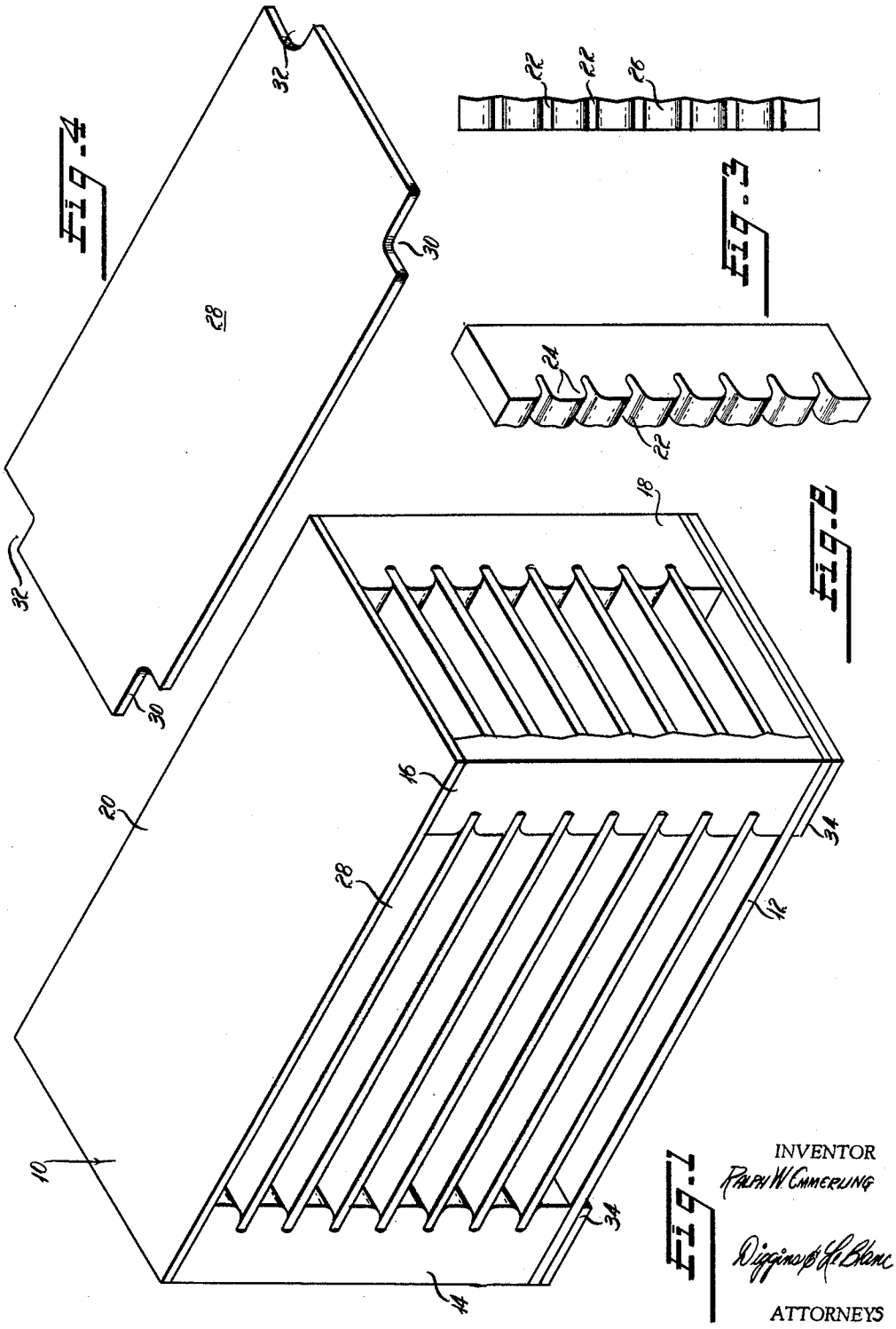
Feb. 9, 1960 R. W. EMMERLING 2,923,997

SAGGERS

Filed July 9. 1956 2 Sheets-Sheet 1



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SAGGERS

Filed July 9. 1956 2 Sheets-Sheet 2

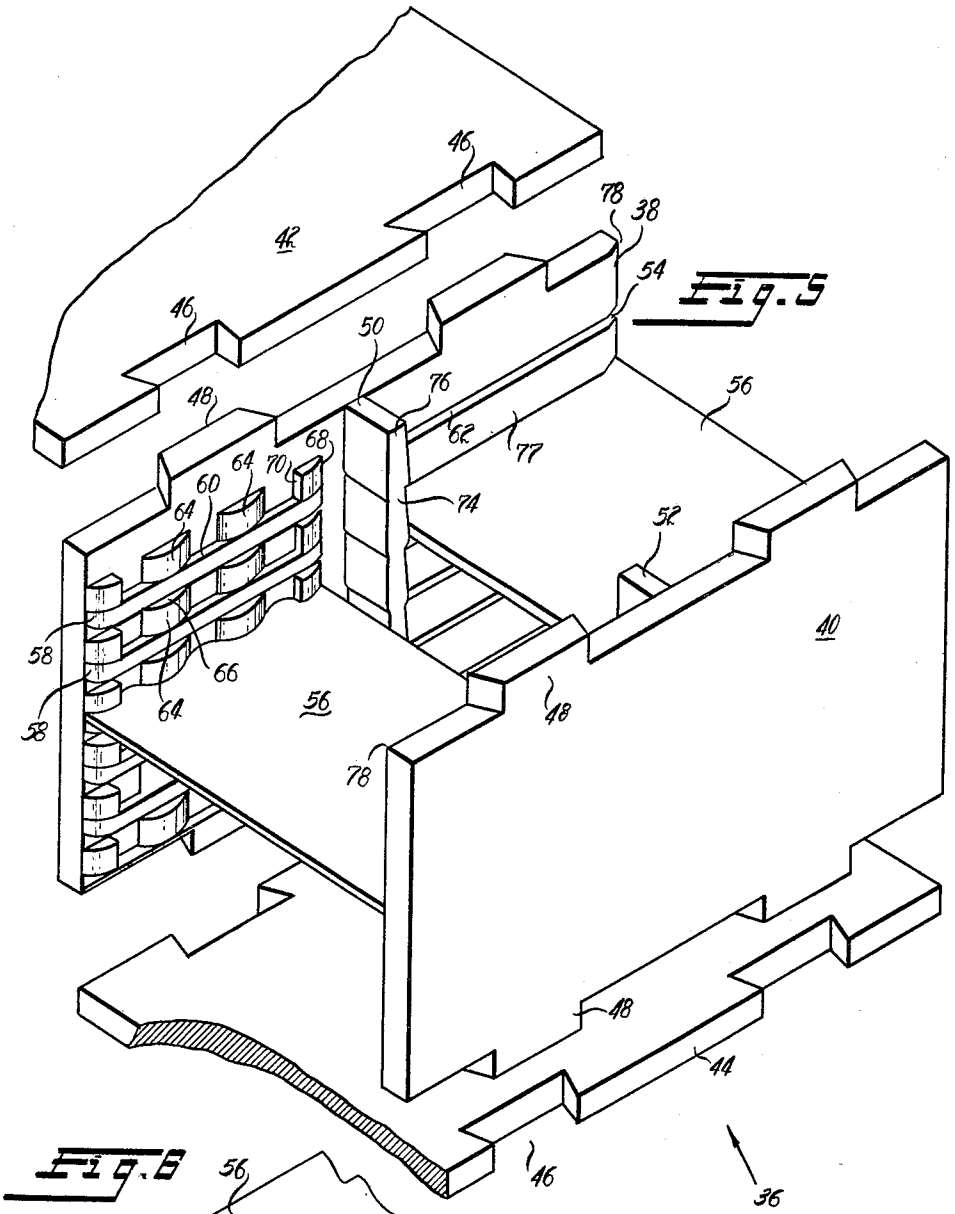


Fig. 5

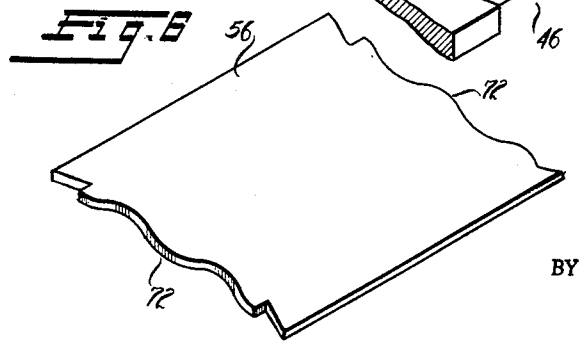


Fig. 6

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2,923,997

SAGGERS

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Application July 9, 1956, Serial No. 596,663

7 Claims. (Cl. 25—153)

This invention relates to a device for exposing ceramic ware to the heat of a kiln in the heat treatment of the ware and more particularly relates to a device for supporting ceramic tile during a glazing operation.

The glazing of ceramic tile is a quite old process and a large number of support devices, commonly known as saggers, have been devised for supporting the tile in the kiln. Generally speaking the saggers heretofore utilized have consisted of a vertical support holding a plurality of parallel superposed ceramic plates between which the tiles are inserted. While these devices have long been used to produce more or less satisfactory glazed tile they are subjected to a number of disadvantages which have the effect of raising the cost of the tile.

The current tendency towards the mass production of homes and the mass production of all elements of construction used therein has given added importance to small savings in cost of mass produced items such as glazed tile. Thus, a completely satisfactory sagger should not only be constructed of relatively low cost materials, but it should be of such a nature that the sagger itself can be constructed in a minimum time with a minimum amount of labor and its construction should facilitate the rapid loading of tiles to be glazed with a minimum number of rejects due to damage to the glazed surface.

In order to utilize the kiln capacity to a maximum extent the ratio of the weight of the sagger to the weight of the ware and the ratio of the volume of the sagger to the volume of the ware should be as low as possible and the refractory of the sagger should have a high thermal conductivity to permit better absorption and dissipation of heat for faster cycling of the kiln. The sagger design should be such that heating and cooling by convection is facilitated and every advantage of radiation should be taken.

It is accordingly a primary object of the present invention to provide an improved sagger which facilitates the rapid and economical production of glazed tile.

It is another object of the invention to provide an improved sagger which permits rapid loading without damage to the glazed surface of the tile.

It is another object of the invention to provide an improved sagger having low ratios of the weight of the sagger to the weight of the ware and of the volume of the sagger to the volume of the ware.

It is another object of the invention to provide an improved sagger having a high thermal conductivity and having a hot and cold mechanical strength which permits the use of thin sections.

It is another object of the invention to provide an improved sagger which is so constructed as to permit rapid heating and cooling of the tiles by convection and to also permit expansion and contraction of the sagger shelves without fracture.

It is another object of the invention to provide an improved sagger formed of a refractory material which provides high mechanical strength, high thermal conductivity and high hot load strength.

These and further objects and advantages of the invention will become apparent upon reference to the following specification and claims and appended drawings wherein:

Figure 1 is a perspective view of a sagger constructed according to one embodiment of the invention;

Figure 2 is a perspective view of one of the support posts of the sagger shown in Figure 1;

Figure 3 is a vertical elevation of the support post of Figure 2 showing the edge thereof;

Figure 4 is a perspective of one of the intermediate shelves of the sagger of Figure 1;

Figure 5 is an exploded view of a sagger constructed according to another embodiment of the invention; and

Figure 6 is a perspective view of one of the intermediate shelves of the sagger of Figure 5.

Referring to Figures 1 through 4, a sagger generally indicated at **10** is comprised of a rectangular bottom shelf **12**, four support posts **14**, **16** and **18** and a rectangular top shelf **20**. All of the support posts are identical and are comprised of elongated rectangular members having slots **22** in one edge thereof and having radius corners **24** at the edges of the slots. As is seen in Figure 3, one flat side of the support posts is provided with a series of shallow V corrugations **26** and the apexes of the V-shaped corrugations fall substantially equidistant of the slots **22**. Reference to Figure 1 will show that the support posts **14** and **16** which are at the back of the sagger are mounted with their flat uncorrugated surfaces contiguous to the long edge of the bottom shelf **12** while the other two support posts **18** are mounted with their flat uncorrugated surfaces contiguous the short edges of the bottom shelf **12**. A plurality of intermediate shelves **28** cut away at **30** and **32** to receive the unslotted portions of the support posts are mounted within the slots **22**. A pair of strips **34** are mounted along the lower edges of the lowermost shelf **12** in order that the superimposed load which occurs upon stacking the saggers may be concentrated on the four corners to eliminate transverse strains.

The support posts are cemented at their tops and bottoms to the top and bottom plates **20** and **12** respectively, but the intermediate plates **28** are retained within the support posts merely by the cooperating shapes of the shelves and support posts, all supports being provided by the slots. This structure permits free expansion and contraction of the intermediate shelves during a cycle of operation and prevents breakages which have heretofore occurred in rigid sagger assemblies. The radius edges **24** of the slots **22** guide the intermediate shelves into the slots during assembly of the sagger to expedite sagger construction and the identical nature of all support posts further minimizes expense and expedites sagger assembly. The V-shaped corrugations in the flat surfaces of the posts prevent the glazed surface of the tile from contacting the posts and thereby prevents any marring of or damage to this surface. The particular shape of the sagger, and particularly the arrangement of the support posts, facilitates sagger loading in that the operator can merely push the glazed tiles onto the shelves from the front of the sagger until the rear edge of the tiles strikes the inner V-shaped surfaces of the support posts **14** and **16**. Because of the V-shape of the posts this contact does not damage the tile but immediately informs the operator that the tile is properly placed in the sagger and no further alignment is necessary. The sagger shown in Figure 1 is constructed to accept two tiles on each shelf although other sizes of saggers are possible.

As seen in Figure 1, the shelves of the sagger are quite thin thereby resulting in low ratios of the weight of the sagger to the weight of the ware and of the volume of the sagger to the volume of the ware and the construction

is open so that heating and cooling through convection is facilitated.

In order to obtain the desired mechanical strength to permit such thin shelves and to provide the desired high thermal conductivity it has been found that the following refractory material is advantageous:

	Percent
Calcined alumina	72.5
Ray 48 mesh kyanite	2.5
Ball clay (air floated)	25.0

The refractory is prepared by grinding a 12,000 lb. batch of the foregoing formula for 10 hours in a ball mill with 1020 gallons of water. After the grinding 99.5% of the wet ground body will pass a 200 mesh standard screen (screen opening .0029 inch) and the batch is then filter pressed and the filter cakes dried to zero moisture. The dry filter cakes are then crushed, pulverized through an impact mill and screened to minus 16 mesh (screen opening .0465 inch).

A typical screen analysis of the screened body is as follows:

Screen Mesh	Opening, inches	Percent on Screen	Percent Through Screen
16	.0465		100.00
28	.0232	16.04	83.96
48	.0116	30.40	69.60
80	.0069	38.94	61.06
150	.0041	46.86	53.14
200	.0029	50.30	49.70
325	.0017	57.36	42.64

Four 100 pound batches of the screened body with an addition of 0.5% organic binder and 4.0% water are then mixed in a muller type mixer for 10 minutes. The body is next pulverized in an impact mill and placed in storage ready for use.

A typical screen analysis of the body prepared for pressing is as follows:

Screen Mesh	Opening, inches	Percent on Screen	Percent Through Screen
28	.0232	0.18	99.82
48	.0116	.038	99.62
80	.0069	1.50	98.50
150	.0041	8.60	91.40
200	.0029	12.78	87.22
325	.0017	19.73	80.27

In pressing the die cavities of a friction press are filled with material which is then pressed with four impact blows. The pressed pieces are dried at 200° F. in a periodic convection type drier for 12 hours and are then set on kiln bars in a vertical position and fired in a continuous gas fired tunnel kiln to 2550° F. on a 48 hour cycle. The pieces are inspected for cracks by sounding and warpage is checked by a gage set for a tolerance of plus or minus .002 inch per inch of strength.

Turning to Figures 5 and 6 there is shown another embodiment of the invention wherein a sagger indicated generally at **36** is comprised of a pair of side support plates **38** and **40** which are tenoned to top and bottom plates **42** and **44**. The top and bottom plates **42** and **44** are provided with mortises **46** which mate with tenons **48** on the side plates **38** and **40** and these members are cemented together.

The inside surfaces of the side plates **38** and **40** are divided into two equal sections by means of short vertical inwardly extending wall portions **50** and **52**. The inner surface of side plate **38** to the right of wall portion **50** is provided with a plurality of horizontal slots **54** which are adapted to receive one edge of shelves **56**. The other side of the inner surface of the side plate **38** to the left of wall portion **50** is provided with a plurality of horizontal ridges **58** having an upper surface **60** which is at the same level as the lowermost edge **62** of slot **54**.

Extending from the inner surface of the left end of the side plate **38** atop the ridge surfaces **60** are a plurality of arcuate projections **64** which terminate short of the undersurface of the overlying ridge. That is to say the upper surface **66** of projection **64** is spaced from the undersurface of the ridge **58** by a distance which is greater than the thickness of the shelf **56** and the upward heighth of the projections is less than the combined thickness of a shelf and tile laying therein. At either end of the ridges **58** are projections **68** which are approximately one half of the length of the projections **64** and which are provided with flat edges **70**.

Referring to Figure 6 the sides of the shelves **56** are shaped to mate with the projections **64** and **68** and are assembled in the sagger by inserting one edge **72** into the slot **54** while the shelf is maintained in a cocked position so that the other edge **72** is received in the space between the upper surfaces **66** of the projections **64** and **68** and the lower edge of the ridge **58**. The shelf is slid into the sagger until its inner edge strikes the wall portions **50** and the edge above the projections **64** and **68** is then lowered to rest upon the surfaces **60** of ridges **58**. When in this position the shelf is locked by projections **64** and **68** and need not be cemented into position, thereby permitting free expansion and contraction without damage to the sagger.

The surfaces of wall portions **50** and **52** are corrugated, that is the wall portions are tapered from a thick section **74** which is generally on a level with the shelves to a thin portion **76** so as to prevent damage to the glazed surface of the tile upon its insertion into the sagger. The surfaces **77** between slots **54** are similarly tapered for the same reason. It will be apparent that the inner surface of side plate **40** opposite projections **64** and **68** on side plate **38** is provided with grooves **54**, while the inner surface of side plate **40** opposite the inner surface of side plate **38** having grooves **54** is provided with projections **64** and **68**. The inner end edges **78** of side plates **38** and **40** at the slotted sides thereof are radiused or beveled to permit rapid and easy insertion of the tile. The arcuate projections **68** on the inner surface of the opposite side plate serves this same function.

The refractory material utilized possesses a high hot and cold strength and thus permits the use of thin shelves with a resultant low ratio of the weight of the sagger to the weight of the ware and a low ratio of the volume of the sagger to the volume of the ware. This material further possesses a high thermal conductivity which permits a fast cycling of the kiln and allows the refractory to heat rapidly to provide increased benefits from radiation. The high hot load strength of the refractory provides exceptional resistance to slumping at elevated temperatures. The construction of the sagger embodies good stability for multiple stacking in the kiln and the combination of bonding and mechanical locking of the plates permits mechanical loading and unloading of the saggers into the kiln.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A sagger comprising a bottom plate and a top plate and vertical support means at both sides of said plates securing said plates together, a plurality of slots in said support means extending to the vertical edges thereof, and shelves mounted in and supported by said slots, said shelves having cutaway portions interlocking with por-

tions of said support means to prevent sliding removal of said shelves, said shelves being very thin and being comprised of calcined alumina, kyanite and ball clay, said support means including a corrugated surface parallel to the longer edges of said shelves for limiting the depth of insertion of tile supported on said shelves, said corrugations imparting a maximum thickness to said support means at the level of said slots, the recessed portions of said corrugated surface occurring intermediate said slots to provide clearance for the glazed surface of said tile.

2. A sagger according to claim 1 wherein said support means are corner posts, said posts comprising elongated members having slots in one edge thereof and having one side thereof with an undulating surface, two of said posts being mounted with said slots facing inwardly of said sagger in the same direction and the other two of said posts being mounted with said slots facing inwardly of said sagger in a direction perpendicular to said first direction.

3. A sagger comprising a bottom plate and a top plate and a pair of parallel side plates joining said bottom and top plates, each of said side plates having a plurality of parallel slots in the inner surface thereof, a plurality of parallel ridges on the inner surface of each side plate, said ridges on each plate being opposite said slots in the other plate, a plurality of protrusions from the inner surface of each plate extending upwardly from said ridges, and a plurality of shelves having one edge thereof received in said slots and the other edge thereof resting on said ridges, said other edge being shaped to matingly interlock with said protrusions.

4. A sagger comprising a bottom plate and a top plate and a pair of parallel side plates joining said bottom and top plates, each of said side plates having a plurality of parallel slots in the inner surface thereof, a plurality of parallel ridges on the inner surface of each side plate, said ridges on each plate being opposite said slots in the other plate, the slots and ridges in each side plate being separated by a vertical wall portion extending from the inner surface of the plate, a plurality of protrusions from the inner surface of each plate extending upwardly from said ridges, and a plurality of shelves

having one edge thereof received in said slots and the other edge thereof resting on said ridges, said other edge being shaped to matingly interlock with said protrusions.

5. A sagger comprising a bottom plate and a top plate and a pair of parallel side plates joining said bottom and top plates, each of said side plates having a plurality of parallel slots in the inner surface thereof, a plurality of parallel ridges on the inner surface of each side plate, said ridges on each plate being opposite said slots in the other plate, the slots and ridges in each side plate being separated by a vertical wall portion extending from the inner surface of the plate, a plurality of protrusions from the inner surface of said plate extending upwardly from said ridges, and a plurality of shelves having one edge thereof received in said slots and the other edge thereof resting on said ridges, said other edge being shaped to matingly interlock with said protrusions, said protrusions extending upwardly from said ridges a distance less than the combined thickness of a shelf and a tile mounted thereon.

6. A sagger as set out in claim 4 wherein the endmost protrusions on each ridge are of a different shape from the remaining protrusions and have one substantially vertical surface substantially perpendicular to said side plates.

7. A sagger as set out in claim 5 wherein said shelves are very thin and are comprised of calcined alumina, kyanite and ball clay.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,923,997 February 9, 1960

Ralph W. Emmerling

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 9, for "Ray" read — Raw —; line 45, in the table, third column thereof, under the heading "Percent on Screen", second line, for ".038" read — 0.38 —.

Signed and sealed this 23rd day of August 1960.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents