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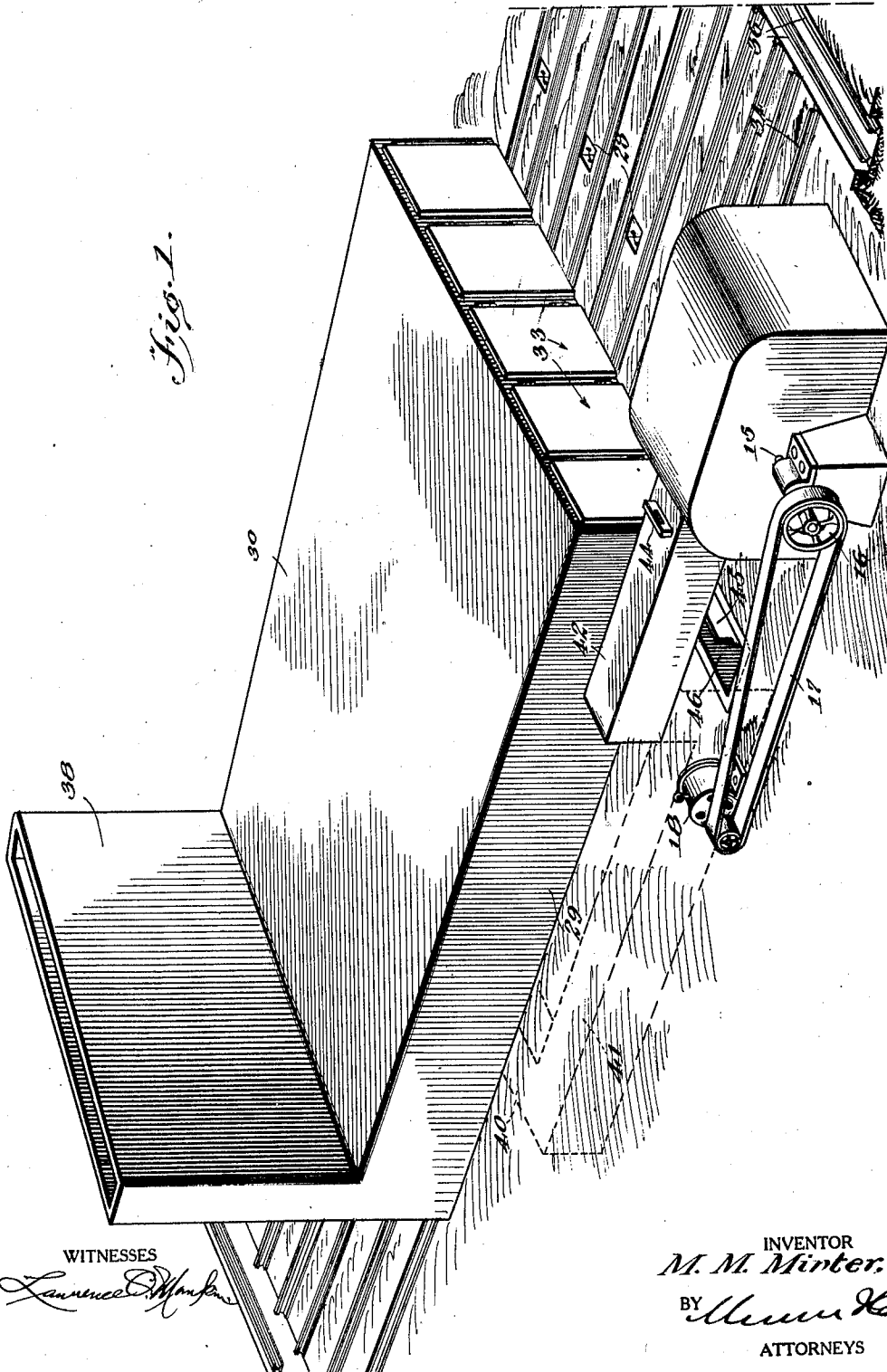
1,594,316

M. M. MINTER

DRYING APPARATUS

Filed July 23, 1925

5 Sheets-Sheet 1



WITNESSES

Lawrence D. Minter

INVENTOR

M. M. Minter.

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July 27, 1926.

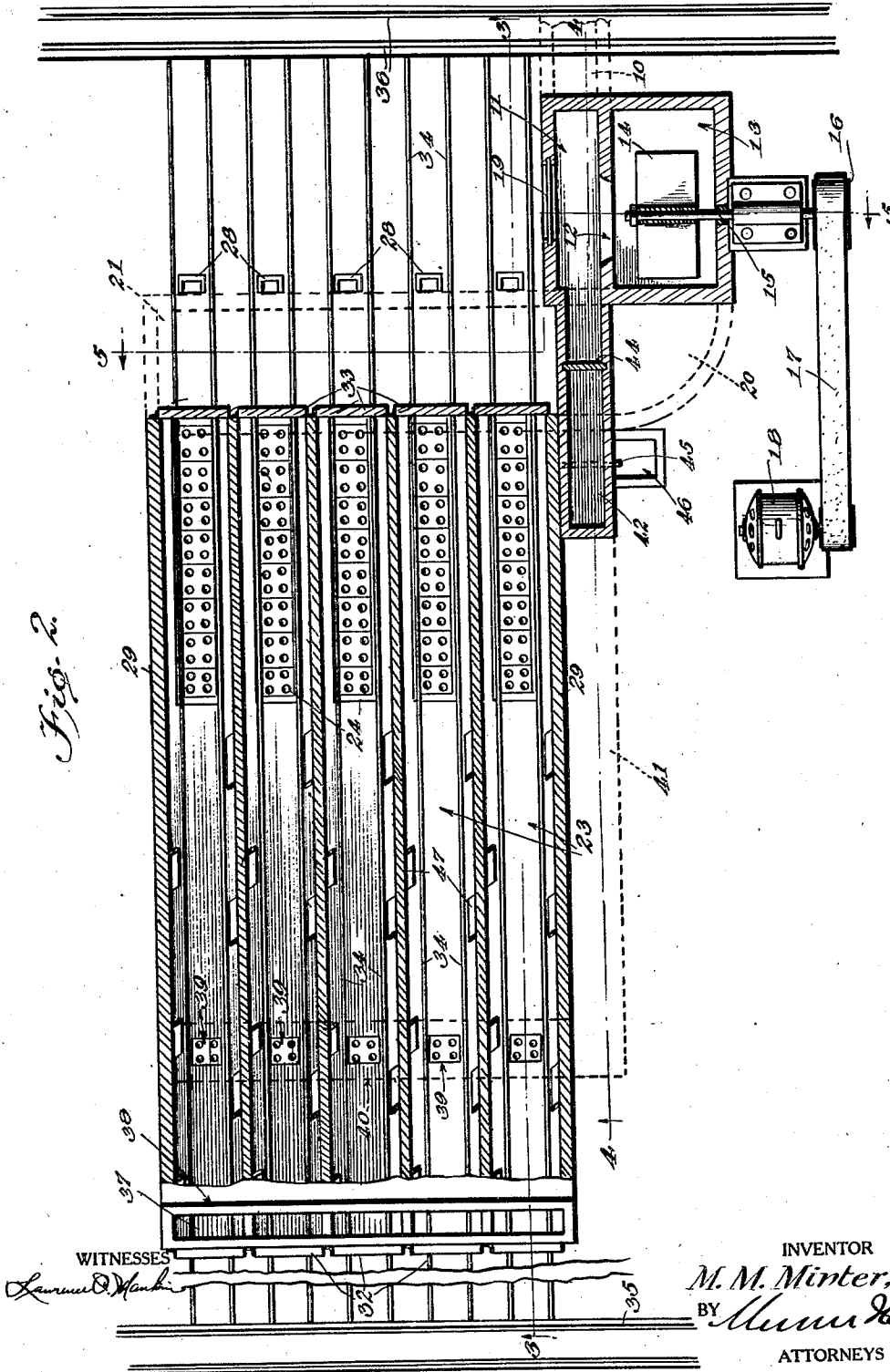
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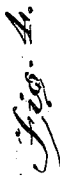
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M. M. MINTER
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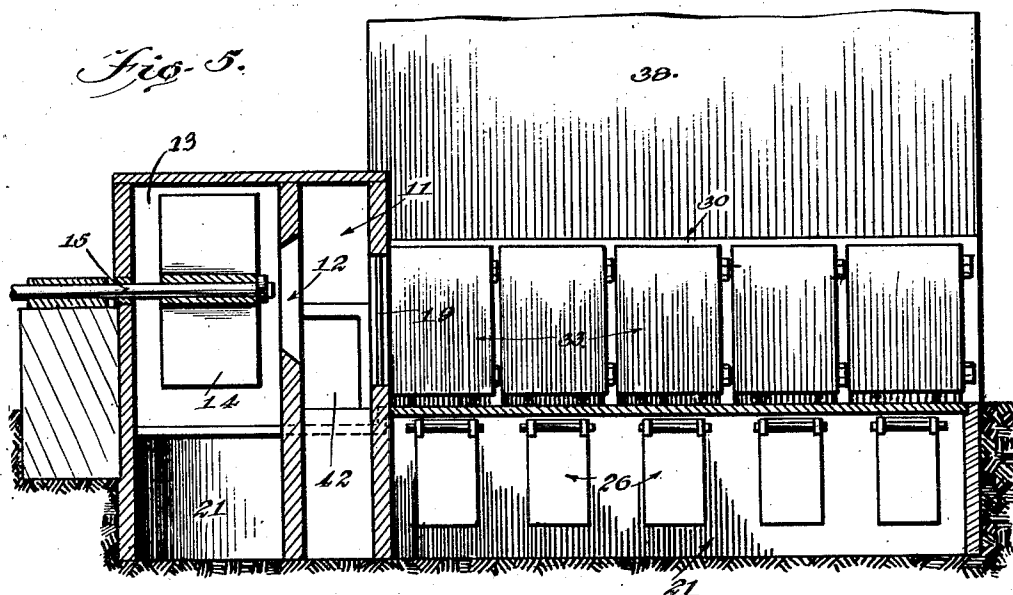
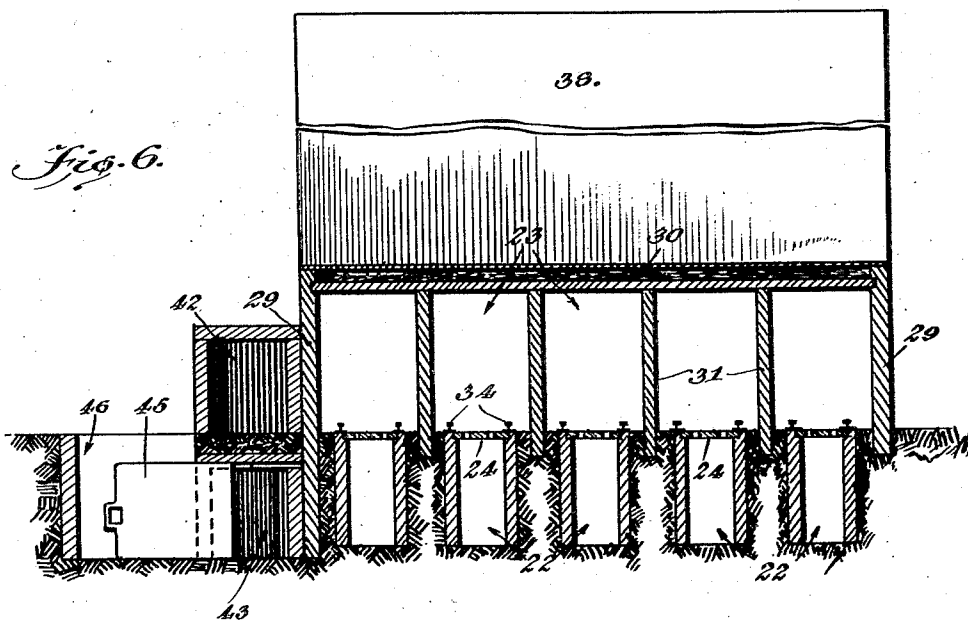
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5 Sheets-Sheet 4



WITNESSES

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5 Sheets-Sheet 5

Fig. 7.

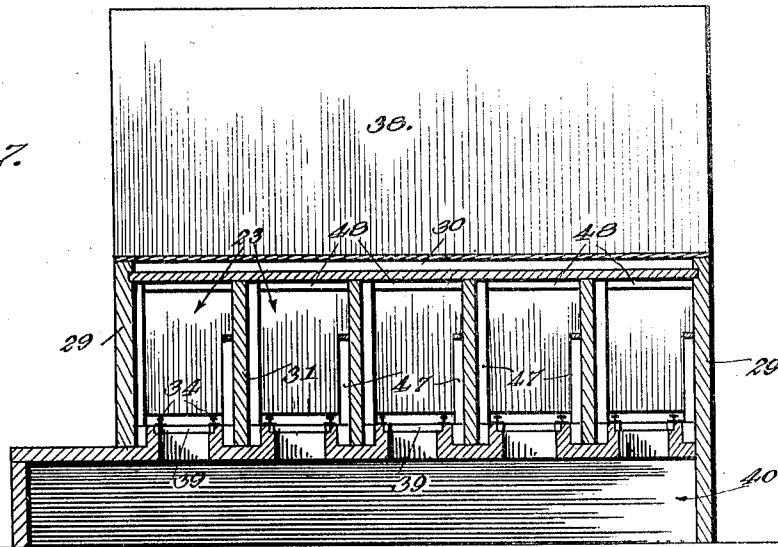


Fig. 8.

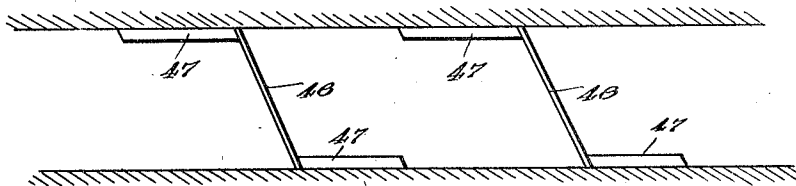
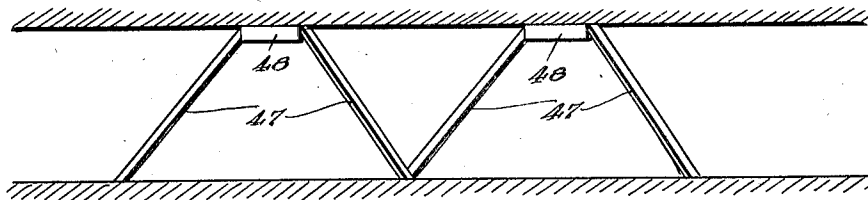


Fig. 9.

WITNESSES

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UNITED STATES PATENT OFFICE.

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DRYING APPARATUS.

Application filed July 23, 1925. Serial No. 45,653.

My present invention relates generally to driers, and more particularly to drying apparatus for clay or other composition plastic material intended for subsequent burning in kilns, and the like. Such drying is a part of the method of manufacturing brick, tile, and similar articles, during which the mechanical moisture is removed from the moulded clay. Practically all clays contain, or have added to them if moulded in a plastic state, from fifteen to twenty-five percent of moisture according to the degree of plasticity required for forming the raw material into the general shapes of the finished articles.

The drying of the moulded plastic product involves the removal of the mechanical moisture by evaporation and during the drying the material shrinks, becomes harder and reduces in weight and it has always been a difficult matter to bring about these natural changes and keep the same uniform throughout the entire mass of material being dried.

It is the primary object of my invention to permit of and provide for the application of the drying air uniformly to all sides of the material being dried and to cause the circulation of such air evenly at a predetermined temperature and degree of saturation, capable of ready quick changes and variations to meet different conditions presented by variations in the character of the material being dried as well as the moisture content of the warm air as supplied to the drier for use therein. All of this has in contemplation a resultant product dried without strains, cracks or warping of the body of the material, as well as a drying operation which can be carried on speedily and cheaply with a uniformly better product than that which can be obtained at the present time with the drying apparatus and means usually employed.

In practice, a slatted bottom car of one or more decks is loaded with ware loosely piled on each deck to allow room for circulation through the ware, the usual apparatus including a drying tunnel with tracks running through it and commonly one of a series, of such length as to hold from twelve to fifteen cars and of such width and height that the cars when loaded practically fill its cross section, leaving only bare working clearance between the loaded cars and the top and sides of the tunnel.

The loaded cars enter the tunnel at one end and the drying air enters the tunnel at the other end, draft and cars travelling in opposite directions so that the drying of the ware is accomplished progressively at such a rate that when a car reaches the car exit end of the tunnel, its ware will be dry. In a theoretically perfect operation, drying air on the other hand will, when it reaches the air exit end of the tunnel, have reached a thoroughly saturated condition although the character of the ware including its degree of initial moisture and also the moisture content of the air initially supplied for drying purposes, must determine to some extent the desired condition of such air as regards final moisture in its passage through the ware. The main consideration is to thoroughly heat the ware entirely through its body in order that the evaporation of its moisture may proceed uniformly throughout its area and it is obvious that if the evaporation in the first instance is such as to dry the surface of the ware before the latter is heated through, a non-uniform condition of the ware necessarily follows with grave danger of cracking and warping.

Although it is understood that in the ordinarily used apparatus adjustments may be made in temperature, air volume, speed of car travel and air velocity, a small tunnel is now used to surround the loaded car with an atmosphere that is practically saturated at its temperature so that the ware to be dried may absorb heat to its very core before evaporation begins. After the ware is heated through it moves along into a slightly higher temperature and a slightly drier atmosphere, but the desired results are defeated to some extent in such tunnels by virtue of the tendency of the air to race through the small spaces left for its travel, without being in contact with the ware long enough to become saturated. In this way the wet incoming ware is dried on the sides and tops of the cars too rapidly and a large proportion of it is injured. If to correct this condition the volume of air is decreased as this is commonly the only recourse, the whole drying process is thereby slowed down and the drying cycle lengthened, the final effect being to compel either the construction of additional drying tunnels or decrease in a capacity the drying plant.

My invention contemplates the use of

larger tunnels than those now employed, with means to avoid radiation through the roof or side walls and with means permitting of the recirculation through the tunnel of all or a portion of the air that has previously passed through the ware as a means of controlling humidity and to economize in the heat necessary for the operation. My invention also proposes an apparatus in which the drying tunnel has means for causing a spiral motion of a draft through the tunnel whereby the drying air which would otherwise flow in straight lines along the sides and top of the tunnels will be caused to flow downwardly beneath the cars in order that it may circulate upwardly through the ware on the cars.

The foregoing general outline in connection with the objects of my invention will permit of a better understanding of the invention from the following description referring to the accompanying drawings. In these drawings which illustrate my present invention and form a part of this specification:

Figure 1 is a perspective view of the drying apparatus as a whole,

Figure 2 is a horizontal section taken therethrough,

Figure 3 is a vertical longitudinal section taken on line 3—3 of Figure 2,

Figure 4 is a vertical horizontal section taken on line 4—4 of Figure 2,

Figure 5 is a vertical transverse section taken on line 5—5 of Figure 2,

Figure 6 is a vertical transverse section taken on line 6—6 of Figure 4,

Figure 7 is a vertical transverse section taken on line 7—7 of Figure 4, and

Figures 8 and 9 are views more or less in the nature of diagrams showing the air controlling baffles as arranged within the tunnels, respectively in top plan and side view.

Referring now to these figures the intake flue 10 through which warm air is supplied to my improved drying apparatus, opens into the lower portion of a riser 11 whose upper portion has an opening 12 through one side wall establishing communication between the riser and a fan chamber 13. In this fan chamber 13, a fan 14 rotates upon a shaft 15, whose outer end has a pulley 16 for belt connection as shown in Figures 1 and 2, by a belt 17, to a suitable source of power as for instance a motor 18, although it is to be understood that the fan may be driven by various other means as desired.

The opening 12 places the suction side of the fan in communication with the intake flue 10, one wall of the riser 11 having opposite to its opening 12 an opening normally covered by a door 19 through which more or less air may be taken directly from the atmosphere where it is so desired or becomes necessary.

At its lower portion the fan chamber 13 communicates with one curved end 20 of a supply flue 21 which extends at right angles to and is closed from the intake flue 10. This supply flue 21 extends along the air intake ends of the several tapering supply ducts 22 projecting lengthwise of the several car tunnels 23, it being noted from Figure 3 in particular that the ducts 22 project for a portion only of the length of the tunnels and communicate with the latter through grates 24 so that the drying air may find its way freely from the ducts 22 upwardly through the grates 24 below those of the cars 25 adjacent to the car exit ends of the tunnels. Provision is made for independent control of air passing into the ducts 24 by virtue of swinging doors 26 at the intake ends of the supply ducts 22, which doors are mounted to swing in the supply flue 21 and are controlled by independent connections indicated at 27, the latter of which extend into control boxes 28 at the surface of the ground.

The side walls of the dryer extending above the surface of the ground and as indicated at 29 are preferably of substantial thickness and the top or roof 30 thereof is preferably insulated as shown in order to prevent undesired radiation and the loss of heat to the atmosphere, and the substantial division walls 31 between the central drying tunnels 23, insure the desired independent action within the tunnels so that their independent control through the connections previously described may be effectively carried out.

The car entry and exit ends of the tunnels are respectively closed by swinging doors 32 and 33, and the tracks 34 for the cars are extended through the tunnels and beyond the opposite ends of the tunnels to transfer tracks 35 and 36 as shown in Figures 1 and 2. Adjacent to their car entry ends the tunnels 23 communicate through upper openings 37 with a discharge stack 38, and intermediate their ends and at points nearer to the air discharge end than the air intake end, the several tunnels are in communication through bottom grates 39 with the transversely disposed portion 40 of a recirculation flue having a portion 41 paralleling one side of the drying apparatus, whose rear end connects with the transverse portion 40 and whose forward end connects by an upwardly offset portion 42 with the upper portion of the riser 11 and also communicates by means of a duct 43 with the supply flue 21 as most plainly seen by reference to Figure 4 and a comparison of this figure with Figure 2. In the upwardly offset forward portion 42 of the recirculation flue, a damper 44 is mounted and normally remains closed except when it is desired to recirculate a portion of the drying

air after it has passed from the inlet ducts 22 of the tunnels and through the major portions of the tunnels to the transverse portion 40 of the recirculation flue. In the duct 43 shown most plainly in Figure 4 by which the recirculation flue may communicate with the supply flue 21, a damper 45 is arranged and this damper also is normally closed. Damper 45 opens laterally as shown in Figure 6 within a side pit 46 and when open, permits of the forward passing of drying air from the supply flue 21 through the recirculation flue 41 and 40 so that such air will pass upwardly into the tunnels 23 through the grates 39 in order to supply the tunnels at these points with air having but little moisture.

Each of the several tunnels which as will be observed in Figure 3 is of substantially greater height than the loaded cars 25 passing therethrough, and each tunnel is of correspondingly greater width so that air passages of material dimensions remain between the tops and sides of the loaded cars and the tops and sides of the tunnels. In these spaces along the tunnel between the inner ends of the inlet ducts 22 and the stack 38, there are arranged in the several tunnels baffles as seen in Figures 2, 3, 7, 8 and 9, the baffles including inclined side strips 47 along the tunnel sides, whose upper ends are connected by inclined cross strips 48 along the tops of the tunnels so that these strips cooperate with one another to bring about a spiral circulation of the air as it passes through the tunnel and in particular guide the air from the said air spaces to points beneath the cars 25 so that the air circulates and recirculates vertically through the ware loaded on the car with the object in view of bringing about much more uniform and hence much more effective results in the drying operation.

As before stated the ideal operation is one in which the air entering the tunnels through the supply ducts 22, passes uniformly and completely through the ware and after entering accumulates by virtue of such circulation a degree of saturation which when the air finally reaches those cars loaded with fresh material in a wet state, will have the effects of heating the material to its very core without drying the same to any material extent upon its surface. Whereas in some cases the air open passage toward the stack 38 has become saturated to its fullest extent before reaching the stack, it is possible by opening the damper 45 to forward pass drying air through the circulation flue and into the tunnels at the points of communication between the recirculation flue and the tunnels in order to correct the over saturated condition of the air. In other instances, where the air passing into the tunnels through the supply ducts 22 is so dry as

to endanger too great evaporation from the surface of the ware without heating the ware throughout, and in instances where it is desired to reduce the volume of air in the tunnel before it reaches the stack, it is possible by opening the damper 44 to place the recirculation flue in communication with the suction side of the fan 14 through the riser 11 and in this way withdraw a portion of the air from the tunnels through the grates 39 and the portions 40, 41 and 42 of the recirculation flue for mixture with the air taken from the inlet flue 10 to be subsequently recirculated through the tunnels through the supply flue 21 and supply ducts 22. This latter operation is carried out in particular where the air in the tunnels reaches the transverse portion 40 of the recirculation flue so dry as to be dangerous to the fresh material on cars between the recirculation flue and the stack 38 for the reasons previously described.

I claim:

1. A drying apparatus including means forming a series of drying tunnels having doors at their opposite ends and each provided with an air inlet at one end and an outlet adjacent to its opposite end, a supply flue along the air inlet ends of the tunnels, a series of individually controlled doors forming dampers between the supply flue and the air inlets of the tunnels, a casing having a fan chamber discharging at its lower portion into the said supply flue and having an upper intake opening at one side, a fan in the upper portion of said chamber, an intake flue, and a riser with the lower portion of which said intake flue communicates, said riser being in communication at its upper portion with the inlet opening of the fan casing.

2. A drying apparatus including means forming a series of drying tunnels having doors at their opposite ends and each provided with an air inlet at one end and an outlet adjacent to its opposite end, a supply flue along the air inlet ends of the tunnels, a series of individually controlled doors forming dampers between the supply flue and the air inlets of the tunnels, a casing having a fan chamber discharging at its lower portion into the said supply flue and having an upper intake opening at one side, a fan in the upper portion of said chamber, an intake flue, and a riser with the lower portion of which said intake flue communicates, said riser being in communication at its upper portion with the inlet opening of the fan casing and having a normally closed opening at its said upper portion for communication with the atmosphere.

3. A drying apparatus including means forming a series of drying tunnels having doors at their opposite ends and each pro-

vided with an air inlet at one end and an outlet adjacent to its opposite end, a supply flue along the air inlet ends of the tunnels, a series of individually controlled doors forming dampers between the supply flue and the air inlets of the tunnels, a casing having a fan chamber discharging at its lower portion into the said supply flue and having an upper intake opening at one side, a fan in the upper portion of said chamber, an intake flue, a riser in communication at its upper portion with the inlet opening of the fan casing and with the lower portion of which said intake flue communicates, and a flue having communication at one end with the several tunnels intermediate the ends of the latter, and having damper controlled communication at its opposite end with the riser.

4. A drying apparatus including means forming a series of drying tunnels having doors at their opposite ends and each provided with an air inlet at one end and an outlet adjacent to its opposite end, a supply flue along the air inlet ends of the tunnels, a series of individually controlled doors forming dampers between the supply flue and the air inlets of the tunnels, a casing having a fan chamber discharging at its lower portion into the said supply flue and having an upper intake opening at one side, a fan in the upper portion of said chamber, an intake flue, a riser in communication at its upper portion with the inlet opening of the fan casing and with the lower portion of which said intake flue communicates, and a flue having communication at one end with the several tunnels intermediate the ends of the latter and having damper controlled communication at its opposite end with the said supply flue.

5. A drying apparatus including means forming a series of drying tunnels having doors at their opposite ends and each provided with an air inlet at one end and an outlet adjacent to its opposite end, a supply flue along the air inlet ends of the tunnels, a series of individually controlled doors forming dampers between the supply flue and the air inlets of the tunnels, a casing having a fan chamber discharging at its lower portion into the said supply flue and having an upper intake opening at one side, a fan in the upper portion of said chamber, an intake flue, a riser in communication at its upper portion with the inlet opening of the fan casing and with the lower portion of which said intake flue communicates, and a flue having communication at one end with

the several tunnels intermediate the ends of the latter and having branches at its opposite end one of which communicates with the riser and the other of which communicates with the supply flue, and dampers in said branches as described.

6. A drying apparatus including a supply flue, means forming a series of drying tunnels having end doors and having inlets and outlets adjacent to their opposite ends, means for independently controlling communication between the supply flue and the inlets of the tunnels, a fan casing discharging into the supply flue, an intake flue in communication with the suction side of the fan casing, a fan within said casing, and a flue communicating at one with the several tunnels intermediate the ends of the latter and nearer to the outlet ends than the inlet ends, said flue having damper controlled communication at its opposite end with the supply flue and with the suction side of the fan casing.

7. A drying apparatus including means forming drying tunnels having air inlets at one end and outlets at their opposite ends, means for supplying drying air to the air inlets of the tunnels, and means having communication with the air supply means and with the tunnels intermediate the ends of the latter and near to the discharge ends thereof for introducing predetermined volumes of air into the tunnels to supplement the air passing from the supply means into the inlet ends of the tunnels.

8. A drying apparatus including means forming drying tunnels having air inlets at one end and outlets at their opposite ends, means for supplying drying air to the air inlets of the tunnels, and means having communication with the air supply means and with the tunnels intermediate the ends of the latter and near the discharge ends thereof, for withdrawing predetermined volumes of air from the tunnels and recirculating such air through the tunnels by way of the said supply means and the tunnel inlets.

9. An apparatus for drying plastic moulded articles including means forming a drying tunnel having an air inlet at one end and an air outlet at its opposite end, and baffles rigidly disposed against and inclined along the side walls and top of the tunnel between its inlet and its outlet to cause spiral motion of the air within the tunnel.

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