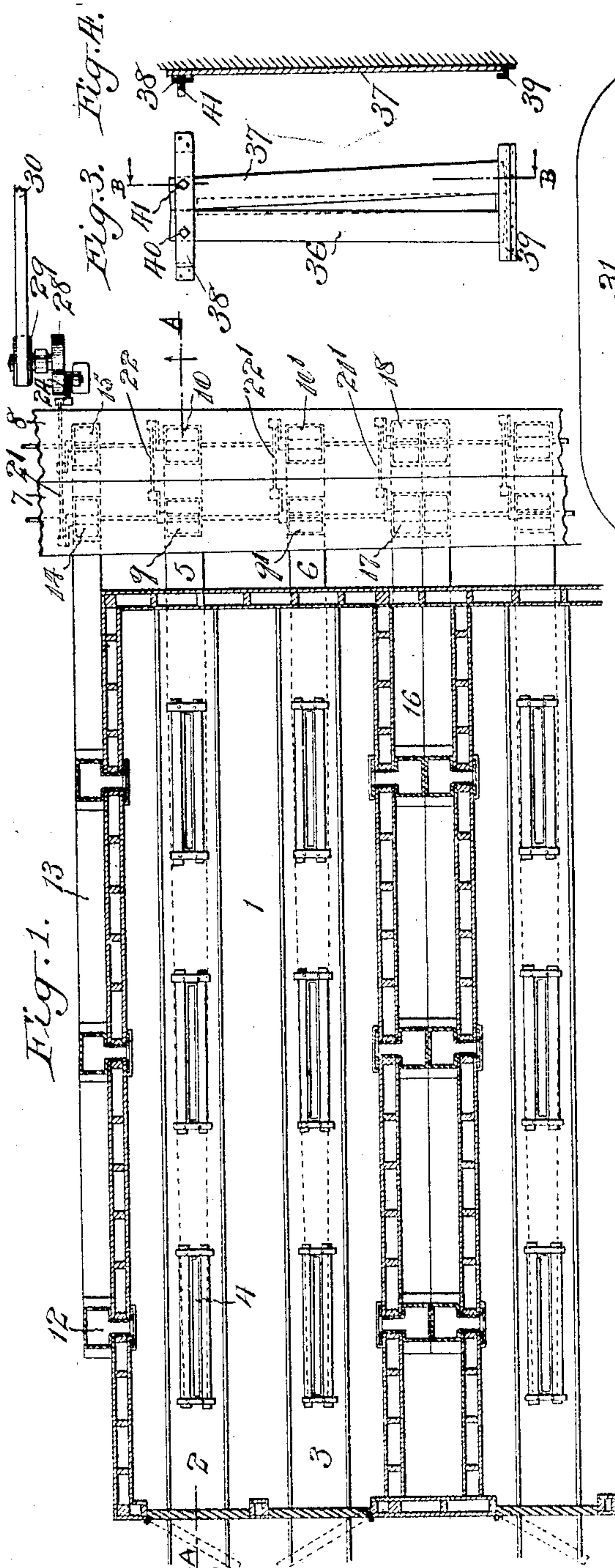


No. 887,317.

PATENTED MAY 12, 1908.

C. B. DURYEA.
DRYING APPARATUS.
APPLICATION FILED AUG. 2, 1907.



Witnesses:
J. George Barry,
C. S. Sundgren.

Inventor:-
Chester B. Duryea
By Brown & Howard
his Attorneys

UNITED STATES PATENT OFFICE.

CHESTER B. DURYEA, OF CARDINAL, ONTARIO, CANADA.

DRYING APPARATUS.

No. 887,317.

Specification of Letters Patent.

Patented May 12, 1908.

Application filed August 2, 1907. Serial No. 386,733.

To all whom it may concern:

Be it known that I, CHESTER B. DURYEA, a citizen of the United States, and resident of Cardinal, in the county of Grenville, Province
5 of Ontario, Canada, have invented a new and useful Drying Apparatus, of which the following is a specification.

My invention relates to a drying apparatus and more particularly to an apparatus for
10 use in drying starch and starchy products, the object being to provide for bringing the hot air into more intimate contact with the surfaces of the starch or starchy materials, so as to increase the rapidity and especially
15 the uniformity of drying, and also the efficiency of a given volume of air. For instance, where the starch is placed in trays as is commonly done, and these trays are superposed, with more or less separation,
20 one over another in several stacks and these stacks of trays are conveyed on a car into a drying kiln, the hot air generally introduced through openings in the bottom of the kiln and removed more or less charged with
25 moisture through openings in the side or top of the kiln, is liable to follow certain paths along lines of least resistance which would naturally be between and around the stacks of trays and cars, rather than through the
30 relatively narrow spaces between the several trays in a stack.

My present invention is directed to means for disturbing the natural set of these inefficient currents at frequent intervals in order
35 to set up as far as may be a condition of numerous reversing eddies throughout the space within the kiln and so cause the hot air to become generally agitated and driven between the several superposed trays and thus
40 to more effectively take up moisture from the material therein and expedite the drying process.

With these ends in view, my invention consists in reversing the air currents in a drying
45 kiln.

My invention further consists in introducing means in the main ducts system for heating and conveying the air to and from the kiln and in providing shunt ducts in the branch
50 ducts system whereby the current of air may be directed from the trunks or main air supply channels first into the kiln through one set of openings and then through another set of openings, the outlet of air being alter-
55 nately directed to the former inlet, *i. e.*, the air currents in the kiln are intercepted and

reversed at intervals, by causing the air which normally is forced through one set of openings in the kiln to be forced through another set of openings, in opposition to the
60 former currents, the withdrawal of air from the kiln working in complementary alternation with the delivery.

My invention further contemplates setting up automatic means for changing the direc-
65 tion of these air currents at such intervals as may be determined upon to produce the best result. My present means for accomplishing this consists in a cam wheel so timed as to close a set of valves in the normal inlets and
70 outlets of the branch ducts into the main ducts and simultaneously therewith open valves in the shunt ducts of the branch ducts to establish reverse currents, these to be at a proper interval again reversed to set up the
75 normal flow.

In the accompanying drawings, Figure 1 represents the bottom plan of a kiln and a portion of a kiln adjacent thereto, the up-
80 right walls of the kiln being shown in horizontal section and the means for reversing the current being shown partly in full lines and partly in dotted lines, Fig. 2 is a section in the plane of the line A—A of Fig. 1 showing the inside face of one of the side walls of
85 the kiln, the tramcars with racks for trays being shown in dotted lines and the air inlet and outlet ducts together with the mechanism for reversing the air currents being shown partly in section and partly in elevation,
90 Fig. 3 is an enlarged face view in detail of the shutters for varying the amount of opening in the inlet and outlet slots, and Fig. 4 is a section of the same taken in the plane of the line B—B of Fig. 3.
95

The bottom of the kiln is denoted by 1. Along the bottom there are laid tracks 2 and 3 for the reception of tramcars on which the trays carrying the material to be dried are conveyed into the kiln. In the present in-
100 stance, the kiln is arranged to receive three tramcars within it on the tracks, as shown in dotted lines, Fig. 2, and this number may be increased or diminished at pleasure, and also the number of tracks in a kiln. In the bot-
105 tom of the kiln there are formed elongated slots 4, in the present instance three along the track 2 and three along the track 3, one under each car, the three along the track 2 communicating with a branch duct 5 and the
110 three along the track 3 communicating with a branch duct 6, the said branch ducts 5 and

6 being connected with the air delivery and return mains 7 and 8 by means of upright shunt ducts 9 and 10, and 9' and 10', respectively.

5 The branch ducts 5 and 6 are tapered as they extend forward of the kiln in order to supply a substantially equal flow of air through the several slots connected therewith, the side wall of the kiln also having
10 formed therein elongated slots 11, in the present instance three, and these communicate with uprights 12, one for each, the uprights 12 in turn leading downwardly to a tapered branch duct 13, which connects by
15 uprights 14 and 15 with the mains 7 and 8; the capacity of branch duct 13 and uprights 14 and 15 corresponding with branch ducts 5 and 6 individually, and their respective upright shunt ducts. In like manner, the slots
20 in the opposite side wall of the kiln connect with uprights which lead to a branch duct 16 which connects with the mains 7 and 8 by means of uprights 17, 18.

In practice, it is found convenient to locate
25 the uprights 9, 9', 14 and 17, which connect with the tapered intake main in alinement and also the uprights 10, 10', 15, 18, which connect with the return tapered main in alinement for the purpose of setting up in
30 connection therewith the reverse current mechanism. Each of the two uprights which connect each branch duct with the delivery and return mains is provided with a cut-off valve 19 operated by crank 20 at-
35 tached to its stem.

The valves in the several equal capacity uprights (for the particular system shown) are quite similar and the cranks lead from their stems in the same direction, but the
40 valves in the uprights from the kiln floor branch ducts which lead into the return main are set at right angles to the valves in the kiln floor branch ducts uprights which lead into the intake main. The valves in the
45 several uprights (or shunt ducts) from the kiln side branch ducts (of equal capacity with the kiln floor branch and shunt ducts) are set among themselves precisely to correspond with the inter-relation of the valves
50 in the uprights from the kiln floor branch ducts, as hereinabove described; and further, the system of valves in the uprights of the kiln floor branch ducts is set at right angles with the system of valves in the shunt ducts
55 of the kiln side branch ducts, *i. e.*, all valves in kiln floor branch ducts uprights which lead into the delivery main are parallel with one another, and set at right angles to valves in kiln side branch ducts uprights which lead
60 into the delivery main, and so on. For example, when valves 14, 10, 10' and 17 are closed, valves 15, 9, 9' and 18 are open, and vice versa. The cranks of the valves in the shunt ducts are connected by rods 21, 22, 22'
65 and 21', so that the valves in the uprights at

any one time acting as out-takes and those acting as intakes from and to the mains are simultaneously operated in the reversal. This arrangement is clearly shown in dotted lines in Fig. 1.

A rod 23 for simultaneously operating all
70 of the cranks is connected with a rock arm 24 pivoted to a support at 25 and provided with a blower 26 which travels along a groove 27 in a cam 28, the latter being rotated by
75 means of a pulley 29 operated by a belt 30 leading to a suitable source of power, not shown. Air is forced into the main 7 through a duct 31 from a power fan, indicated at 32, and is returned from the main
80 8, leading to the fan. There is also provision made for taking in any desired proportion of fresh air through an opening 34 and for heating the air by passing it over inclosed coils, indicated at 35, and also for including, by
85 means of ventilator, indicated at 33, a proportion of return air corresponding with the fresh air intake. The resistance slide 42, the fresh air opening slide 43, and the ventilator
90 slide 44 are provided for the purpose of controlling the proportion of fresh intake air.

The several slots in the floor and wall of the kiln may be adjusted in size and shape by means of shutters 36, 37, held in proximity to the mouth of the opening by straps 38, 39,
95 at or near their opposite ends and held in their adjusted position to open and close the opening by means of set screws 40 and 41 which are screwed into the straps and bear against the faces of the shutters.
100

In operation, the stacked cars having been run into position within the kiln and the doors closed, hot air is admitted through the floor slots from the main 7 and escapes
105 through the wall slots and main 8. As the cam 28 rotates, the rock arm 24 will, after a predetermined interval, depending upon the rate of rotation of the cam, be rocked from the position shown in full lines, Fig. 2, to that shown in dotted lines, Fig. 2, which
110 movement of the cam will close the valves in the uprights leading to the intake main 7 and open the valve in the uprights leading to the return main 8 from the branches 5 and 6 leading to the slots in
115 the floor of the kiln, and at the same time will open the valves in the uprights leading to the intake main and close the valves leading to the out-take main from the branches in communication with the slots at the side
120 walls of the kiln thereby setting up an inflow of hot air through the slots at the side walls of the kiln and an outflow through the slots at the bottom of the kiln and this order of things will, in turn, be reversed when the cam
125 28 shall have completed another half revolution, setting up again an inflow of hot air through the slots in the base of the kiln and this reversal of currents will continue at
130 predetermined intervals depending upon the

speed of rotation of the cam so long as the mechanism is in operation. This sudden reversal of air current will minimize any tendency of the air currents to set up inefficient regular flows around the cars, etc., and by producing numerous reversing eddies will materially increase the circulation within the boundaries including the drying material, that is, between the trays, thereby producing a more rapid and uniform drying, at the same time increasing the efficiency of a given delivery of air to the kiln.

What I claim is:—

1. In connection with a drying kiln, ducts for conducting a drying medium to and from the kiln and automatic means for reversing the direction of flow of the drying fluid in and out of the kiln at predetermined intervals.

2. In connection with a drying kiln, mains through which the drying medium is conducted to and away from the kiln, branch ducts leading from the mains to different parts of the kiln and automatic means in connection with the branch ducts for systematically reversing the flow of the drying medium through the kiln without disturbing the flow of the drying medium along the mains.

3. In connection with a drying kiln provided with openings in its bottom and side walls and mains for conducting a drying medium to and from the kiln, of branch ducts leading from the main to the openings in the bottom and sides of the kiln, valves located in the ducts and means for operating the valves to simultaneously shut off the flow of current through the openings in the bottom of the kiln and start a flow through the openings in the side of the kiln and vice versa.

4. A drying kiln provided with openings

in its bottom and sides, means for varying the size of the openings, mains for conducting a drying medium to and from the kiln, ducts connecting the mains with the said openings in the bottom and sides of the kiln and means for reversing the flow of drying medium through the ducts and hence through the kiln.

5. A kiln provided with openings in its bottom and side walls, means for varying the size and shape of the openings, mains for conducting the drying medium to and from the kiln, ducts connecting the mains with the openings in the bottom and sides, and means for reversing the flow of drying medium.

6. A kiln provided with openings in its bottom and side walls, taper mains for conducting a drying medium to and from the kiln, tapered ducts connecting the mains with the openings in the bottom and sides of the kiln and means for reversing the flow of drying medium through the ducts.

7. A kiln provided with openings in its bottom and side walls, taper mains for conducting a drying medium to and from the kiln, tapered ducts connecting the mains with the openings in the bottom and sides of the kiln, means for reversing the flow of drying medium through the ducts, and means for discharging more or less of the return air, and taking into the system a corresponding amount of fresh air.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two witnesses, this twenty-first day of June 1907.

CHESTER B. DURYEA.

Witnesses:

F. GEORGE BARRY,
C. S. SUNDGREN.