

March 13, 1956

V. A. BARNHART

2,737,801

HOLLOW STRUCTURAL CLAY BUILDING UNIT

Filed Aug. 9, 1949

2 Sheets-Sheet 1

FIG. 1.

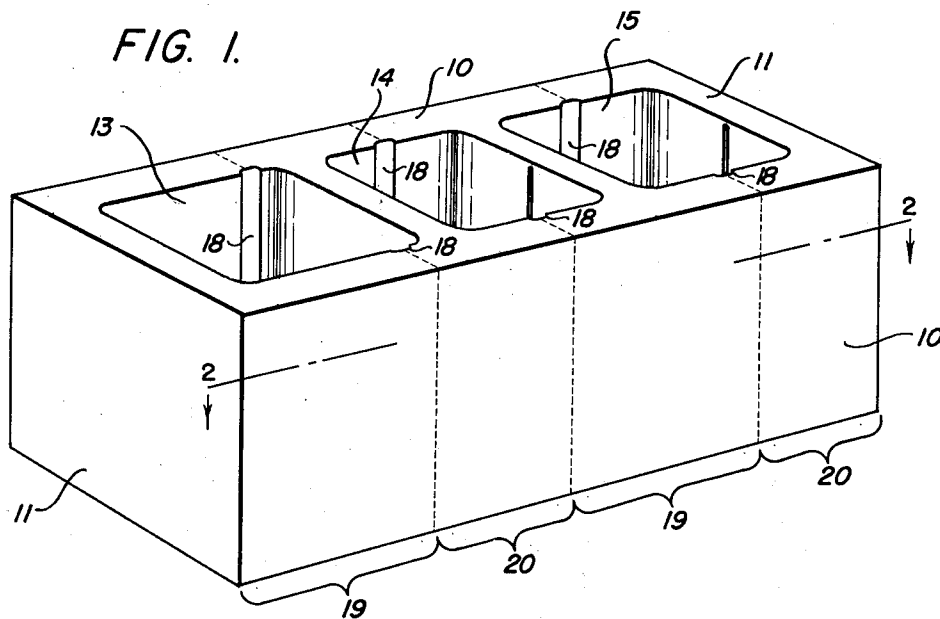


FIG. 2.

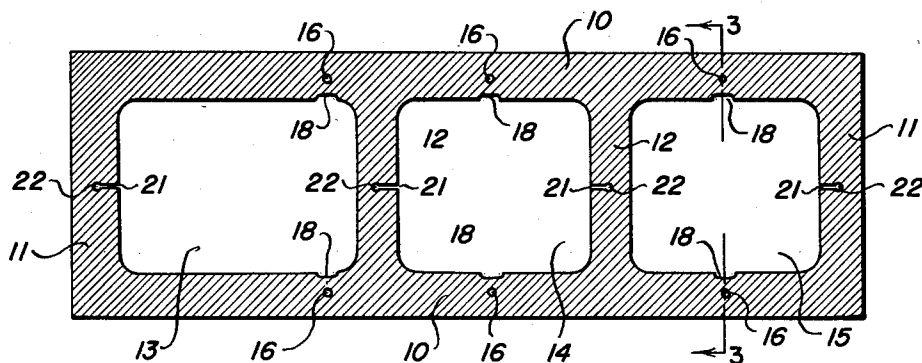


FIG. 3.

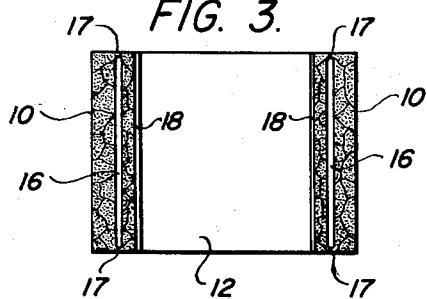
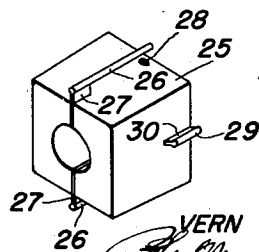


FIG. 4



Inventor:

VERN A. BARNHART

H. Mallinckrodt and
Philip A. Mallinckrodt
Attorneys

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V. A. BARNHART

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FIG. 5.

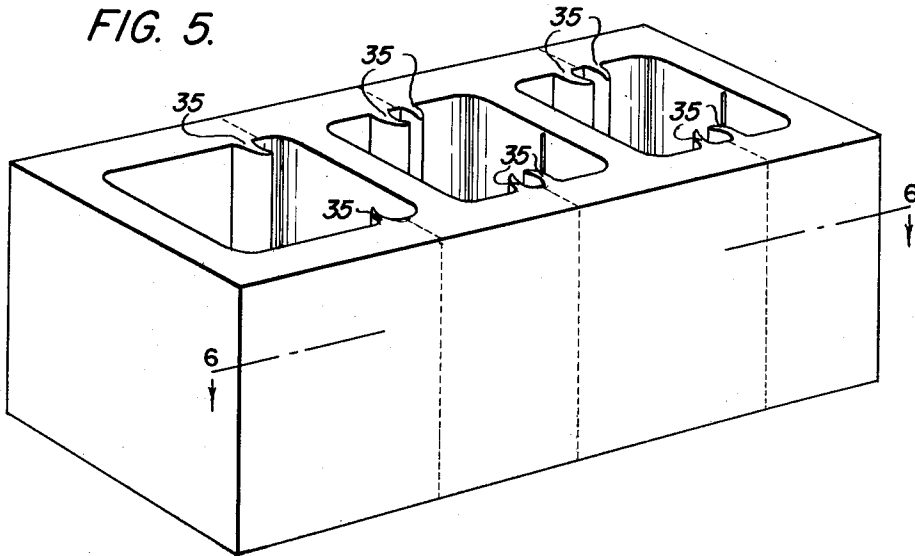


FIG. 6.

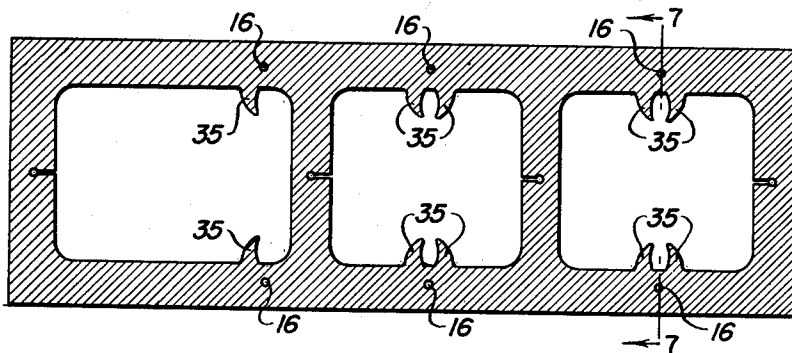
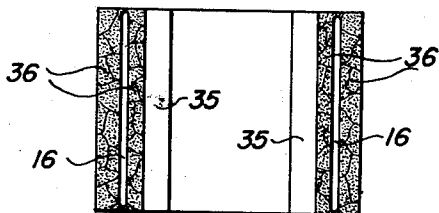


FIG. 7.



Inventor:
VERN A. BARNHART
By *J. N. Mallinckrodt and*
Philip A. Mallinckrodt,
Attorneys.

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2,737,801

HOLLOW STRUCTURAL CLAY BUILDING UNIT

Vern A. Barnhart, Athens, Ohio

Application August 9, 1949, Serial No. 109,354

9 Claims. (Cl. 72—41)

This invention relates to fired hollow building units of structural clay, as used extensively in masonry building construction. Often such units are referred to as hollow structural tile.

The advantages of units of this type in building construction are well-known to the art, and need not be enumerated here. There are disadvantages, however, which have been annoying and have limited their general usefulness.

A major disadvantage has been the difficulty of breaking a unit into smaller pieces needed from time to time during the progress of building construction for completing a laid course of units to a given dimension. As ordinarily formed, the walls of such units will not break cleanly when an attempt is made by a mason to separate the block along a desired line of cleavage. Thus, much time and material is wasted on any given job.

This difficulty has been overcome in the past by the provision of kerfs in the walls of the unit, whereby predetermined fracture planes have been established during manufacture. This, however, has produced highly undesirable results in another direction, namely, weakening of the walls of the unit and impairment of its structural strength. This has been particularly serious because of the tendency for a kerf to be uncontrollably extended during the firing stage of the manufacture, resulting in a marked weakening of the walls of the unit. Accordingly, the practice of forming a unit with kerfs has never been adopted generally, and is frowned upon in the trade.

A generally satisfactory way of overcoming the difficulty has been the provision of closely spaced cross-walls or webs immediately adjacent a desired line of cleavage along the main walls of the unit, so that the unit could be struck a blow at that line to produce an uneven but fairly straight fracture confined to the narrow strip of the major walls lying between the cross-walls. While this has given fair results in practice, the weight added to a unit by the provision of structurally-unnecessary cross-walls is excessive. It has proven to be practical from an economic standpoint only in special instances.

Accordingly, a principal object of the present invention is to provide a fired hollow structural clay or tile unit provided with predetermined lines of cleavage capable of producing straight and clean fracture planes when the unit is properly struck by a mason, without impairing the structural strength of the unit nor adding to its weight.

Other objects are:

To provide such a unit which shall have a conventional outward appearance.

To provide such a unit with lines of cleavage establishing a potential single fracture plane across the unit between widely separated, structural cross-walls.

To provide such a unit wherein kerfs may, if desired, be employed for the purpose of aiding cleavage, without the usual and expected accompanying disadvantage.

To provide such a unit capable of production in various conventional configurations, sizes, and weights; and at

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costs comparable to or less than those for ordinary units of the type.

To provide for an extensive and favorable mortar-bonding area adjacent the fracture plane.

These objects I accomplish by the provision of elongate passages of restricted cross-section extending within and lengthwise of appropriate walls of the unit along predetermined desired lines of cleavage of such walls. I have found that only one of such passages, disposed approximately centrally of the thickness of a wall, is necessary in order to produce a clean fracture plane through that wall along the line of extension of the passage. This passage is preferably of tubular configuration, having a diameter substantially no greater than one-third the thickness of the wall. The diameter is, however, advantageously as small as is practical to produce, since the important thing is establishing a laterally closed break within the wall along the desired line of cleavage, rather than reducing the thickness of the wall along such line. Thus, I have found that a passage having a diameter of approximately $\frac{1}{8}$ of an inch is very satisfactory for a wall thickness of $\frac{3}{4}$ of an inch.

I have found that the most satisfactory method of producing units having such small passages extending longitudinally within the walls thereof is by the customary process of extrusion of the plastic clay through a die, severing of individual units from the resulting clay column, and firing such units.

Core pins, anchored to the die core in cantilever fashion by means of narrow bridge pieces set back from the discharge end of the die, serve to form the desired passages. Such apparatus is itself novel in the art, and a detailed disclosure thereof will be made in a separate application for patent. Other methods and means may, of course, be utilized to form the units of the invention. For example, the units may be produced in an ordinary block-making machine or press, suitable cores being employed for the block mold in order to produce the cleavage passages of the invention, all as will be obvious to those skilled in the art.

In the preferred method of producing the units of the invention, the severing of individual units from the extruded clay column, as customarily accomplished by a conventional wire cutter, drags sufficient clay over what would otherwise be open ends of the cleavage passages to close such ends, thereby producing what might be termed a "sealed" unit having the outward appearance of a conventional unit of the type. Such sealing of the cleavage passages within the walls of the unit prevents, in use, entry therinto of moisture, and has been found to aid in proper burning of the unit during the firing step in its production.

A sharp blow by a hammer directly upon the unit at the location of a cleavage passage in a wall, or upon a bricklayer's chisel or a heavy spike held against the unit at such location, the same being repeated at the opposite side of the unit, will effectively break the entire unit along a fracture plane comprehending parallel cleavage passages disposed in those respective walls concerned in the particular break desired.

A feature of the invention resides in the unique discovery that if a cleavage passage, such as described above, be utilized at the termination of a kerf, there will be no extension of the kerf during burning of the unit. This means that a kerf may now be satisfactorily utilized if combined with a cleavage passage of the type described. In this instance, the cleavage passage should have a diameter which is somewhat greater than the width of the kerf, so as to absorb shrinkage stresses during burning of the unit.

Another feature of the invention resides in the provision of fins projecting inwardly of the unit immediately

adjacent the lines of extension of the cleavage passages, thereby establishing respective longitudinal mortar-bonding areas supplemental to those afforded by the rough fracture-plane surfaces when the unit is split along such cleavage passages. These fins, it should be noted, project outwardly from the inner faces of the walls of the unit, and are additive to the normal wall thickness as customarily determined for proper structural strength. Thus, while such fins do incidentally increase the strength of the unit, their real purpose is to provide supplemental mortar-bonding areas along cleavage lines. The weight added to the unit by such fins is so small as to be inconsequential, and is considerably less than is added by full cross walls.

Further objects and features of the invention will become apparent from the following detailed description of the presently preferred specific forms thereof illustrated by way of example in the accompanying drawings.

In the drawings:

Fig. 1 represents a perspective view of one form of unit pursuant to the invention;

Fig. 2, a horizontal section taken on the line 2—2 of Fig. 1;

Fig. 3, an elevation of a section of a unit fractured along the line 3—3 of Fig. 2, and showing the rough fracture surface;

Fig. 4, a perspective view drawn to a reduced scale, of a core block utilized as part of a conventional extrusion die for producing the novel cleavage passages of the invention, the view being taken from the feed end looking toward the discharge end;

Fig. 5, a view corresponding to that of Fig. 1, but illustrating a somewhat different form of the invention embodying the feature of projecting fins which establish supplemental mortar-bonding areas;

Fig. 6, a horizontal section taken on the line 6—6 of Fig. 5; and

Fig. 7, a view corresponding to that of Fig. 3, but taken on the line 7—7 of Fig. 6.

Referring to the drawings: the hollow structural tile building unit of Figs. 1, 2 and 3 is of a conventional formation so far as configuration is concerned. Its walls are of standard thickness, which is customarily determined in the art from a consideration of various factors, such as over-all dimension of the unit.

As illustrated, the unit comprises mutually spaced, longitudinal walls 10 and opposite end walls 11. Intermediate the length of the unit are mutually widely spaced webs 12, which divide the hollow interior of the unit into sections 13, 14, and 15. The end walls 11 and webs 12 may be collectively grouped under the term "cross-walls."

In the present instance the webs 12 are so disposed that hollows 14 and 15 are of the same size and hollow 13 is longer, the transverse center line of the unit being coincident with the transverse center line of the intermediate hollow 14. This provides a unit particularly adapted for either so-called "half-bonding" or "third bonding," when provided with lines of cleavage as hereinafter described.

In accordance with the invention, the unit is provided with passages of restricted cross-sectional area disposed within and extending longitudinally of respective walls, intermediate the thickness of such walls, to establish lines of cleavage along which predetermined, clean-cut fracture planes may be produced in the breaking of the unit into pieces of reduced size, say for completing a laid course of units to a given dimension which is not an exact multiple of the length of the unit concerned. I have found that, to be effective for establishing lines of cleavage, such passages need not have a cross-sectional area so great as will appreciably impair the normal structural strength of the unit, for it is the provision merely of a laterally closed break in the continuity of the wall thickness, extending along the desired line of cleavage, which is important, not reduction in such wall thickness.

In the illustrated instance, such laterally closed breaks are provided by cleavage passages 16 of tubular formation, the same being closed at their ends and sealed within the unit by means of clay sheets or caps 17, Fig. 3, which are integral with the walls of the unit and very thin relatively thereto. Thus, the unit presents a conventional outward appearance. Furthermore, the cleavage passages are completely closed and protected from the heat during firing of the unit, so there is no danger of uneven burning and consequent wall distortion. They are protected, too, against entry of moisture either before or after the units are laid in building construction. While it is advantageous and a feature of the invention that the cleavage passages be closed at their ends, and thus sealed in the unit, their function in the establishment of lines of cleavage are fulfilled as well when open at their ends.

In order to provide an indication to the mason of the location of the sealed cleavage passages, it is desirable to mark in some manner, superficially of the unit, the lines of extension of the respective passages. I have found it advantageous to provide such marking by forming ribbon-like indentations 18 along the inner wall faces of the unit opposite and longitudinally of the respective passages. These indentations cooperate, in a measure, with the cleavage passages 16 in the establishment of a clean-cut fracture plane, and also, I have found, insure absolute sealing, all along their extents, of the unavoidable bridge-breaks accompanying the extrusion method of production. While it is desirable to employ such ribbon-like indentations 18 for marking purposes, other means of marking, which serve only an indicating purpose, may be employed inasmuch as the bridge-breaks are to a large extent self-sealing during the modern de-airing extrusion process.

For the purpose of providing for both half and third bonding in building construction, the cleavage passages 16 are disposed in the unit illustrated so that the hollows 14 and 15 will be bisected longitudinally by respective fracture planes, and the hollow 13 will have a fracture plane pass longitudinally therethrough adjacent its web wall 12. In this manner, there are alternate long and short sections defined along the length of the block, the long sections 19, Fig. 1, being of substantially equal length. Thus, when the block is made twelve inches long, it may be broken with ease to produce individual sections fulfilling requirements for lengths of 2, 4, 6, 8 or 10 inches, or, stated somewhat differently, lengths which are $\frac{1}{6}$, $\frac{1}{3}$, $\frac{1}{2}$, $\frac{2}{3}$, or $\frac{5}{6}$ the overall length of the block, as prescribed by the new modular practice of the building industry, set forth in the handbook entitled "Modular Masonry A-62." It should be noted that, as so arranged, only one potential fracture plane is present between each pair of mutually adjacent cross-walls, which is a decided advantage in breaking the unit, but not a necessity. Nevertheless, in such a unit as many cross-walls as desired may be utilized, irrespective of the number of potential fracture planes, and these may be located as desired, so long as they are not in line with a potential fracture plane.

It should be understood that, while the tubular type of cleavage passage is preferred in many instances, passages having other cross-sectional configurations, such as square or diamond shaped, may be employed to advantage.

The illustrated unit is preferably provided with a potential fracture plane extending longitudinally thereof, so the unit may be easily divided in half longitudinally. For this purpose, I show the use of the cleavage passage and kerf combination hereinbefore mentioned.

As illustrated, each cross-wall of the unit is provided with such a combination centrally thereof. The combination comprises a kerf 21, terminating within the wall in a longitudinally co-extensive cleavage passage 22 whose diameter is slightly greater than the width of the kerf.

As stated hereinbefore, the tubular cleavage passage accommodates stresses set up during the burning of the unit, and prevents the formation of an undesirable so-

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called "fire crack" which extends the kerf and seriously weakens the wall. While the cleavage passage in this instance is specified as tubular, any rounded formation presenting a terminal surface for the kerf which has no sharp angles for inducing a fire crack may be employed, for example, a passage having an oval cross-section.

The cleavage passages are advantageously formed by core pins carried by and auxiliary to the customary core parts of a conventional extrusion die. A core part adapted for use in the production of units of the foregoing particular type, is illustrated in Fig. 4. The core block 25 carries at one set of opposite sides thereof elongate core pins 26 by means of respective short and thin bridge pieces 27, which are anchored within suitable receiving slots formed at the feed end of the core block. The greater part of the length of the core pins, extending toward and preferably completely up to the discharge face of the core block, are cantilever to the minor bridge-supported portions, so that the extrusion pressure within the die will seal the thin breaks made in the clay column by the respective bridge pieces 27. Such core pins 26 form the cleavage passages 16, the particular core block illustrated being used to form either the hollow 14 or the hollow 15. Any suitable projections such as the set screws 28, may be utilized to form the ribbon-like indentations 18.

Carried by the core block 25 at the other set of opposite sides thereof and proximate the discharge face of the die are core pins 29, which are secured along their lengths to respective kerf-forming bridge pieces 30. These form the respective combinations of kerfs 21 and terminal passages 22.

Conventional wire cutters are employed to cut the clay column into individual units. In the use of same, I have found that the wire drags sufficient clay over the openings of the cleavage passages to form the end closure sheets or caps 17 for the cleavage passages 16, as well as similar end closure sheets or caps for the kerfs 21 and terminal passages 22. This holds true for passages up to as large as approximately $\frac{1}{4}$ inch, which size passages may be advantageously utilized in the larger units where wall thicknesses are great enough to accommodate them without appreciable structural weakening.

The apparatus described above and improvements thereon, as well as the method of closing the otherwise open ends of the cleavage passages, form the subject matter of my copending application Serial No. 558,953, filed January 13, 1956, entitled, "Method and Apparatus for Producing Hollow Structural Clay Building Units."

In Figs. 5, 6, and 7, the unit is identical with that previously described, except for the provision of fins which project inwardly of the hollows of the unit at either side of and paralleling the respective lines of cleavage, and for the elimination of the marking indentations 18.

In the illustrated instance, fins 35 are provided which taper outwardly from the inner wall faces of the unit for the purpose of weight reduction, and which have a certain coved formation, as shown, for the purpose of mortar retention. Fins of various other formations may be satisfactorily employed, however. Furthermore, indentations 18 may be utilized here, too, if desired.

The cleavage passages 16 are disposed between mutually spaced fins 35, or between a fin 35 and a web cross-wall 12, as illustrated. Thus, a fracture surface, such as that appearing at 36 in Fig. 7, resulting from the creation of a fracture plane between two oppositely disposed cleavage passages 16, has its mortar-bonding area extended by the projecting depth of a fin 35. Such fin depth may conveniently be as great as the thickness of the wall from which the fin projects, thereby doubling the normally available mortar-bonding area with very little increase in the weight of the unit. It will be noted that the fins incidentally add area to the horizontal mortar bed, which is a great advantage in use. They also increase the compression strength of the individual blocks.

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It has been found, furthermore, that the provision of fins facilitates, to a certain extent, the breaking operation, for the effect of the wall-splitting blow tends to be concentrated between the fins.

Though this invention is here illustrated and described with respect to certain presently preferred embodiments thereof, it should be understood that various changes may be made therein and various other forms may be constructed on the basis of the teachings hereof, by those skilled in the art, without departing from the protective scope of the following claims.

I claim:

1. A hollow structural clay tile building unit, comprising walls defining an internal void open at a pair of opposite mortar-bonding faces of the unit, said walls including opposing single walls of substantially uniform thickness which is normal for hollow structural clay tile considering the size of the unit; and passages of restricted cross-sectional area, disposed within the respective single walls, intermediate the thickness thereof, and extending substantially from one of said mortar-bonding faces of the unit to the other of said mortar-bonding faces, thereby establishing respective lines of cleavage along which predetermined, substantially clean-cut fracture planes may be produced in the breaking of the unit into pieces of reduced size, the said cross-sectional area of each of said passages having that dimension which extends with the thickness of the wall substantially no greater than one-third the thickness of said wall, and that dimension which is perpendicular to the first-named dimension being approximately equal to the said first-named dimension, so as not to appreciably impair the normal structural strength of said unit.

2. The combination recited in claim 1, wherein kerfs extend inwardly of the respective single walls from respective wall faces thereof to intersection with the respective passages, said kerfs being coextensive in length with the respective passages.

3. The combination recited in claim 1, wherein opposite ends of said passages are closed by relatively thin sheets of material integral with the said bonding faces of the unit.

4. A hollow structural clay tile building unit having walls defining an internal void open at a pair of opposite mortar-bonding faces of the unit, said walls including single walls of substantially uniform thickness which is normal for hollow structural clay tile considering the size of the unit; at least one set of passages of restricted cross-sectional area formed within respective walls of a set of said single walls which are oppositely disposed across the hollow interior of said unit, each passage of said set of passages being positioned intermediate the thickness of its respective wall and wholly therewithin so as to be closed and concealed laterally of the unit, and the passages of said set extending in parallel along a plane for cleavage of said unit and extending substantially from one of said bonding faces to the opposite bonding face of said unit, whereby lines of cleavage are established for each single wall of said set, along which respective predetermined and substantially clean-cut fracture planes may be produced in the breaking of said unit into pieces of reduced size along said plane for cleavage, the said cross-sectional area of each of said passages having that dimension which extends with the thickness of the wall substantially no greater than one third the thickness of said wall, and that dimension which is perpendicular to the first-named dimension being approximately equal to the said first-named dimension, so as not to appreciably impair the normal structural strength of said unit.

5. Structure as recited in claim 4, wherein each wall of said set of said single walls has a kerf leading inwardly thereof, from a wall surface thereof, to a juncture with the cleavage passage therein, said cleavage passage being wider than said kerf, and being defined only by curved walls presenting no fire cracks.

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6. Structure as recited in claim 5, wherein the cleavage passages are circular in cross-section, and have diameters greater than the widths of said kerfs.

7. Structure as recited in claim 4, wherein opposite ends of said cleavage passages are closed by relatively thin sheets of the clay material from which the unit is made, said sheets being integral with the bonding faces of the unit.

8. Structure as recited in claim 4, wherein fins are provided immediately adjacent and extending along the lines of cleavage defined by said cleavage passages, said fins projecting inwardly of the voids and supplementing the normal wall thickness of the unit to provide mortar-bonding areas auxiliary to said fracture planes produced by breaking the unit along said lines of cleavage.

9. Structure as recited in claim 4, wherein shallow indentations extend longitudinally along the inner wall faces of the unit at the locations of and substantially coextensively with the respective cleavage passages.

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