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July 27, 1926. 1,594,315

M. M. MINTER

KILN

Filed July 17, 1925 4 Sheets-Sheet 1

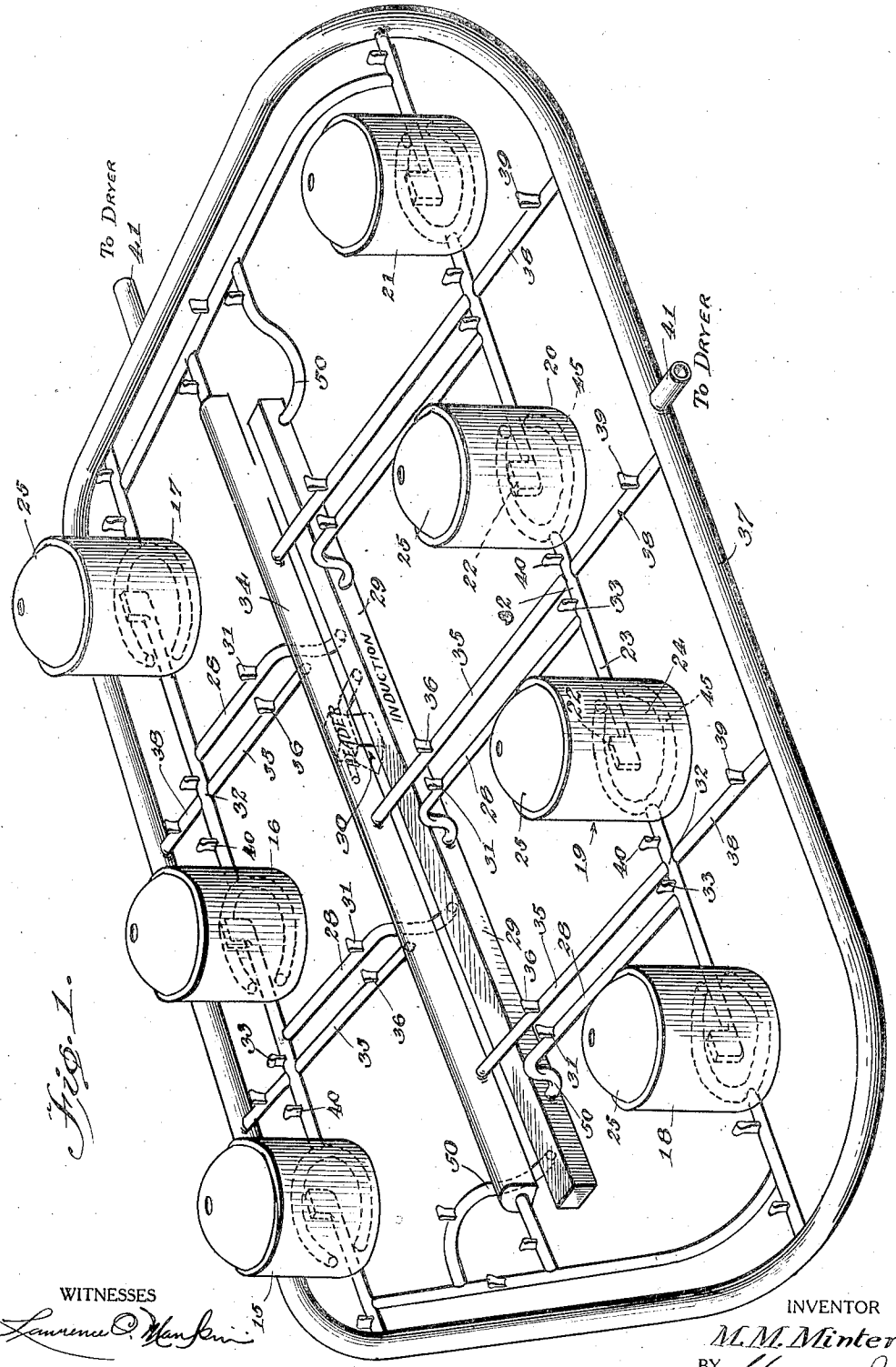


Fig. 1.

WITNESSES

Lawrence C. Manson

INVENTOR

M. M. Minter

BY Munn & Co.

ATTORNEYS

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M. M. MINTER

KILN

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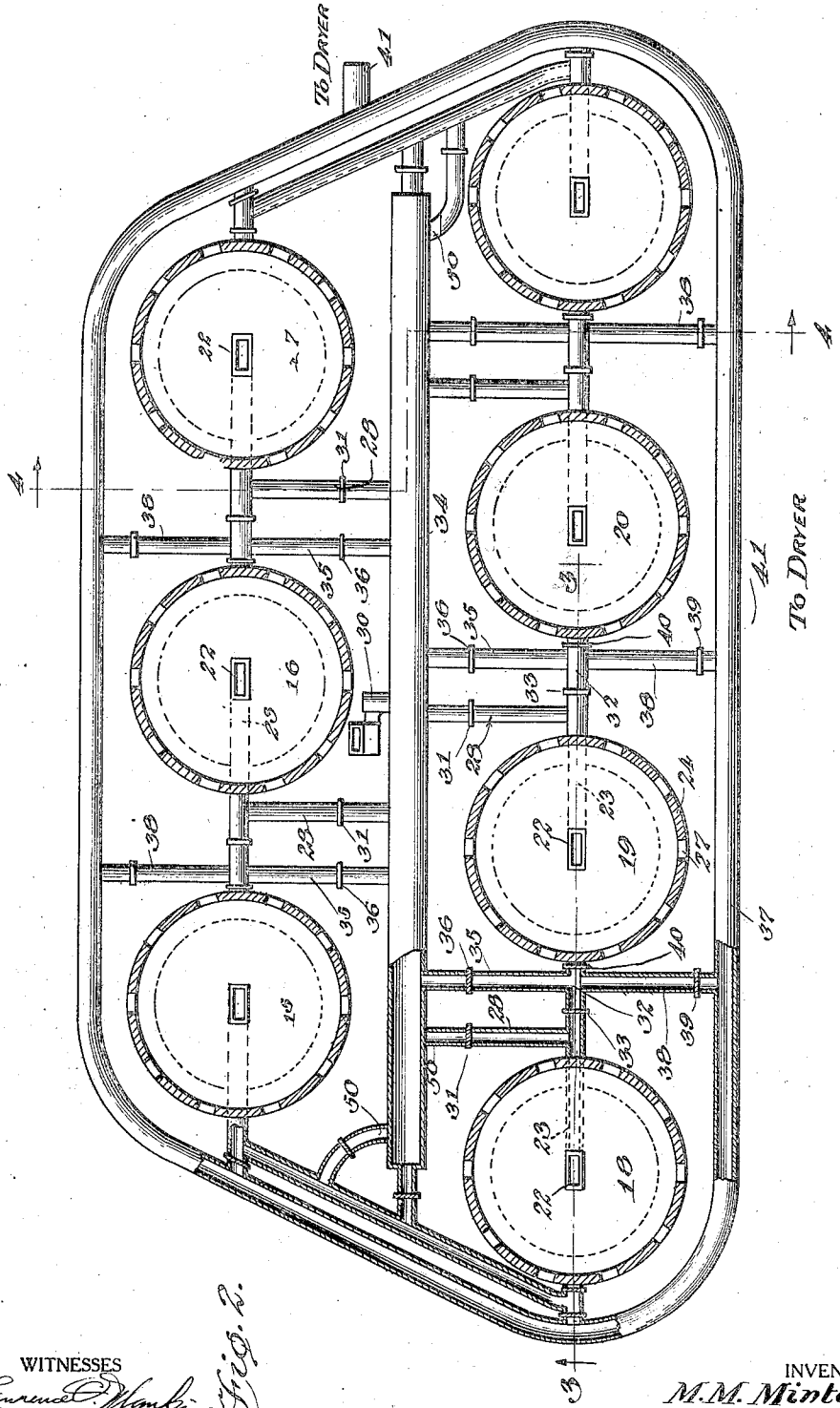


Fig. 2.

WITNESSES

Lawrence D. Hinkin

INVENTOR

M. M. Minter,

BY Munn & Co.

ATTORNEYS

July 27, 1926. 1,594,315

M. M. MINTER

KILN

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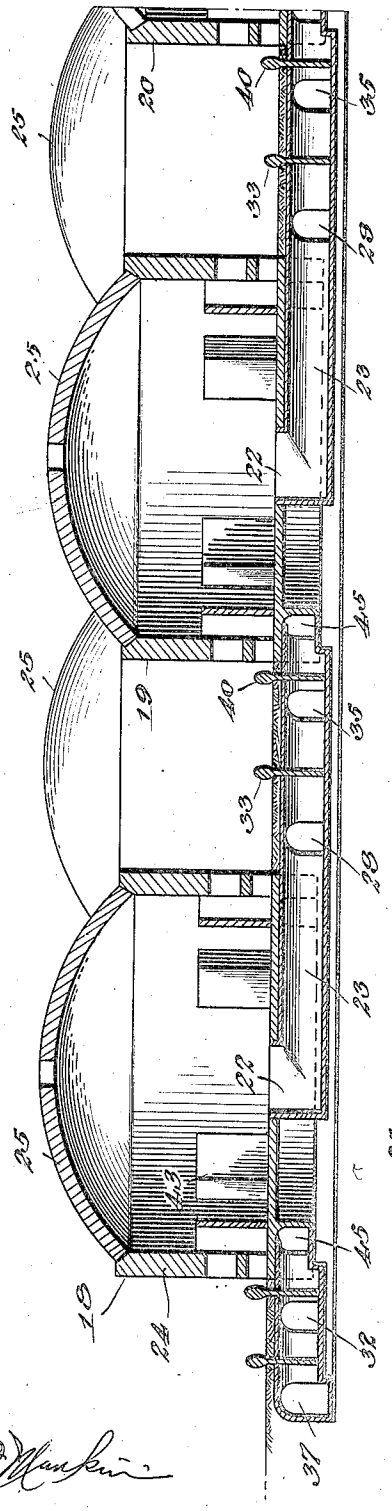


Fig. 3.

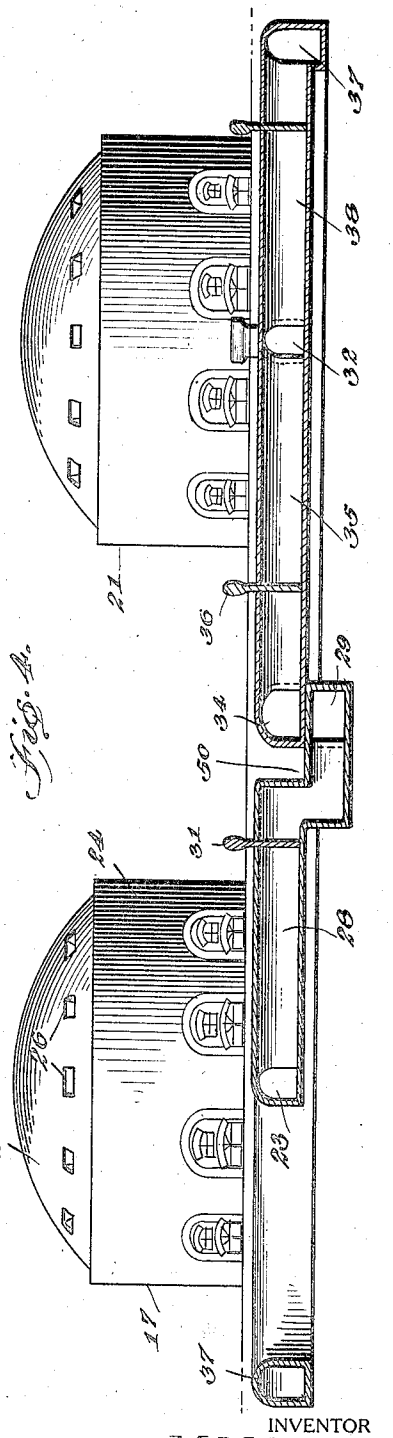


Fig. 4.

WITNESSES

Lawrence O. Mankin

INVENTOR

M. M. Minter,

BY Munn & Co.

ATTORNEYS

July 27, 1926. 1,594,315

M. M. MINTER

KILN

Filed July 17, 1925 4 Sheets-Sheet 4

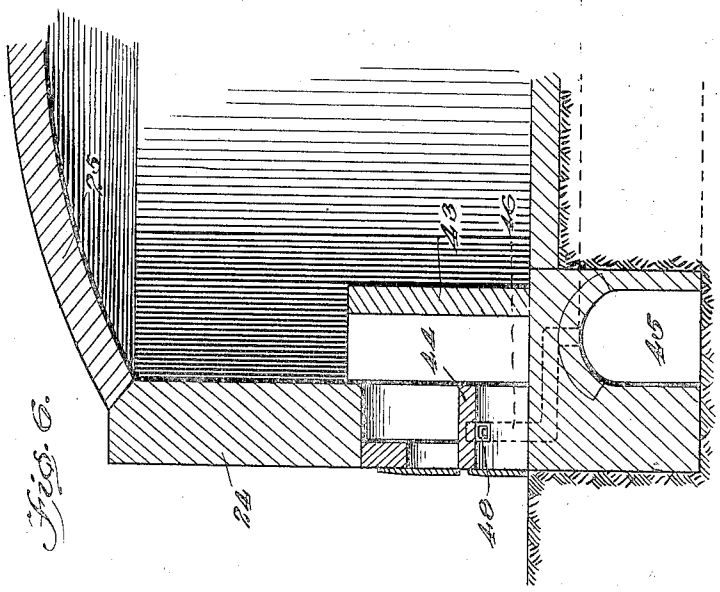


Fig. 6.

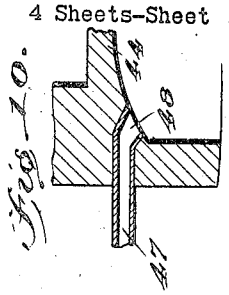


Fig. 10.

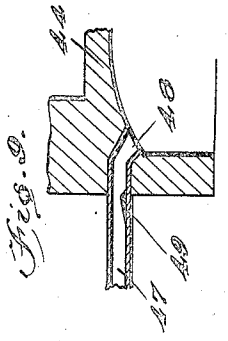


Fig. 9.

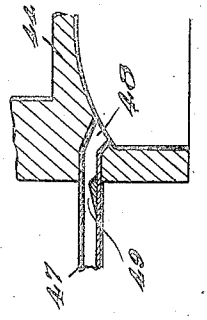


Fig. 8.

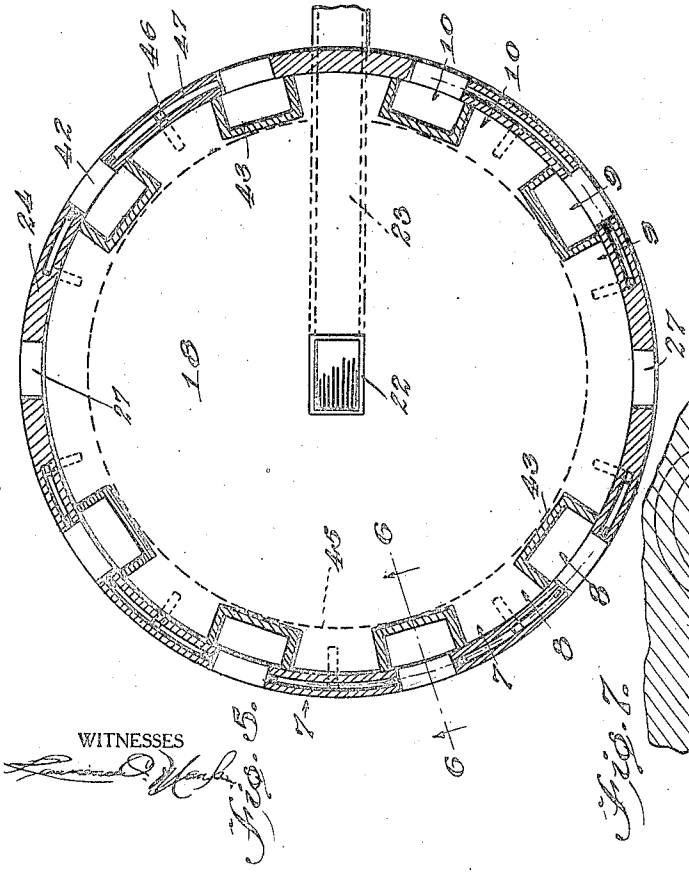


Fig. 5.

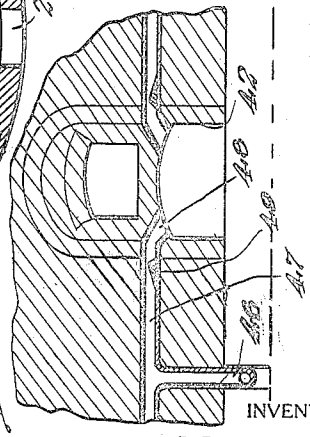


Fig. 7.

WITNESSES

INVENTOR

M. M. Minter,

BY Munn & Co.

ATTORNEYS

Patented July 27, 1926. 1,594,315

UNITED STATES PATENT OFFICE.

MAURICE M. MINTER, OF COLUMBUS, GEORGIA.

KILN.

Application filed July 17, 1925. Serial No. 44,330.

My present invention relates generally to kiln systems for burning brick and other clay or composition ware, and more particularly to a continuous kiln system of the type described and claimed in my Patent #1,272,495, granted July 16, 1918, over which my present system proposes operating advantages in respect to elasticity, economy and in certain other respects.

Among the many objects of my invention probably the most important is the provision of an apparatus in the use of which waste of heat may be eliminated to a great extent, provision being made for the ready easy collection from any kiln of the series of such heat as may not be needed in any other kiln so that the heat thus collected may be transferred for use at another point for instance in the preliminary drying of green ware.

Another object is the provision of an apparatus by means of which practically unlimited range is permitted in the selection and inclusion or exclusion of certain kilns in the operating series, proper regulation may be easily obtained and maximum efficiency maintained at all times.

In the accompanying drawings which illustrate my present invention and form a part of this specification,

Figure 1 is a perspective diagram of the system,

Figure 2 is a view partly in top plan and partly in horizontal section thereof,

Figure 3 is a partial vertical longitudinal section on an enlarged scale, taken substantially on line 4—4 of Figure 2,

Figure 4 is a vertical cross section taken substantially on line 4—4 of Figure 2.

Figure 5 is a detail horizontal section through one of the kilns,

Figure 6 is an enlarged vertical section partially through one of the kilns taken on line 6—6 of Figure 5, and

Figures 7, 8, 9 and 10 are detail sections taken respectively on lines 7—7, 8—8, 9—9, and 10—10 of Figure 5.

Referring now to these several figures, my invention proposes a series of kilns 15, 16, 17, 18, 19, 20 and 21, each having a central outlet 22 in its base communicating with an outlet flue 23, and each having the usual circular wall 24 and crown 25 with openings 26 and loading doors 27, the latter and the openings 26 being walled up except when the kiln is cooling after the ware has been burnt and during withdrawal of the finished ware and loading of the kiln with green ware.

The outlet flues 23 of the several kilns are in communication by independent induction branch flues 28 with a main induction flue 29, with one point of which an induction fan 30 communicates, each induction branch flue 28 having therein a damper 31.

Each kiln outlet flue 23 is in communication with the inlet flue 32 of the next adjacent kiln in one direction through a damper 33 and the several inlet flues 32 are in communication with a header 34 through header branch flues 35 having therein dampers 36. Moreover, each inlet flue 32 is in communication with a surrounding warm air flue 37, encircling the entire series of kilns, by virtue of a branch warm air flue 38 having therein a damper 39, and each inlet flue 32 has a damper 40 between the kiln into which it opens and the adjacent ends of the branch flues 35 and 38.

The warm air or waste heat flue 37 may have one or more outlets 41 which I contemplate shall, in practice, extend to a dryer where the green material is initially dried before loading in the kilns.

It is thus obvious that each kiln may be connected up by manipulation of the dampers so as to operate in connection with any one or more of the other kilns of the series in a manner which will presently appear.

Each of the kilns has an annular series of regularly spaced openings 42 which form the fire doors having the usual inner upright baffle or bag walls 43 best shown in Figures 5 and 6 which cause the indrawn products from the bottom of the fire doors and also the tables 44 which cross each fire door at a point spaced above the bottom thereof, to be deflected upwardly into the kiln for subsequent passage downwardly through the ware to the outlet 22.

Each kiln has moreover a supply flue 45 therebeneath of segmental form closed at its ends adjacent to opposite sides of the outlet flue 23 thereof and extending beneath the several fire doors with which it is connected by vertical and horizontal air channels 46 and 47, the former extending upwardly between the fire doors and the latter extending from the upper ends of the former into the fire doors and opening downwardly therein through opposite sides of the table,

the final outlet of these channels being flared as indicated at 48. Each supply flue 45 is entered at a midway point by the respective inlet flue 32 and each supply flue is intended to supply substantially the same amount of heated air or products to the several fire doors it serves. Since all of the channels 46 and 47 are the same size, and it is much more simple and economical to so form them, I preferably utilize choker blocks 49 in the horizontal channels 47 of each fire door and of gradually and successively decreasing size from opposite sides of the respective inlet flue 32 as will be plainly seen by a comparison of Figures 7 to 10 inclusive.

In the present embodiment of my invention, the induction flue 29 is constructed below and along the header 34 and the header branch flues 35 are level below the surface of the ground with the induction branch flues 28, the latter having drops 50 as most plainly shown in Figure 4 by which they enter the induction flue 29.

Thus, in operation, kiln 18, for instance, being ready to burn, the loading doors 27 and openings 26 are closed while the fire doors 42 above and below tables 44 are open. Fires are started in these doors both on and below the tables 44 and dampers 33 and 40 of the outlet flue of this kiln and the inlet flue of kiln 19 are closed. Damper 36 is closed and damper 31 of the adjacent induction branch flue 28 is opened, thus connecting the outlet 22 of kiln 18 with the induction flue 29 through 23, 28, and drop 50, the draft being discharged into the atmosphere through the induction fan 30. #19 kiln being then loaded and ready for heat from #18 kiln, #19 kiln is closed at all points, inlets, doors, and fire boxes from the entry of air except through the supply flue 45 thereof; damper 31 of the branch induction flue of kiln 18 is closed while the dampers 33 and 40 between kilns 18 and 19 are open. Dampers 31 of the branch induction flue 28 of kiln 19 is then opened, and the action of the induction fan will be such as to draw from the induction flue 29 through the branch 28 of kiln 19, from the outlet 22 of this kiln thus causing the heat from kiln 18 to pass through the outlet 22 thereof and through its outlet flue 23 direct into the inlet flue 32 of kiln 19 and thus into the supply flue 45 of the latter kiln, the heat so passing into the kiln 19 being regulated in the graduated supply channels so that it is evenly distributed around the kiln for discharge downwardly through the ware and uniform action thereon. A positive circulation is thus maintained in both kilns 18 and 19, which may continue during the burning of the ware in kiln 18 and also after the ware has been burned and during its cooling, and it is obvious that the same operation may be carried forward by manipulation of the dampers so that each and every kiln may be either fired direct, that is with direct connection with the induction flue through its own individual induction branch flue, or may be fired through any other kiln either for the purpose of utilizing the heat of the burning kiln for the preheating or water smoking of the ware in the second kiln.

Where any kiln having therein heat to be withdrawn is at the proper point for withdrawal of this heat at a time when the other kilns are not in position to need this heat or all of it, the heat may be permitted to pass into the low temperautre or waste heat flue 37 by opening the damper 39 as well as the damper 33 so as to place the outlet of the respective kiln in open communication with the flue 37 through the respective branch flues 38.

It is not necessary that a regularly progressive action be maintained as by means of the branch flues and their dampers and by the utilization of a header 34 such as I have described, it is possible to cool kiln 18 by withdrawing the heat therefrom through for instance kiln 21, while kiln 19 is burning and the draft therefor maintained through kiln 20, both volumes, that is, the heat and draft going to the induction flue and to the atmosphere through the induction path. After water smoking the ware in kiln 21 during the cooling of kiln 18 and burning the ware in kiln 19 through kiln 20, as described, kiln 20 will be ready to fire, for instance through kiln 21 while the remaining heat of kiln 18 may be passed to the low temperature or waste heat 37 for passage through its outlet flue 41 to the drier.

By closing damper 40 and opening dampers 31, 33 and 39 the cooling of kiln 18 above mentioned, may be accelerated as one volume of heat will then pass to the induction flue and to atmosphere through the induction fan and one volume will pass to the low temperature flue 37, and at the same time kiln 19 may be supplying a volume of heat to preheat air for combustion in the fire boxes of kiln 20 with damper 40 between kilns 19 and 20 half open and damper 36 adjacent thereto also half open. Obviously, the firing in any kiln may take place by the supply of pre-heated air to the combusion spaces below the tables 44 of the fire doors while cool air from the atmosphere passes across the fire upon the tables 44. In fact a great many variations may be accomplished, with improvement in the final result as the object, by manipulating the dampers and firing the several kilns either direct or through one or more other kilns.

By firing regulated amounts of fuel, several kilns in a line may be fired at the same time without obstruction and a re-

ducing or carbonizing atmosphere or in other words, an excess of carbon may be maintained in one kiln while an oxidizing atmosphere is maintained in another kiln at the same time by admitting into the latter kiln air from the atmosphere above the tables 44 while drawing into the first kiln a reducing atmosphere from another kiln.

As before stated each kiln may be fired direct or through a second kiln, and each may be fired through a second kiln and at the same time fire such second kiln either with or without preheated air from another kiln. Moreover, each kiln may be fired by preheated air from another kiln and through a second firing kiln, both volumes passing through a third kiln to the induction flue. All of the kilns may be cooled direct to the atmosphere in the usual manner with all dampers closed and doors and fire boxes open, or may be cooled into the low temperature flue 37 or into the induction flue and to the atmosphere through the induction fan. Each kiln may be cooled through one or more of the other kilns either for the purpose of water smoking, preheating of the supply of pre-heated air for combustion, without any regard to regular or progressive action so that the system as of old will thus be elastic to a maximum degree in so far as selection and operation is concerned, and in order that waste and shut-downs may be avoided, and the burning of the ware accomplished in a highly effective and especially economical manner.

I claim:—

1. In apparatus of the character described, a kiln having fire doors at spaced points therearound and having a supply flue extending therearound below the said fire doors and closed at its ends, said kiln having an inlet flue opening centrally into the supply flue and having supply channels leading upwardly from the supply flue between the fire doors, and other supply channels leading horizontally from said first named channels and opening into opposite sides of the fire doors.

2. In apparatus of the character described, a kiln having fire doors at spaced points therearound and having a supply flue extending therearound below the said fire doors and closed at its ends, said kiln having an inlet flue opening centrally into the supply flue and having supply channels leading upwardly from the supply flue between the fire doors, and other supply channels leading horizontally from said first named channels and opening into opposite sides of the fire doors, each of said fire doors having a table thereacross dividing the same into upper and lower combustion spaces, the outlet ends of the last mentioned channels opening through opposite sides of the tables into the lower combustion spaces.

3. In apparatus of the character described, a kiln having fire doors at spaced points therearound and having a supply flue extending therearound below the said fire doors and closed at its ends, said kiln having an inlet flue opening centrally into the supply flue and having supply channels leading upwardly from the supply flue between the fire doors, and other supply channels leading horizontally from said first named channels and opening into opposite sides of the fire doors, each of said fire doors having a table thereacross dividing the same into upper and lower combustion spaces, the outlet ends of the last mentioned channels opening through opposite sides of the tables into the lower combustion spaces, and having therein means to graduate the supply through said channels to the several fire doors upon opposite sides of the inlet flue.

4. In apparatus of the character described, a kiln having fire doors and tables across the fire doors dividing the same into upper and lower combustion spaces, said kiln having an inlet flue and a supply flue into which the inlet flue opens and also having supply channels communicating between the said supply flue and its several fire doors.

5. In apparatus of the character described, a kiln having fire doors and tables across the fire doors dividing the same into upper and lower combustion spaces, said kiln having an inlet flue and a supply flue into which the inlet flue opens and also having supply channels communicating between the said supply flue and its several fire doors, and opening through opposite sides of the tables into the lower combustion spaces thereof, as described.

6. In apparatus of the character described, a kiln having fire doors and tables across the fire doors dividing the same into upper and lower combustion spaces, said kiln having an inlet flue and a supply flue into which the inlet flue opens and also having supply channels communicating between the said supply flue and its several fire doors, and opening into the lower combustion spaces of the fire doors, said channels having means to graduate the supply of air to the several fire doors and render the same uniform as described.

7. In a kiln system, a series of kilns having connecting ducts each including the outlet duct of one kiln and the inlet duct of the next kiln throughout the series, a pair of dampers spaced from one another in each connecting duct, a header common to the several kilns, having damper controlled branch flues in communication with the several kiln connecting ducts between the dampers of the latter, and a waste heat flue having branch flues communicating with the said kiln ducts also between the dampers of the latter.

8. In a kiln system, a series of kilns having connecting ducts each including the outlet duct of one kiln and the inlet duct of the next kiln throughout the series, a pair of dampers spaced from one another in each connecting duct, a header common to the several kilns, having damper controlled branch flues in communication with the several kiln connecting ducts between the dampers of the latter, and a waste heat flue having branch flues communicating with the said kiln ducts also between the dampers of the latter, said waste heat flue extending around the series of kilns and having one or more outlets as described.

9. In a kiln system, a series of kilns having inlet and outlet ducts connecting and communicating with one another between the kilns, an induction flue having draft inducing means and having a series of branch flues communicating with the outlet ducts of the kilns, dampers in said branch flues, a header common to the several kilns, having branch flues in communication with the several inlet ducts of the kilns, dampers in said latter flues, dampers in the said ducts between the said branch flues, dampers in the ducts between the header flues and the inlets of adjacent kilns and a waste heat flue having damper controlled communication with the several kilns at points between the dampers of the several connecting ducts.

10. In a kiln system, a series of kilns having inlet and outlet ducts connecting and communicating with one another between the kilns, a pair of spaced apart dampers controlling communication between the outlet duct of each kiln and the inlet duct of the next kiln throughout the series, an induction flue having draft inducing means and having a series of damper controlled branch flues in communication with the outlet ducts of the kilns between the outlets thereof and the dampers thereof nearest to said outlets, a header common to the several kilns having damper controlled branch flues in communication with the kiln ducts between the dampers of the latter, and a waste heat flue also having damper controlled branch flues communicating with the said kiln ducts between the dampers of the latter.

MAURICE M. MINTER.