

Jan. 24, 1928.

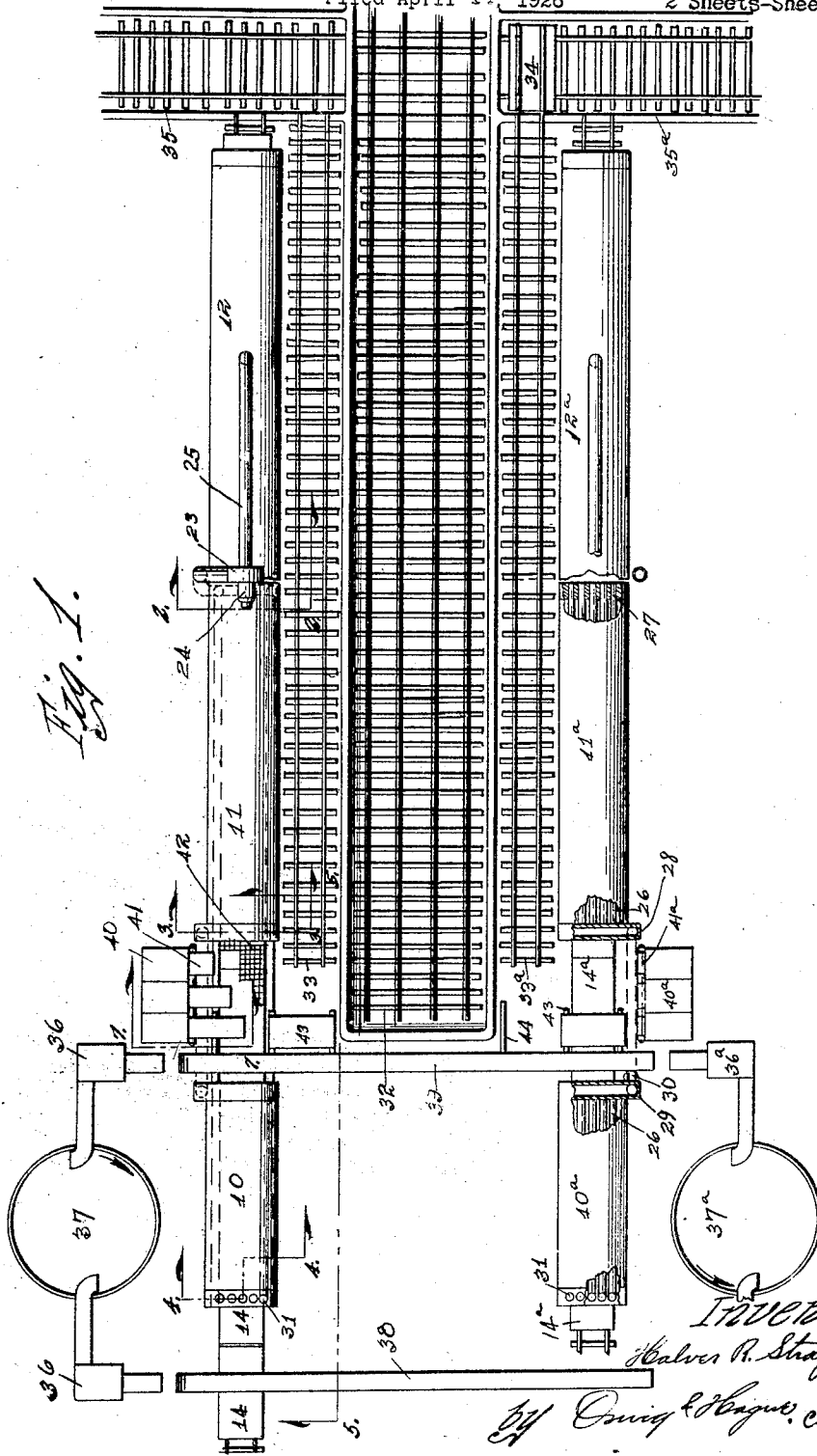
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1,657,138

COMBINED DRYING AND BURNING KILN

Filed April 14, 1926

2 Sheets-Sheet 1



*Fig. 1.*

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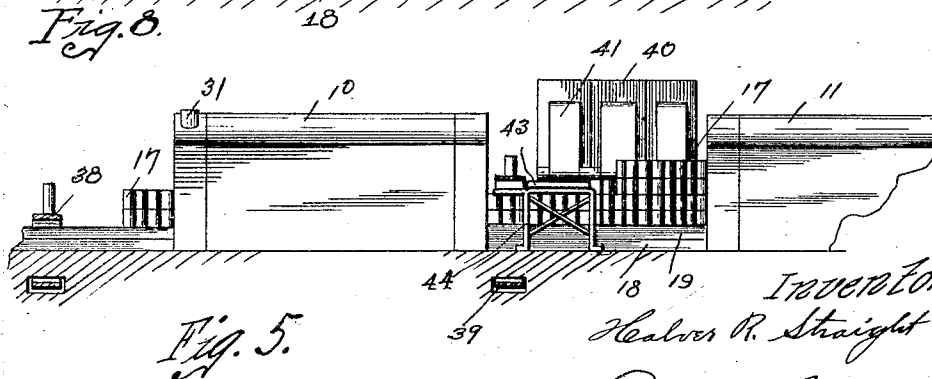
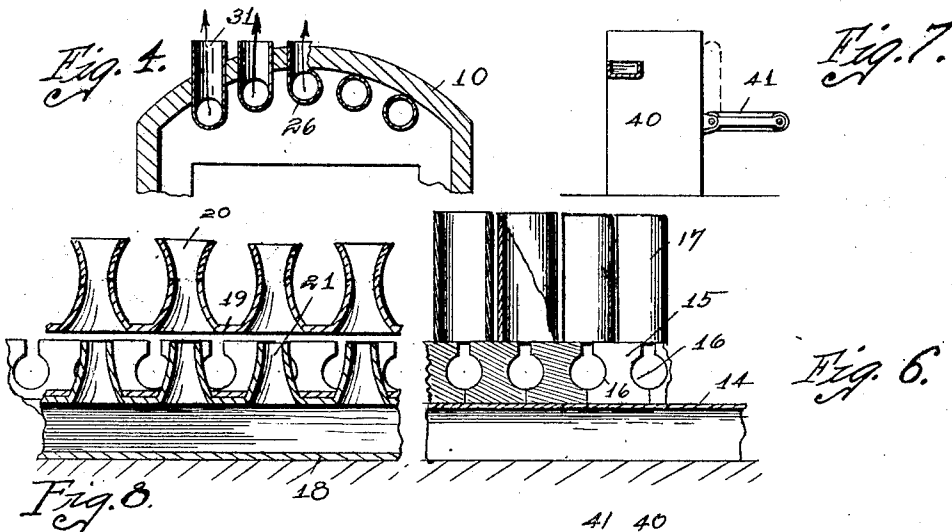
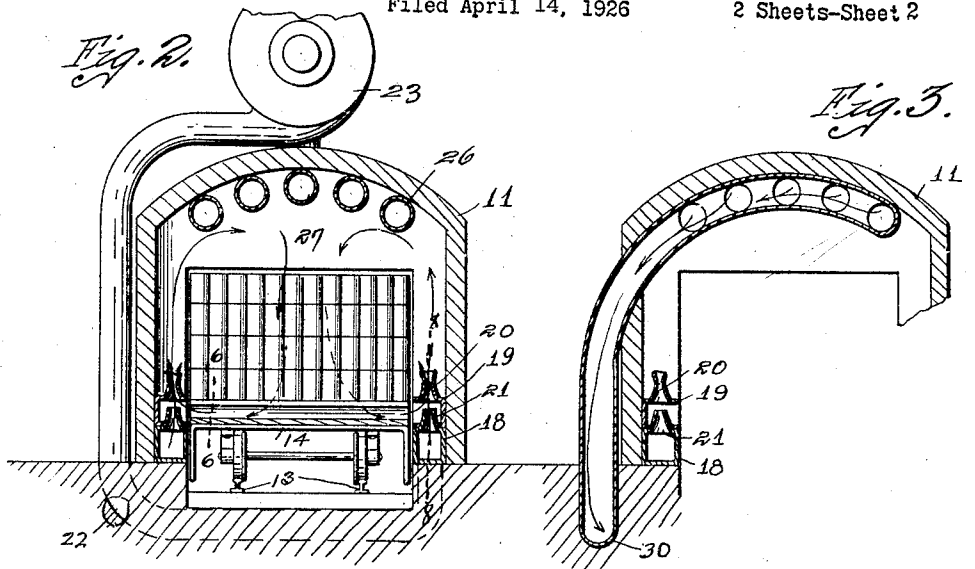


Fig. 5.

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# UNITED STATES PATENT OFFICE.

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COMBINED DRYING AND BURNING KILN.

Application filed April 14, 1926. Serial No. 101,989.

This invention relates to improvements in the drying and burning of ceramic wares.

The object of my invention is to so construct and arrange a kiln that the drying and burning kilns may be so combined that the plastic or undried ware may be placed on suitable cars and first passed through the drying kiln, and then advanced through the burning kiln in a progressive manner, and provide in connection therewith means whereby the said cars may be partially filled with drain tile or similar ware and then dried, after which other plastic ware may be placed on top of the dry ware and then passed through the remainder of the drying kiln, after which it may be advanced through the burning kiln, thereby providing means whereby the cars may be filled to a larger capacity, before entering the burning kiln, than would otherwise be permitted if the cars were completely filled and then dried, as the weight of the material on the top portion of the car would crush that in the lower part. I find in burning pressed brick and the like that this precaution is not necessary, as the brick in the lower part of the car will support the entire weight of the stack, even if it is all stacked in an undried condition.

It is, therefore, a further object of my invention to provide means whereby pressed brick and the like may be introduced at a later point of admission to the drying kiln, thereby eliminating the necessity of operating the first stage or stages while burning this class of ware.

A further object is to so arrange and construct the kiln and apparatus for delivering ware thereto, that a single pug mill may be utilized to feed a number of tile machines, one of which is located at a point adjacent to the first point of delivering the tile to the drying kiln, and another at a second point of delivering tile to the drying kiln and etc., so that tile may be fed to the kiln cars at either one or several of these points of delivery.

A further object is to provide one or more brick machines located at the second point of delivery so that the cars may be loaded with ware at this point and delivered to the second drying kiln.

A further object is to provide two sets of drying and burning kilns arranged in a parallel manner with each other, and to provide

means whereby the tile or brick machines of one set of kilns may be utilized to furnish material to either one or both of said sets of kilns, so that if one set of tile machines is out of operation, the other tile machine may be made to supply both sets of kilns.

A further object is to arrange the sets of kilns in such a manner that a track arrangement may be provided whereby freight cars may be filled easily and economically from either one or both of said sets of kilns.

A further object is to provide in a drying kiln improved means for circulating the drying medium through the ware.

My invention consists in the construction, arrangement and combination of the various parts of the device, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which:

Figure 1 is a plan view of my improved combined drying and burning kiln.

Figure 2 is a detail sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a detail sectional view taken on the line 3—3 of Figure 1.

Figure 4 is a detail sectional view taken on the line 4—4 of Figure 1.

Figure 5 is a segmental, longitudinal, sectional view taken on the line 5—5 of Figure 1.

Figure 6 is an enlarged, detail, segmental, sectional view showing a tile supporting floor, taken substantially on the line 6—6 of Figure 2.

Figure 7 is a detail sectional view taken on the line 7—7 of Figure 1.

Figure 8 is a detail sectional view taken on the line 8—8 of Figure 2.

My improved kiln construction comprises a drying kiln 10, a second drying kiln 11 and a burning kiln 12, all of said kilns being in the form of an arched tunnel and arranged in common alinement. The drying kilns 10 and 11 have their adjacent ends spaced a considerable distance apart, while the adjacent ends of the kilns 11 and 12 are joined. The bottoms of all of said kilns are provided with tracks 13 for supporting ware bearing cars 14. The upper surface of each of the cars 14 is provided with a fireproof floor construction formed of a series of transversely arranged blocks 15. The adjacent edges of said blocks are provided with

grooves 16 so arranged that when the blocks are laid side by side on the said cars, transversely arranged passages will be provided, which are open at each end and top. The floor is so constructed that tile 17 may be stacked thereon in a vertical manner so that vertical passages may be provided through the stack of ware which will communicate with the horizontally and transversely arranged passages in the floor.

Supported at each side of the cars 14 and resting on the floor of the kilns 10 and 11 I have provided conduits 18, the top faces of which are slightly below the horizontal passages through the floor blocks 15. Arranged above each of the conduits 18 is a second conduit 19 which has its inner side open and in alignment with said horizontal passages. The upper surfaces of the conduits 19 are provided with a series of upwardly extending nozzles 20, while the upper faces of the conduits 18 are also provided with a series of upwardly extending nozzles 21, the nozzles 21 being arranged beneath and in alignment with the nozzles 20. The conduits 18 are connected by means of a transversely arranged conduit 22, one end of which extends upwardly along one side of the kiln 12 adjacent to the kiln 11 and has its upper end operatively connected with a blower casing 23, which is provided with a suitable blower mechanism not illustrated, and which may be operated by a suitable motor 24.

The casing 23 is provided with an intake pipe 25 which may be connected with the interior of the burning kiln 12 at various convenient points in the cooling end of said kiln, so that heated air may be drawn from said kiln and delivered to the conduits 18 under pressure, which will be discharged through the nozzles 21 and into the nozzles 20, thereby causing an induced air current through the passages 16 and downwardly through the vertical passages of the ware, which will be discharged upwardly between the sides of the ware and the inner face of the walls of the kiln in the manner as indicated by the arrows in Figure 2, thereby providing means for creating a very uniform circulation of air through said ware.

In the top of the kilns 11 and 10 I have provided a series of longitudinally extending pipes 26. The pipes of the kiln 11 are mounted in an end portion 27 above the ware in the cars and communicating with the interior of the burning kiln 12. The opposite ends of the pipes 26 of the kiln 11 are mounted in a header 28. A similar header 29 is provided for the kiln 10. The said headers 28 and 29 are connected by a pipe 30. The opposite ends of the pipes 26 of the kiln 10 are provided with upwardly extended portions 31 extending through the top of said kiln, thereby providing means

whereby heated air from the kiln 12 may be passed through the top of both of the kilns 10 and 11 and cause the space above the ware in said kilns to be heated. The blast from the nozzles 20 and the circulation formed thereby cause said heated air or gases to be moved downwardly through said ware, and the cooler air to be discharged upwardly and intermingled with said heated air, thereby providing a drying medium of quite uniform temperature.

It will be seen in Figure 1 that I have provided a second set of kilns 10<sup>a</sup>, 11<sup>a</sup> and 12<sup>a</sup> similar to the ones above described and parallel therewith, said kilns being spaced apart a considerable distance so that a double railroad track 32 may be placed between said kilns, and also tracks 33 and 33<sup>a</sup> placed between said railroad tracks and the corresponding kilns. The said tracks 33 and 33<sup>a</sup> are designed to receive the kiln cars by means of suitable transfer cars 34 which are mounted on transversely arranged tracks 35 and 35<sup>a</sup>. By this arrangement it will be seen that loaded kiln cars from either the kilns 12 or 12<sup>a</sup> may be moved to the respective tracks 33 or 33<sup>a</sup>, which run parallel and adjacent to the tracks 32, so that ware may be easily and quickly loaded from said kiln cars directly to the freight cars with a minimum amount of labor.

Located near the outer wall of the kiln 10 and at each end, I have provided a tile machine 36, both of which are designed to receive material from a pug mill 37 located between said tile machines. Said tile machines and said pug mill are simply illustrated diagrammatically, as the details of construction of the machines form no part of my present invention. In alignment with the delivery end of each of said tile machines 36 are conveyors 38 and 39. The conveyor 38 has its upper run located slightly above the top surface of the cars 14 and 14<sup>a</sup>, the lower run of said conveyor extending beneath said cars. Any suitable means may be provided for mounting and operating said conveyors, so they may be caused to rotate in either direction.

By this arrangement it will be seen that tile from the left hand tile machine, as shown in Figure 1, may be delivered to the conveyor 38 and received from said conveyor 38 and placed on the bottom of the car 14 or 14<sup>a</sup>, which should be partially loaded, after which the said partially loaded cars are moved through the kilns 10 and 10<sup>a</sup> and to a point between said kilns 10 and 10<sup>a</sup> and the adjacent kilns 11 and 11<sup>a</sup> respectively.

The conveyor 39 is mounted in such a manner as to pass above this first tier of tile, in the manner clearly shown in Figure 5. Tile may then be delivered from the second tile cutter 36 to the conveyor 39, and from said conveyor 39 to the cars 14 or 14<sup>a</sup>

and stacked on top of the first tier of dried tile, after which it may be moved through the kilns 11 and 11<sup>a</sup>. The kiln 10<sup>a</sup> is also provided with tile cutters 36<sup>a</sup> and a pug mill 37<sup>a</sup> similar to the one above described, so that either one of these milling outfits may be used to deliver tile to either one or both of said sets of kilns.

At a point adjacent to the outer walls of the kilns 10 and 11 and located between their adjoining ends, I have provided a series of brick machines 40, a similar set of brick machines being provided for the kilns 10<sup>a</sup> and 11<sup>a</sup>. Each of said brick machines is provided with a conveyor 41. In the drawings I have illustrated the brick machines as arranged in groups of three. The conveyor 41 of the forward one of said brick machines is longer than the conveyor 41 of the second brick machine, and so on in the manner clearly illustrated in Figure 1, so that material from the outer one of said brick machines may be delivered to the inner edge of the platform of the cars 14, while the material from the second tile machine may be delivered to the center of said cars, and the material from the third tile machine delivered to the outer edge of said platform. The operator stands on the car platform, while laying the ware, which is arranged in the manner illustrated at the point 42.

By this arrangement it will be seen that I have provided means whereby the ware may be easily and quickly placed on said cars with a minimum amount of energy. The conveyors 41 are pivotally mounted relative to the brick machines in such a manner that they may be elevated to a vertical position when not in use, as shown by dotted lines in Figure 7, to thereby permit the cars to be loaded with tile as previously described.

In connection with the loading of the tile from the conveyor 39, it should be mentioned that a platform 43 is provided on which the operator stands, said platform being located above the first layer of tile, as clearly shown in Figure 5. This platform is detachably and slidably mounted on suitable supports 44, so that it may be moved to a convenient position adjacent to the stock being piled. If the operators are stacking the ware faster than the advance of the ware bearing cars, the platform 43 may be moved rearwardly to a position partially under the upper run of the conveyor 39, or vice versa.

Thus it will be seen that I have provided pair of combined drying and burning kiln, said combined kiln being arranged in pairs in such a manner that the said pair of kilns may be economically operated at a minimum amount of labor and power.

It will further be seen that each set of kilns may be provided with its own set of mills, which are provided with suitable de-

livery conveyors so arranged that the mills may be used for one set of kilns or to both sets of kilns, thereby avoiding delays on account of one of the sets of mills being inoperative.

It will further be seen that I have provided an improved circulating system for the drier kilns.

I claim as my invention:

1. In a device of the class described, a series of drying kilns and a burning kiln arranged in common alinement, said drying kilns being slightly spaced apart, said burning kiln being arranged adjacent to the outer end of one of said drying kilns, means for conveying ceramic ware through all of said kilns, means for delivering plastic ware to said conveying means at the outer end of one of said drying kilns so that said conveying means may be partially loaded, and means for delivering plastic ware to said conveying means at a point between two adjacent drying kilns so that the said conveying means may be completely loaded.

2. In a device of the class described, combined drying and burning kilns, means for conveying ceramic ware through all of said kilns, means for delivering plastic ware to said conveying means at a point adjacent to the receiving end of said drying kiln, and means for delivering plastic ware to said conveying means at a point between the receiving and delivery ends of said drying kilns.

3. In a device of the class described, a pair of combined drying and burning kilns arranged parallel and spaced apart, means for conveying ceramic ware through each combined drying and burning kilns, means for conveying plastic ware to either of said conveying means at the receiving end of said drying kilns, and means for delivering plastic ware to either of said conveying means at a point between the receiving and delivery ends of said drying kilns.

4. In a device of the class described, a pair of drying kilns arranged parallel and spaced apart, means for conveying ceramic ware through each of said kilns, means for conveying plastic ware to either of said conveying means at the receiving ends of said kilns, and means for delivering plastic ware to either of said conveying means at a point between the receiving and delivering ends of said drying kilns.

5. In a device of the class described, a pair of drying kilns arranged parallel and spaced apart, means for conveying ceramic ware through each of said kilns, means for conveying plastic ware to either of said conveying means at the receiving end of said kilns, means for delivering plastic ware to either of said conveying means at a point between the receiving and delivering ends

of said drying kilns, and means for delivering plastic ware to either or both of said delivering means.

6. In a device of the class described, a pair of drying kilns arranged parallel and spaced apart, means for conveying ceramic ware through each of said kilns, means for conveying one form of plastic material to either of said conveying means at the receiving end of said kiln, means for delivering the same form of plastic material to either of said conveying means at a point between the receiving and delivering ends of said kilns, and means for delivering another form of plastic material to either of the last receiving points of said kilns.

7. In a device of the class described, a pair of drying kilns arranged parallel and spaced apart, means for conveying ceramic ware through each of said kilns, means for conveying one form of plastic material to either of said conveying means at the receiving ends of said kilns, means for delivering the same form of plastic material to either of said conveying means at a point between the receiving and delivering ends of

said kilns, means for delivering another form of plastic material to either of the second receiving points of said kilns, and means for delivering plastic material to either or both of said delivery means.

8. In a device of the class described, slightly spaced and adjacent drying kilns, means for conveying ceramic ware through all of said kilns, means for delivering plastic ware to said conveying means at a point adjacent to the receiving end of one of said drying kilns, and means for delivering plastic ware to said conveying means through the space between said kilns.

9. In a device of the class described, a drying kiln, means for conveying ceramic ware through said kiln, means for delivering plastic ware to said conveying means at a point adjacent to the receiving end of said drying kiln, and means for delivering plastic ware to said conveying means at a point between the receiving and delivery ends of said drying kiln.

Des Moines, Iowa, April 8, 1926.

HALVER R. STRAIGHT.