ABSTRACT: A three- or four-legged deck stool of castable refractory composition for supporting brick or other objects to be fired on a kiln car, has, as an object-supporting top integral with the legs, a nearly square plate with evenly spaced, parallel, round-bottomed V-grooves defining therebetween like ridges having coplanar respective narrow flat longitudinal lands providing bearing surface for object support. Every second ridge includes a series of longitudinally equispaced upwardly tapering like shaped hot gas passage holes longitudinally offset from holes in adjacent series; each hole opening upwardly symmetrically through the land and sloping walls on each side thereof. For building brick firing, the stools are preferably fabricated of a petalite or cordierite or equivalent castable refractory composition, and so proportioned, with a slight spacing between adjacent stools, as to provide an effectively continuous object supporting plane coextensive with but spaced from the car top, and effectively longitudinally continuous from car to car in a tunnel kiln.

In subjecting a number of objects to the action of hot gases, as in firing brick, tile and other ceramic objects, or for heating objects for other purposes, it is necessary to provide support equipment on which the objects may be arrayed, spaced in relation to each other and also vertically above a movable support such as a kiln car, so that a required application, distribution and circulation of hot gases to or about the objects is obtained.

In the case of tunnel kiln firing, the objects are supported on a kiln car by spacing means of refractory composition, such as deck stools; and the present invention, though having broader application, is herein described in terms of kiln car deck stools for supporting building brick to be fired. With known suitable refractory compositions, for a given support or stool structure there is usually a compromise made in the actual composition and processing of the refractory material used between load supporting strength, brittleness, refractory character, and the heat shock resistance obtained in the final refractory stool.
KILN CAR DECK STOOL

A general object of the present invention is to provide improved kiln car furniture for support of brick, tile or other objects similarly to be fired or subjected to action of heat in a tunnel kiln, wherein over a cycle period of several hours the objects to be fired and consequently the car and stool equipment are raised from ambient or room temperature to as much as about 2,000° F., and brought back to a temperature of say 250° before exit of the car into the ambient atmospheric temperature.

Another object is to provide a kiln car stool structure for the described purposes affording an excellent distribution of the heating gases, about objects to be subjected to heating action for firing or analogous purposes, and a consequently advantageously improved heating and firing of the objects. A further object is to provide a kiln car stool for the named purposes, which is adapted to castable refractory fabrication techniques, and in which support or bearing surface for the object may be provided adequate with normal handling to avoid, for example, indenting clay objects placed thereon to be fired, while yet not interfering with good circulation about and contact with the objects by the hot gases.

Other objects and advantages will appear from the following more detailed description of a particular embodiment of the invention and from the drawings wherein:

FIG. 1 is a side view of kiln car top region showing in side elevation stools in accordance with the invention arrayed on the car top for supporting brick to be fired in a tunnel kiln;

FIG. 2 is a top plan view of a single stool;

FIG. 3 is an end elevation of a single stool;

FIG. 4 is a fragmentary detail in plan of the stool top plate surface form; and

FIG. 5 is a fragmentary detail end view of the top plate structure.

As the environment of use of the invention, in FIG. 1 there is shown in side elevation the top portion A of one kiln car of an endwise “interlocked” series of cars moving through a tunnel kiln (not shown), each carrying a single layer load of building bricks B supported in spaced relation to each other and to the flat kiln car top on what is in effect a substantially continuous horizontal surface provided by top plate portions of an array of like kiln car deck stools S. Thus beneath the bricks there is afforded, between the kiln car top and the plane defined by the stool top plate portions, a space into which the firing flame is projected from opposite sides of the kiln, along which waste gases pass through the length of the tunnel. The structure of an individual stool and particularly of the essential support plate, is shown in and described with respect to FIGS. 2-5 inclusive.

The three-legged stool, shown in the drawings as one embodiment of the invention, as an integral structure, is comprised of an article-supporting top plate 11, two similar legs 12, 12, each of downwardly tapering blunt L-shaped or right angle horizontal cross section and located near the corners on one side of the top plate structure, and a third leg 13, generally downwardly tapering but rectangular in cross section. The outer vertical faces of the legs have a design location spaced inwardly of the plate edge projection, to obviate likelihood of interference between legs of adjacent stools consequent upon warpage in manufacture.

As seen particularly from FIG. 2 in conjunction with FIG. 3, through the bottom surface 11a of the plate portion 11 is generally flat, the top is undulant or corrugated by a series of equally spaced parallel generally round-bottomed, like V-shaped grooves 15 defining therebetween sloped walled like ridges 16, each of which terminates in a narrow longitudinal flat land 17; the lands being all coplanar with each other in a plane parallel to the plate bottom surface 11a.

As more readily seen in FIG. 2, in plate 11 a multiplicity of upwardly convergent like holes 19 are arranged in a perforation pattern wherein alternating ridges have respective series of equally longitudinally spaced holes centered on the longitudinal centerline or center plane of the respective ridge; each opening at the top through a mouth elongated transversely to the ridge. The intervening ridges are not apertured and, of course, at the locations of the respective integral leg junctures with the plate bottom, holes are lacking that would otherwise appear in certain series. As further seen in FIG. 4, from a circular inlet cross section on the plate bottom side of diameter about equal to the ridge bottom width each hole tapers to an outlet opening intersection with the ridge flat and sloping sidewalls, the projection of which on a horizontal plane is an ellipse with major diameter transverse to the ridge and about equal to the ridge base width.

To provide a more even distribution of the flow openings, and hence of upwardly flowing gas, the number of full ridges is odd; but on each side margin of the top plate, there occurs an upward “half ridge” with about full width land, however, the first full ridge from each side being a perforated ridge, and the holes in adjacent series being offset from each other by half the regular longitudinal spacing. With each hole opening symmetrically through a flat land and the slopes on opposite sides thereof, upwardly passing gas streams, in encountering flat end surfaces of supported objects such as bricks, are directed to both sides of the ridge at each hole, thence to pass in both directions longitudinally in each of the two grooves defined between the adjacent ridge and the imperative ridges on each side thereof. Thus in tunnel kiln firing from opposite sides of the car inwardly under the stools, the gases pass upwardly through the holes, is distributed in longitudinal directions from each hole to pass around the edges of all brick end faces overlaying such holes and then upward along the exposed long brick faces to the top of the load. Thus there is obtained throughout the load an excellent distribution of the hot gases flowing from below the stools upwards around the brick sides, both for uniform heating in the load, also effectively to carry away evaporated moisture in initial stages, and ultimately to evenly and thoroughly heat and fire each entire brick.

The plate structure disclosed, whether incorporated in a stool or made in a legless form to be supported say on upended fire brick in place of integral legs, further is well adapted to production by known methods of fabrication from castable or pressed refractory compositions, preferred among which are petalite-containing or cordierite-containing compositions as known and available in a wide variety for obtaining desired and suitable compromises between load sustaining strength, brittleness, refractory capability and thermal cycling shock resistance in the finished stool form. In legless form, the basic stool structure may be dry-pressed from appropriate refractory composition; though for better heat shock resistance a cast plate would be preferred.

For a brick kiln car having a top deck 10 feet long and 9 feet wide and adapted for “interlocking” with like forward and trailing cars, the car being intended to take a single layer load of standard building bricks, as 8 by 8 array of stools as next detailed would be used, in which the nearly square top plate portions are spaced about one-fourth inch from each other.

For such arrangement, an individual stool, shown in the drawings and found advantageous, could have an overall height from the feet to land plane of about 11½ inches with a nominal spacing of the external leg faces of at least one-half inch inward of the plate periphery projection; and a 14 groove top plate portion about 13 5/16 inches long (that is, in direction parallel to the ribs) and 14% wide, with a total thickness of 1¼ inches from plate bottom to the flat lands and a 3/16-inch-groove depth. The center planes of the holes on the ridges, that is, the spacing between hole-bearing ridges (every second ridge) is aptly approximately 2 3/32 inches, and thus approximately 1 1/2 inches between the successive ridges; the flats or lands of the ridges being three-sixteenths inch wide; the holes appropriately having a conical bore from a 1/16-inch-bottom circular shape to what would be a 1/4-inch-circular diameter at the land, or in the projected ellipse stated as an approximation, a 1/8-inch-minor axis centered on the land and a 1-inch-major axis transverse thereto. The plate portions of the stools are similarly oriented, with ridge running trans-
versely of the car as the optimum disposition. The thickness in leg 13 and side of the right-angle section in 12 is about 1/4 inches where the flaring junction to the plate begins; a 1/4-inch draft or taper being provided over the straight leg lengths from that level to the bottom. In four-legged stools the leg form 12, 5 of course, is used at each corner.

For one final standard building brick size of 8 by 3% by 23/4 inches, resulting after 10 percent kiln shrinkage of ‘wet’ bricks each having as loaded a 5-pound unit weight, with the bricks loaded standing on end with the brick width extending across the land direction, and evenly arrayed on stools as above described, the bricks will each be supported on at least three ridge flats, representing at least about 1.3 sq. inches per brick of bearing or contact with the stool; and 768 to 900 bricks may be easily loaded per car, representing an initial loading of 43 to 50 pounds per square foot on the stools or 60 to 70 pounds per stool. The structure of the plate portion 11 with holes disposed in the ridges as described provides great gas flow area in the holes yet excellent strength in the supporting plate to sustain such loading, whether the stool structure for the car be provided by plates as described but with complete hole series in each perforated ridge and placed upon fire bricks as separate legs, or by the integrally legged stools as described.

1 claim:

1. For objects to be subjected to high-temperature heating, as a load borne by and spaced above the deck of a car or the like in a kiln by hot gas projected horizontally between the deck and the load, a support structure of refractory material comprising:

a top plate and symmetrically disposed leg means to maintain the plate in spaced relation to said deck;
the upper face of said top plate having a plurality of parallel equispaced grooves defining between successive grooves parallel ridges;
each said ridge including a longitudinal flat top land strip, said land strips substantially horizontally coplanar;
said plate perforated by a multiplicity of vertical holes arranged in a pattern affording substantially uniform distribution of holes over the plate area;
said grooves being broad round bottomed in cross section, and each said hole terminating at the upper face in a mouth opening through and to each side of a top land strip of a said ridge.

2. As a support structure for firing brick or the like, the structure as described in claim 1, wherein said multiplicity of holes is provided by a series of throughholes in every second ridge, with the intervening ridges unperforated; the majority of the holes excepting in series in ridges passing over locations of said legs, being substantially equally longitudinally spaced along their respective ridges.

3. The structure as described in claim 2, wherein the holes in the successive apertured ridges are longitudinally offset from those in adjacent series.

4. A structure as described in claim 1 wherein each of said holes opens at the plate upper face through a discharge mouth extending symmetrically transversely across a ridge land into adjacent sloping ridge sidewalks.

5. A structure as described in claim 3 wherein each said hole is upwardly tapering or convergent, from a substantially round inlet at the plate bottom face, to said mouth.

6. As a kiln car stool adapted for support of bricks to be fired, the structure as described in claim 1, with said leg means comprising at least three legs integrally cast with said top plate from a castable refractory composition.

7. The kiln car stool as described in claim 6, fabricated of a castable refractory composition having as a primary functional refractory base a mineral selected from the group consisting of petalite, cordierite and mixtures thereof.

8. A kiln car stool adapted for support of bricks borne by and spaced above the deck of a kiln car for firing by hot gas projected horizontally between the deck and the bricks, a structure of refractory material integrally comprising:
a brick-supporting top plate and leg means symmetrically disposed on the bottom of the plate to maintain the plate in spaced relation to said deck;
said leg means comprising at least three legs;
the upper face of said top plate having a plurality of parallel equispaced grooves defining, between successive grooves, parallel ridges; each said ridge including a longitudinal flat top land strip, said land strips substantially horizontally coplanar;
said plate perforated by a multiplicity of vertical holes arranged in a pattern affording substantially uniform distribution of holes over the plate area unobstructed by said legs;
said grooves being broader than the land strips and round-bottomed in cross section; and each said hole terminating at the upper face in a mouth opening through and to each side of a top land strip of a said ridge.

9. A kiln car stool as described in claim 8, fabricated of a castable refractory composition having as a primary functional refractory base a mineral selected from the group consisting of petalite, cordierite and mixtures thereof.

10. A kiln car stool as described in claim 8, wherein said multiplicity of holes is provided by a series of throughholes in every second ridge, with the intervening ridges unperforated; the majority of the holes being substantially equally longitudinally spaced in series along respective ridges; the holes in the successive apertured ridges being longitudinally offset from those in adjacent series.

11. A kiln car stool as described in claim 10, wherein each of said holes opens at the plate upper face through a discharge mouth extending symmetrically transversely across a ridge land strip into adjacent sloping ridge sidewalks.

12. A kiln car stool adapted for support of bricks borne by and spaced above the deck of a kiln car for firing in a kiln by hot gas projected horizontally between the deck and the bricks, a structure of a castable refractory material comprising:
a brick supporting top plate and symmetrically disposed leg means to maintain the plate in spaced relation to said deck;
the upper face of said top plate having a plurality of parallel equispaced grooves defining between successive grooves parallel ridges; each said ridge including a longitudinal flat top land strip, said land strips substantially horizontally coplanar;
said plate perforated by a multiplicity of vertical holes arranged in a pattern affording substantially uniform distribution of holes over the plate area unobstructed by said legs;
said leg means comprising at least three legs integrally cast with said top plate from said castable refractory composition.

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