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G. W. REED

2,230,309

CERAMIC PRODUCT

Filed June 4, 1938

FIG. 1.

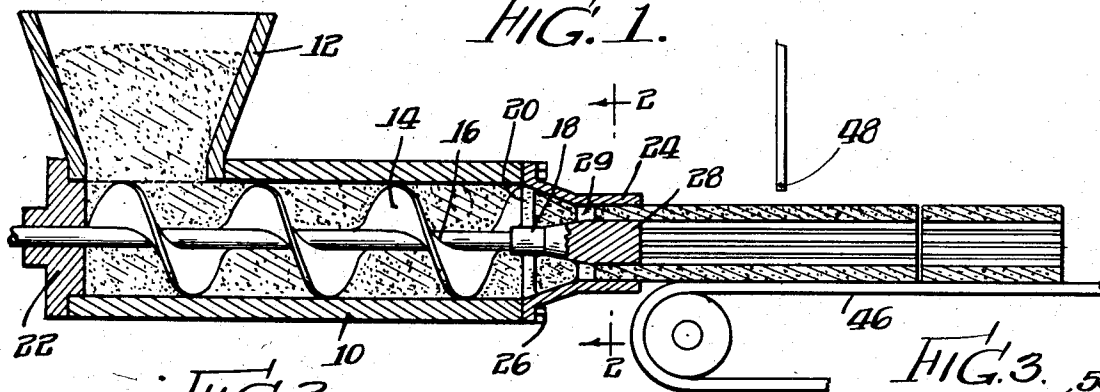


FIG. 2.

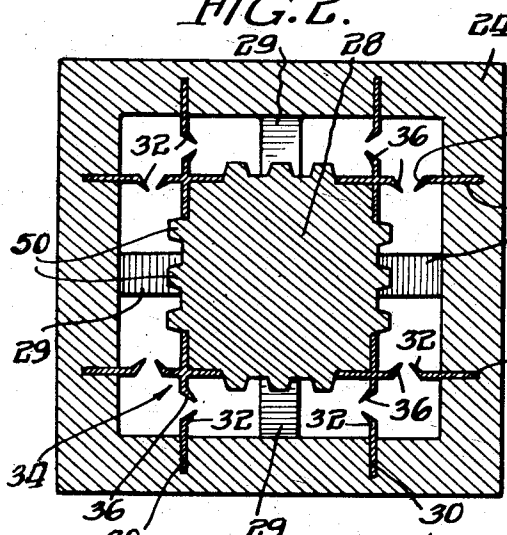


FIG. 3.

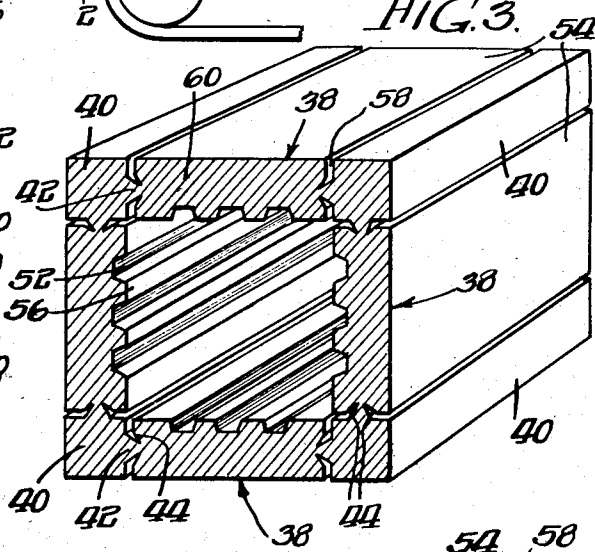


FIG. 4.

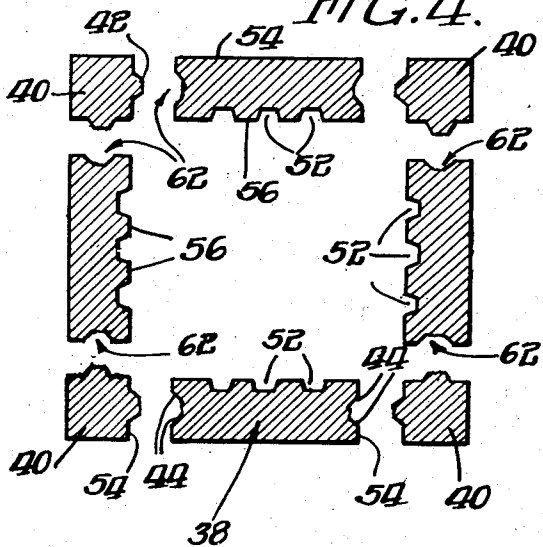


FIG. 5.

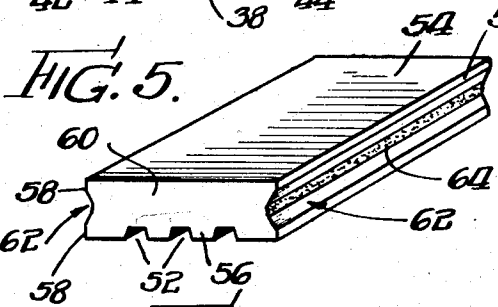
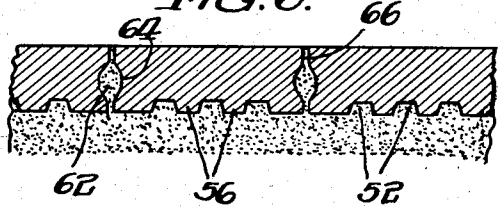


FIG. 6.



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CERAMIC PRODUCT

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10 Claims. (Cl. 72-37)

The present invention relates to the manufacture of ceramic construction units.

More particularly the present invention relates to the production of relatively vitreous units, such as building tiles, adapted for use in structures where a high degree of impermeability is desirable. Building units of this character are conventionally formed and "burned" in a kiln, the desired degree of vitrification of the product being dependent in large measure on careful control of the burning operation. The instant tiles being normally of prismatic shape, when packed into a kiln for burning, provide a relatively dense packing and, as a result, do not thoroughly ventilate during the heating operation. It is, accordingly, necessary, in order to maintain the desired uniformity and control of temperature, that the mass be heated in the kiln over a relatively great length of time. So also this product, in spite of slow and careful cooling, is, when made in the conventional manner described above, characterized by a great per cent of breakage since the product is relatively susceptible to destruction under adverse heat conditions.

The present invention more particularly contemplates the production of vitreous ceramic units of the above character by first providing a mass of suitable plastic material in the form of an element comprising a central aperture having a shape corresponding to the shape of a plurality of the ultimate units, but wherein the units are joined by integral connecting portions along opposite side edges and which may be broken apart to provide improved mortar adhering surfaces.

Unitary elements of this character may be readily stacked in the kiln to provide complete ventilation of the kiln packing so that heating will be rendered substantially uniform throughout the mass. As a result of this arrangement, the time of heating and cooling may, not only be sharply reduced, but the waste or loss due to breakage substantially eliminated.

Prior attempts to provide a process of this type have in general resulted in final tile units having surfaces unsuitable for assembly into a structure having the desired degree of impermeability. It is important to note that the usual mortars employed to join the individual units in the finished structure are relatively porous and free from any substantial degree of impermeability. Thus, unless the individual tiles are maintained within reasonable limits, the sanitary and moisture-retaining character of the resulting struc-

ture is lessened and the real purpose of using such tiles is defeated.

One type of tile, resulting from the attempts to provide adequate ventilation during burning, has been formed with sometimes jagged and irregular projecting portions located at or in the vicinity of the surfaces to be mortared and thus prevented proper fitting and alinement of the units. These projecting portions, moreover, have resulted in an inordinately large spacing between adjacent tiles so that an undesired amount of permeable mortar surface is exposed.

It is, accordingly, an object of the present invention to obviate the above discussed difficulties and to provide an element adapted to be burned while completely "ventilated" and which at the same time may be readily broken apart after burning to provide individual tiles free from undesired surface projections and adapted to be properly alined in the finished structure and to be assembled closely with a mortar joint of minimum extent.

A further object of the present invention is to provide a process of manufacturing tile as well as an intermediate tile forming unit of the above character comprising a series of tile sections corresponding in form to the finished tile construction units, being integrally joined and being adapted to be readily broken apart to provide units having a desired uniform and symmetrical configuration and being free from irregular or projecting portions which would tend to enlarge the adjacent mortar joint.

Another object of the present invention is to provide a process and product as above wherein the integrally formed tile sections are arranged in generally polygonal order and joined along side edges by readily breakable means adapted to be broken interiorly of the normal plane of said side surface whereby the broken surfaces are ultimately formed interiorly of the normal outer confines of the tile in order to permit close abutment of the units in the finished structure.

An additional object of the present invention is to provide a ceramic construction unit and particularly a construction unit of the highly vitreous type having roughened, broken edges for interlocking with mortar to provide an improved mortar joint but wherein the roughened or broken surfaces are positioned interiorly of the outer side plane of the unit whereby to permit assembly with narrow mortar joints.

It is furthermore an object of the present invention to provide a construction element as above having longitudinally recessed side edges,

a portion of the interior surface of the recess comprising a broken, irregular edge adapted for improved mortar adherence, substantially all of the broken or irregular surface being located within the recess.

The present invention additionally contemplates the provision of a unitary form of relatively plastic tile making material comprising a series of sections corresponding to the shape of the finished tile units and integrally joined together by connecting or bridging portions, the connecting portions so arranged in form as to permit limited, angular movement of the sections joined thereby under the influence of the elevated temperatures prevailing in the kiln.

It is, accordingly, an object of the present invention to provide an element adapted to be burned in the kiln wherein any distorting or warping tendencies are caused to act upon the relatively thin bridging or connecting portions between the respective tile unit sections so that the finished tile units will possess their predetermined, undistorted form.

A yet further object of the present invention is to provide a process comprising the forming or extrusion of a plastic mass of tile making material into a predetermined section, burning the section while completely ventilated, and then breaking the section apart along predetermined lines of integral juncture to provide ceramic tiles of predetermined, generally prismatic exterior configuration free from projecting broken surfaces.

Numerous other objects and advantages will more fully appear during the course and progress of the following specification.

Figure 1 is a sectional view taken vertically and centrally through an extrusion machine constructed for the purpose of carrying out the process of the present invention.

Figure 2 is a detail sectional view taken on the line 2-2 in Figure 1.

Figure 3 is a perspective view of the extruded element or section formed by the machine in Figures 1 and 2.

Figure 4 is an end view of the extruded element shown in Figure 3, the parts being shown in relatively separated position after burning and breaking.

Figure 5 is a perspective view of a finished tile embodying the features of the present invention.

Figure 6 is an end elevational view showing a plurality of the construction units of Figure 5 assembled together through the agency of a suitable mortar to provide a relatively impermeable floor structure.

Referring to the figures of the drawing, wherein the present invention is disclosed more in detail, Figures 1 and 2 show a machine adapted to extrude a section suitable for burning and the production of construction elements in accordance with the present invention.

The extrusion device, which is shown more or less diagrammatically in the figures, is of the auger type comprising a chamber 10 fed with suitable, preferably relatively plastic tile making material through a hopper 12. The plastic material in the chamber 10 is fed progressively in the righthand direction, as viewed in Figure 1, through the agency of an auger or spiral conveyor 14 mounted on a shaft 16 and journaled at one end in the bearing 18 supported by the plurality of struts 20 and at the other end in the wall 22. It will be understood that the shaft 16 is driven by any suitable means (not shown).

The plastic material advancing to the right in Figure 1, passes through the extrusion head or orifice 24, secured to the chamber 10 by fastening means 26.

Attention is directed to the fact the extrusion head 24 is of generally rectangular form and supports centrally thereof, through the agency of struts 29, a forming member or die 28 of similar rectangular configuration so that the plastic extruded material in effect passes through a space defined by co-axial, rectangular inner and outer limits and, accordingly, the extruded product possesses the configuration of a rectangular, tubular section. It is, moreover, important to note that the outer portion of the extrusion head 24 is provided with eight inwardly projecting forming members 30. Two of the forming members 30 are mounted in each side wall of the member 24, being rigidly positioned as by welding in appropriate grooves. The inwardly projecting free ends of the members 30 are oppositely inclined and sharpened as at 32.

The inner forming member or die 28 is provided with similarly arranged members 34 mounted at the four corners thereof and so positioned that they are aligned in the same plane with the corresponding members 32. Each of the forming members 34 likewise has an inclined, sharpened, free edge portion 36 spaced a predetermined distance from the inclined edge portion 32 of the opposite forming member 30.

It will be obvious from the above description that the section of plastic material proceeding from the extrusion head will have a cross sectional shape, as shown in Figure 3. Particular attention is directed to the fact that the sections of material enclosed by the forming plates or members 30 and 34 and the opposed sides of the inner and outer forming members 28 correspond to the cross sectional shape of the finished construction element.

In other words, the extruded product or element comprises four portions corresponding in cross sectional size and shape to the finished tile, these elements being indicated by the reference numeral 38 and being integrally joined by corner or connecting portions 40. As a result of the projecting forming members 30 and 34 in the die, the tile unit sections 38 and the corner sections 40 of the extruded member are joined by bridging portions of constricted dimension. These bridging portions are indicated by the reference numeral 42. It will be noted that they are relatively thin or narrow with respect to the thickness of the adjacent material.

Attention is particularly directed to the fact that these bridging or connecting portions 42, in the embodiment shown, converge toward the tile unit sections 38 and the adjacent side surfaces of each of the tile members are likewise inwardly inclined as at 44 so that they tend to converge in the same direction.

In other words, the inwardly inclined side edges formed in the tile unit sections by the inclined, sharpened forming portions 32 and 36 of the extrusion head provide a longitudinally extending recess along the tile sections 38 for accommodating the narrow end of the bridging or connecting portion 42. Thus, the narrow or thin end of the bridging portions 42 provides a break-off section for separating the tile units, as will appear hereinafter more in detail.

In accordance with the present invention, it is contemplated that the extruded section emanating from the extrusion device be severed

into lengths corresponding to the length of the finished tiles. An endless conveyor 46 engages the extruded length of material and serves to convey it continuously in the righthand direction through the agency of drive means (not shown). Cooperating with the conveyor 46 is a cutting means 48 arranged above the top flight of the conveyor and adapted to be actuated downwardly at predetermined intervals to sever the material into elements of predetermined length. The cutting means 48 may comprise a wire, saw or any other conventional device.

The central die or forming member 28, as clearly shown in Figure 2, is provided with outwardly projecting portions 50 on its periphery so that the product formed by the extrusion device is provided with grooves or serrations 52 along the inner surfaces corresponding to the bottom or rear face of the finished tile units.

Reverting to the showing of the extruded and severed element shown in Figure 3, attention is directed to the fact that each of the tile unit sections 38 comprises an outer flat surface 54 which constitutes the top or outer surface of the finished tile and resides in an exposed portion in the ultimate tile structure.

The grooved, fluted or serrated inner face 56 of each of the portions 38 constitutes the opposite or lower face of the tile and it will be apparent that the grooves 52 provide for increased mortar adherence in retaining the tiles in operative position. Accordingly, the surfaces of the sections 38 extending longitudinally of the extruded element and transversely between the surfaces 54 and 56 constitute the side walls or edges of the finished tiles and are designated by the numeral 58. It will be understood from the above disclosures that the end surfaces 60 of each tile are provided by the action of the cutting means 48 hereinbefore described.

In proceeding in accordance with the present invention, the extruded elements are carefully dried and packed in a suitable kiln, care being exercised meanwhile to prevent breakage. The elements may be packed into the kiln in any desired manner to provide relatively free passage of the kiln gases through the mass of material so that heating and cooling may proceed substantially uniformly as to all portions thereof. The generally polygonal arrangement of the integrally joined tile sections 38 with the central flue or aperture extending longitudinally therebetween permits the kiln to be readily packed in this manner. After subjecting the kiln packing to the required temperature for a required length of time, the temperature is lowered and the burned vitreous product removed for breaking and separating the individual tiles.

Breakage is readily accomplished by subjecting the vitreous element to a sharp blow or jar whereupon the various portions thereof will break apart, as clearly shown in Figure 4. Attention is particularly directed to the fact that breakage occurs substantially at the thinnest part of the bridging or connecting portion 42, namely, substantially at the point where it joins the adjacent tile section 38. The line of breakage, moreover, will occur interiorly of the longitudinally extending side depressions formed by the inclined surfaces 44.

In other words, the surfaces 44, in diverging interiorly of the sides of each tile section, provide a recess which has been indicated generally by the reference numeral 62 and the breakage of the originally integral bridging portion 42 occurs

within this recess. As a result, the jagged, irregular or broken surface resulting from the breakage at this point is in effect interiorly positioned with respect to the final tile and does not project to interfere with the fitting of the individual tiles.

As clearly shown in Figure 5, the present invention provides a construction element which is substantially prismatic in form, having top, end and side building surfaces. The recess 62 extending longitudinally of the opposite side surfaces 58 is provided centrally with a longitudinally extending, irregular or broken surface designated by the reference numeral 64.

In accordance with the preferred embodiment of the present invention, it will be noted that substantially none of the projections formed by the irregularity of the broken surface 64 will extend beyond the outer or bounding plane of the side wall or, in other words, beyond the planes in which reside the surfaces 58. Thus, when assembled in a wall or floor structure, as shown in Figure 6, the construction units may be accurately aligned, as shown in the figure, and positioned as closely as may be desired to produce a mortar joint 66 of the desired dimensions. As shown in the figure, the mortar fills the longitudinally extending recesses 62 and contacts directly with the irregular, broken surface 64, insuring a substantially perfect degree of mortar adhesion even though the adjacent units may be set relatively closely together.

The present invention provides a simple and effective ceramic construction unit and process for producing the same which reduces production losses and costs and results in a final product of improved character and quality. When proceeding in accordance with the present invention, the adverse effects of the thermal conductivity of the material being burned is overcome. Clay of the type employed in manufacturing tiles may, for example, have a thermal conductivity one-tenth of that of the thermal conductivity of carborundum. When the flat tiles are packed flatwise in the kiln in accordance with one of the prior methods of practice mentioned above, this technical factor is responsible for inordinately slow burning of the mass, a resulting high fuel cost and a high percentage of cracked units as a result of the so-called cooling cracks which occur when the kiln is cooled.

In accordance with the present invention it is contemplated that the instant flue-shaped extruded units be arranged in the kiln preferably superposed on end so that the gases and heat of the kiln will pass freely vertically through the mass to directly heat all parts uniformly. Stresses, such as are normally set up during burning and which tend to warp the elements, are permitted to act harmlessly by the bridging or connecting portions 42 which, being located adjacent the side surfaces of the respective tiles and being relatively thin, absorb all of the twisting strains without transmitting them to the adjacent units. In other words, the relatively thin portion adapted to be broken, after burning, in effect acts as a pivot or hinge and permits relative twisting of the portions to absorb the warpage inherent in the burning operation.

The present invention, moreover, provides a highly desired, roughened, irregular finish on the surfaces to be mortared which insures proper mortar adhesion without the necessity of a protruding or projecting "burr." It is to be noted in this connection that the entire mortar receiving periphery of the tile, including the end sur-

faces 60, has desirable mortar securing properties. The end surfaces 60, being formed by cutting the continuous clay bar, are roughened sufficiently to provide slightly ragged faces for the purpose of enhancing this effect.

While the present invention has been described as being carried out with the assistance of an extruding machine, it will be understood that various other forming machines may be employed. The extruded section forming the preferred embodiment of the present disclosure comprises in general four tile unit sections polygonally arranged in a quadrangle and joined by corner members, but it will be understood that various other specific configurations will come within the scope and intent of the present invention, particularly those wherein the tile sections are generally polygonally positioned in the integral element.

In accordance with the present invention the corner portions of the extruded unit designated by the numeral 40 are, after burning and separating from the tile units, employed in the construction of decorative floor tile assemblies, particularly wherein impermeability is not an important factor. It has been found that the tapered protruding extensions 42, which form the bridging portion in the original unit, may be employed to accurately space these units, both from adjacent units and from the supporting floor. In other words, the corner elements 40, as shown in Figure 4, are employed in floors, for example, where it is desired that the mortar joints be of uniform width while at the same time being relatively wide.

Changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the form herein described being a preferred embodiment for the purpose of illustrating the invention.

The invention is hereby claimed as follows:

1. A vitreous tile unit of generally prismatic form adapted to be assembled to provide a finished wall structure, said unit comprising opposed side surfaces adapted to receive mortar for securement in abutting relationship to corresponding faces of adjacent units to provide a juncture between said units, said side surfaces comprising longitudinally extending recesses, said recesses interiorly thereof comprising a longitudinally extending, irregular, broken surface occupying a portion of the interior surface of said recesses and adapted to promote mortar adhesion but having substantially all projecting portions thereof positioned below the outer plane of said side surfaces.

2. A ceramic building unit of generally prismatic form having opposite side surfaces, said side surfaces being recessed, said recesses interiorly thereof comprising irregular, jagged surfaces formed by breaking a member integrally joining with a portion of said recesses.

3. A ceramic building unit of generally prismatic form having opposite side walls, said side walls being provided with longitudinally extending side recesses formed therein, said recesses at a point spaced interiorly of the plane of said side walls comprising irregular, jagged surfaces formed by breaking integral portions therefrom and adapted to promote mortar adhesion without providing projecting portions.

4. A building unit having a plurality of surfaces adapted to be juxtaposed to similar sur-

faces in adjacent building units to form bonded joints, said surfaces being recessed, irregular, jagged surfaces formed interiorly of said recesses and being so arranged that said irregular portions do not extend substantially out of the recesses whereby to provide improved mortar adhering surfaces without requiring substantial thickness of mortar joint.

5. A ceramic building unit adapted to be assembled with other similar units to provide a finished wall or floor structure, said unit having a recessed surface formed on one side thereof, the base of said recess presenting an irregular jagged surface.

6. A ceramic building unit adapted to be assembled with other units to provide a finished wall or floor structure, and having at least one side portion adapted to receive mortar, said side portion comprising a recess extending inwardly of said side and comprising an irregular broken mortar receiving surface within said recess adapted to receive mortar to provide a permanently cemented final assembly.

7. A ceramic building unit adapted to be assembled with other units to provide a finished wall or floor structure, and having at least one side portion adapted to receive mortar, said side portion comprising a recess formed in said side and comprising an irregular broken mortar receiving surface within said recess adapted to receive mortar to provide a permanently cemented final assembly, said recess extending longitudinally of said side surface and being spaced from the lateral marginal edges of said side surface.

8. A ceramic building unit adapted to be assembled with other units to provide a finished wall or floor structure, and having at least one side portion adapted to receive mortar, said side portion comprising a recess formed in said side and comprising an irregular broken mortar receiving surface within said recess adapted to receive mortar to provide a permanently cemented final assembly, said recess extending longitudinally of said side surface and being spaced from the lateral marginal portions thereof, said irregular broken surface portion being formed longitudinally of said recess and occupying a portion thereof only, the remainder of said recess being defined by regular, even surface portions.

9. A ceramic building unit adapted to be assembled with other units to provide a finished wall or floor structure, and having at least one side portion adapted to receive mortar, said side portion comprising a recess formed in said side and comprising an irregular broken mortar receiving surface within said recess adapted to receive mortar to provide a permanently cemented final assembly, said recess extending longitudinally of said side surface and being spaced from the lateral marginal portions thereof, said irregular jagged surface portions extending longitudinally and centrally of said recess and having substantially all the jagged portions thereof positioned interiorly of the plane of said lateral marginal portions.

10. A fired tile member having longitudinally extending, opposed, parallel side surfaces provided with longitudinally extending, recesses disposed centrally of said side surfaces, a portion of each recess being defined by a jagged mortar receiving surface spaced from both lateral side margins of said recess and located substantially interiorly of the planes of said side walls.

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