June 28, 1960 A. A. KAUL 2,942,453

WALL CONSTRUCTION AND BOND

Filed July 19, 1954 4 Sheets-Sheet 1

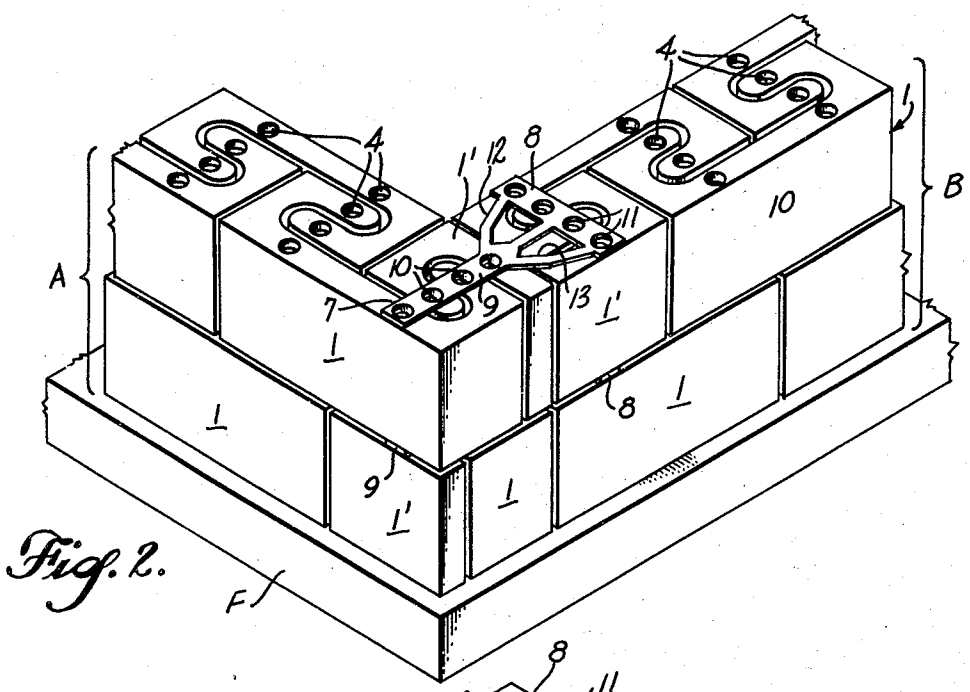


Fig. 2.

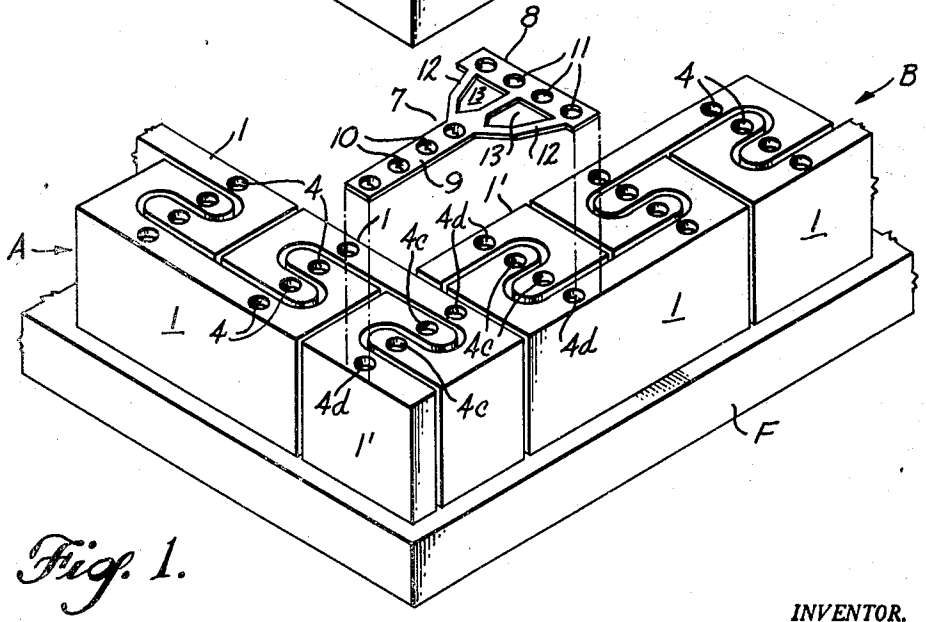


Fig. 1.

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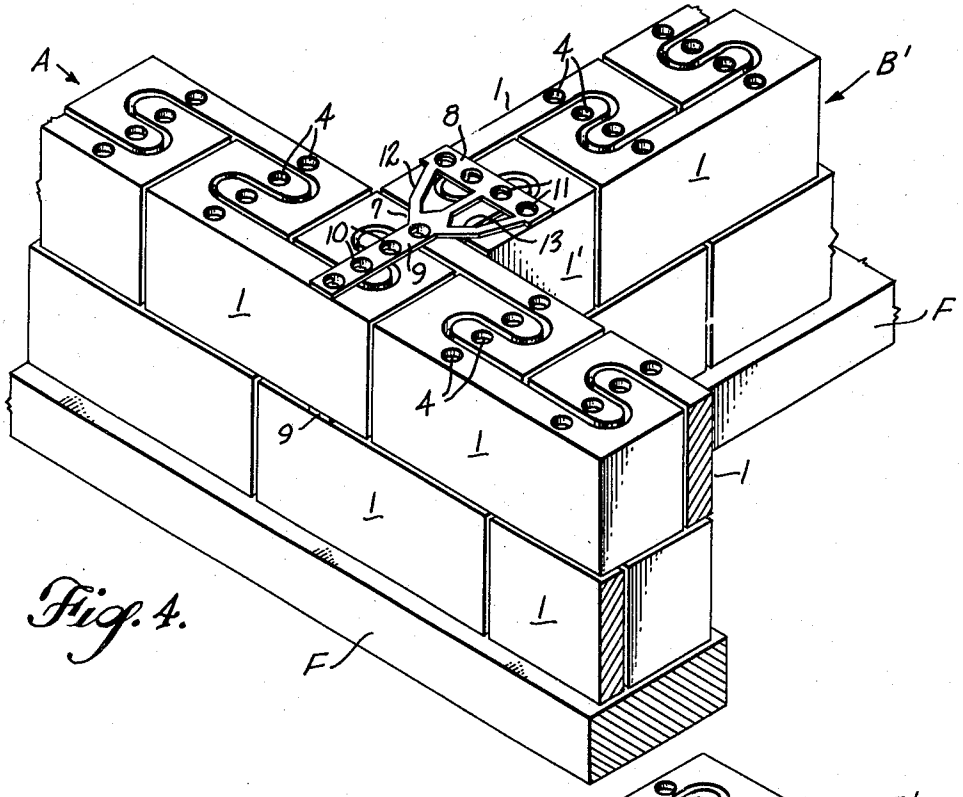


Fig. 4.

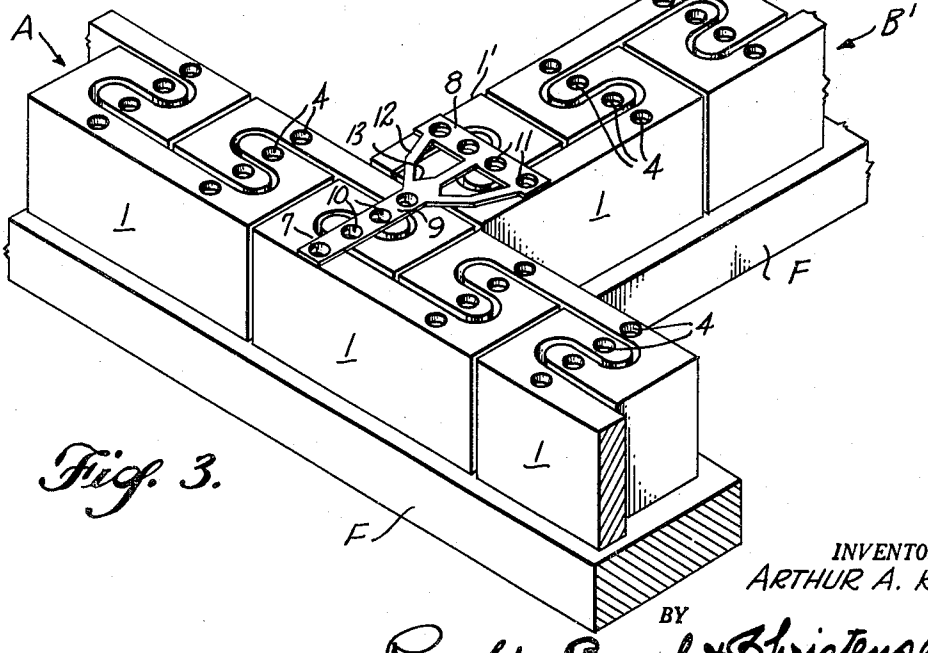


Fig. 3.

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WALL CONSTRUCTION AND BOND

Filed July 19, 1954 4 Sheets-Sheet 3

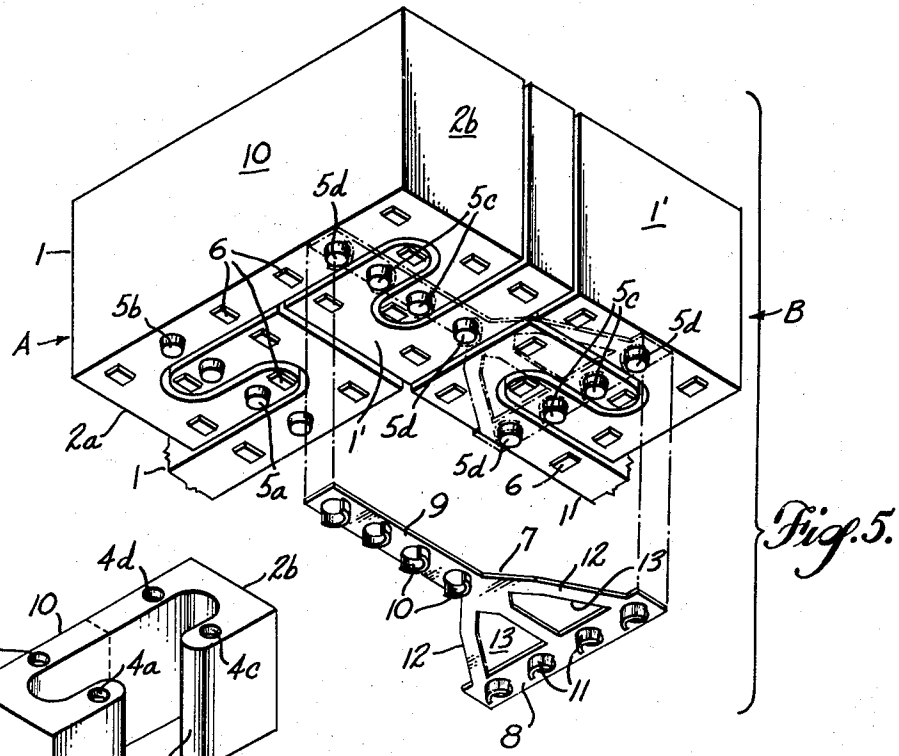
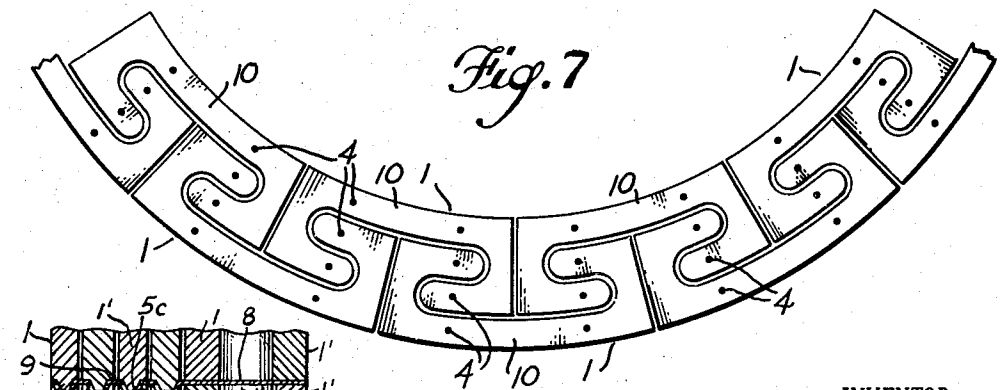


Fig. 5.

Fig. 6.

Fig. 7



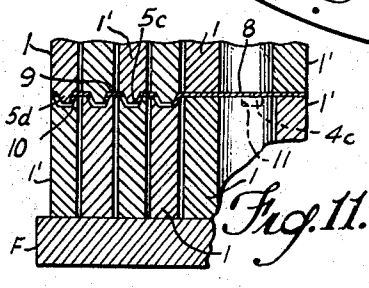


Fig. 11.

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WALL CONSTRUCTION AND BOND

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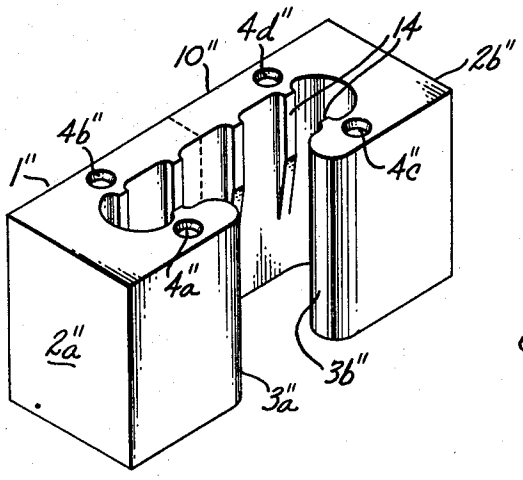


Fig. 8.

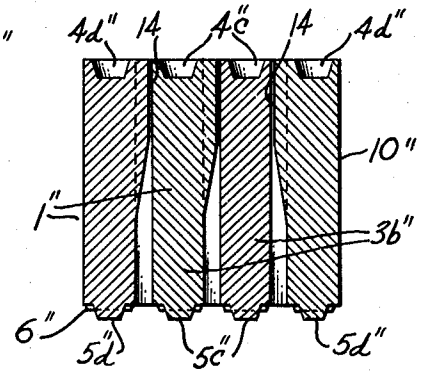


Fig. 10.

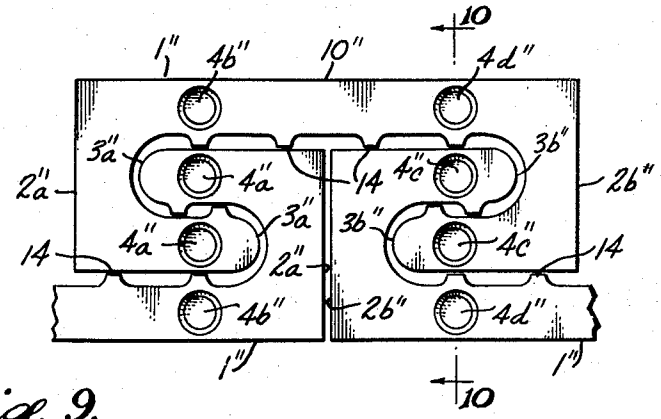


Fig. 9.

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United States Patent Office 2,942,453 Patented June 28, 1960

2,942,453

WALL CONSTRUCTION AND BOND

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Filed July 19, 1954, Ser. No. 443,988

4 Claims. (Cl. 72—38)

The present invention concerns a wall construction involving a minimum number of different styles or shapes of an interlocking wall block or unit, with which may be built walls, partitions, corners, etc., making up a complete building structure, usually molded of concrete, and more particularly concerns the employment in such a structure of a standardized bond unit, of a thin material such as sheet metal, whereby a wall structure running in a given line or plane, and a partition wall (using the latter term to define any wall which extends at an angle to the line or plane of that first-mentioned wall structure, and abuts the latter) may be joined together without the employment of special junction or corner block units.

It has been proposed many times heretofore to build building structures of interlocking block units, without the use of mortar. In many such proposals the several walls have been built primarily of one, or a small number of different, styles of block units, throughout the major extent of any given wall structure. However, at the corners or angles, or speaking generally, where partition walls adjoin such a wall structure, it has always proved difficult to bond together the two angularly disposed walls. Often, in attempting to do so, it has been found necessary to use special junction or corner block units, units which are of a shape, size, or style differing from the standard units of which the wall is primarily constructed, but which are necessary in order to tie into the standard block units of which each of the main wall structure and the partition wall is built. The situation is further complicated if the partition wall, as is sometimes the case with interior partitions, is built of block units of a style differing from the style of units in the main wall structure. Usually a minimum of several different special units are required in order to satisfy all probable requirements, without regard, however, to special requirements, such as the meeting of walls at angles other than right angles.

Such special block units have no utility except at the junction of two such walls. Nevertheless, they must be manufactured specially, in small quantities, and yet must be stored, shipped, handled, and be made available on each job, in the quantities required for that particular job. This is obviously wasteful of time and effort, and hence costly. The breakage or loss or misplacement of such a special block unit is far more disrupting than if it were a standard block unit, for the work cannot well proceed in the absence of the special unit. The necessity for and the cost of employing such special block units has so increased the cost and reduced the inherent advantages of the prior interlocking block structures that they have not, in the main, been widely used, notwithstanding the advantages inherent in their use in other respects.

The use in the present invention of the single standardized bond unit mentioned above, capable of being stamped cheaply and in large quantities from sheet metal, and applicable without modification in every course and

to any usual type of junction, so long as the standard block units are used in the two adjoining walls, enables the wall structures of this invention to be built of only two block styles, namely a full size block and a half size block, and thereby reduces the variety of block styles to a minimum, and maintains the cost of its building at the lowest practicable figure, yet sacrifices nothing in strength, appearance, or utility. All corners and wall termini are smoothly complete. Each course at each junction is thoroughly bonded across the joint between walls. The cost of the bond units is negligible, and especially so in comparison to the cost of special block styles. They are light in weight, and easily handled and installed. No displacement of blocks at the junctions, in order to accommodate the bond units, is required. The bond units are invisible in the finished wall. They tie into the several blocks in each wall, across their joint, and obviate the need for mortar, yet permit the use of stucco to seal the joints, and for added bonding, if desired.

The block units, aside from the bond units, are so formed as to interlock in each wall against separation lengthwise or transversely of the wall, yet are readily laid up. Preferably the interlocking is of triple nature, whereby the blocks are quite accurately located, lengthwise of the wall, in the direction of its thickness, and vertically, in correct relationship to the other blocks, and are strongly held in such relationship. The bond units are designed to cooperate directly with one such interlocking means.

These blocks are, in a preferred form, made in a manner which maintains their accuracy of location, yet reduces the amount of material incorporated in each thereof, hence reduces their weight and cost.

Each such block has, by preference, spacer lugs to space it above blocks in the course below, whereupon it rests. By such means a space is left which will admit stucco later applied for appearance or as a bond, and permits penetration of such stucco into the interior of the wall, sufficient for sealing all joints between block units.

The principles which underlie the present invention, and the mechanical structures by which those principles are carried out, will be better understood from a study of the accompanying drawings, wherein the block is shown in several different forms, suited to different purposes, and from this specification and the claims which terminate the same.

The present invention is a continuation-in-part of my application Serial No. 363,550, filed June 23, 1953 and now abandoned.

Figure 1 is an isometric view of a first, or starter course, illustrating the standard wall block units of the present invention (in a basic form) used in a wall structure and in a partition wall abutting at a corner, together with a bond unit ready for location at the joint between the two walls.

Figure 2 is a view similar to Figure 1, showing a second course in place upon each of the wall structure and of the partition wall, and showing an identical bond unit located in the same manner across the joint between the two.

Figure 3 is a view similar to Figure 1, but showing the first course of the partition wall abutting the first course of the wall structure proper intermediate the length of the latter, and showing also the bond unit in place.

Figure 4 is a view similar to Figure 2, but of the meeting of the second courses of the wall structure and partition wall of the type illustrated in Figure 3.

Figure 5 is an underside isometric view of the joint between a wall structure and a partition wall such as

that illustrated in Figures 1 and 2, illustrating the relationship of a bond unit to the lower edges of the block units in a course.

Figure 6 is an isometric view of a standard full length stretcher block unit of simple basic design, such as is used in the walls of Figures 1 to 5. Figure 6 also illustrates by dash lines the division of such a block unit into two half block units, which is the only other style required.

Figure 7 is a plan view of a curved wall structure, employing block units of a slightly different curved form but of the same basic design as in the preceding figures.

Figure 8 is an isometric view similar to Figure 6, and illustrating a somewhat modified and lightened form of block unit, such as is presently the preferred form.

Figure 9 is a top plan view of a block unit of the style of Figure 8, and of portions of two other block units interlocking therewith, and Figure 10 is a cross-sectional view through the wall structure thus formed, along the line **10—10** of Figure 9;

Figure 11 is a vertical detail section of two courses at the junction of two wall structures, taken lengthwise of the stem of a special T-shaped bond strip.

The wall construction of the present invention employs primarily two series or tiers in each course, of a standard or normal stretcher block unit, or (mostly at the ends) including half blocks, but requiring no special junction block units of any sort or at any place in the wall. It includes the manner of assembly of such blocks in interlocking relationship into a wall, or walls at an angle, in the latter case by means of the use of a special bond strip which is so formed as to interlock with the blocks in each course in the walls which meet at an angle, either at a corner or intermediate the length of one of the walls. The interlocking of the blocks and of the bond strip at the junction between two walls may be such that the individual blocks in one series or tier interfit and interhook each with blocks in the other series or tier in the same course, to eliminate the possibility of separation or appreciable displacement relative to one another of all blocks in the same course in a given wall, either longitudinally or transversely, and/or by the preferred addition of cups and buttons the blocks interlock also as between courses to prevent any possibility of displacement of the blocks of one course relative to those of an adjoining course. The bond strip, cooperating with the cups and/or buttons, provides a similar interlock as between abutting walls. Thereby is provided a wall construction which does not require mortar to hold the block units together and accurately located, nor to bond across a junction between two abutting wall constructions, but which can and which preferably does enable the employment of a thin grout blown or otherwise placed on and between the blocks after the wall construction is completed, which grout serves not only to hold the block units in their relative positions against any displacement whatever, but also serves as a seal to prevent entrance of moisture, wind, dirt, and the like, into the crevices between blocks, and if applied heavily enough serves also as a stucco to give the final wall a finished appearance.

One form of standard stretcher block unit is shown in full length, in a basic form, in Figure 6. It is formed as a longitudinally extending stretcher block **1** intended to be disposed on one edge, which block includes a vertical planar exterior face **10**, two vertical end walls **2***a* and **2***b*, and two hooks **3***a* and **3***b*, directed inwardly towards one another at the face opposite the face **10**, and spaced from the latter by a distance approximating the thickness of the hooks themselves, but spaced apart to leave an opening between the hooks **3***a* and **3***b* of a width sufficient to admit the thickness of two end walls.

Reference has been made above to end walls and hooks individually designated by a numeral and a letter. Hereinafter, if these and other elements similarly designated are referred to generally rather than some one individually and specifically, the numeral only will be used.

The proportions of the block unit are of some importance. If the effective thickness of the planar face **10** be taken as a modular unit, the effective thickness of each hook **3** is likewise a modular unit, and the overall effective thickness of the block unit is three modular units. Its length is by preference eight modular units. Since the ends of the hooks **3***a* and **3***b* are spaced apart by twice the thickness of the end wall (which also is approximately one modular unit), this spacing becomes two modular units, and the tip of each hook is three modular units from the nearer end wall. The reference to "effective thickness" means only that the actual distance is somewhat less, due to the necessity for leaving clearance to allow interfitting of the blocks, as will later be made clear. By way of example, rather than as a limitation, a modular unit may be assumed to be two inches. The height of the block units is immaterial, but is shown as equal to the overall width, namely, three modular units.

Each such full length block, of whatever specific form, is provided upon one of its horizontal edges or surfaces, preferably upon its upper edge, with depressions or cups generally designated **4**, and specifically there are shown the four cups **4***a*, **4***b*, **4***c* and **4***d*. The cups **4***a* and **4***b* are spaced in the length of the block from the one end wall **2***a* by approximately one-fourth the length of the block, that is, by two modular units, and the cups **4***c* and **4***d* are spaced at a like spacing from the opposite end wall **2***b*. The cups **4***a* and **4***c* are therefore spaced apart one-half the length of a block, or four modular units, as are the cups **4***b* and **4***d*. The cups **4***a* and **4***c* are thereby located near the points of the respective hooks **3***a* and **3***b*, whereas the cups **4***b* and **4***d* are located in the edge of the planar wall portion **10**. Similar buttons generally designated **5**, and specifically the four buttons represented at **5***a*, **5***b*, **5***c* and **5***d* (see Figure 5, for example) are identically located but in the opposite horizontal surface, in this instance, in the bottom surface of each block **1**. In this manner, if one such block were to be set directly upon another, the buttons **5** in the lower surface of the upper block would be received in the cups **4** in the lower block, and one block would thus be located accurately above the other, and the two blocks would be prevented, without more, from relative displacement in any lateral direction. The blocks are not ordinarily stacked thus, one directly above another, as will be made clearer hereinafter. The block dimensions are such that the cups and buttons, as locating elements, insure slight spacing between end and side faces of adjoining blocks in the same course, into which grout or stucco material may be forced to seal the joints.

In addition, it is preferred that each block be provided with a series of spacer lugs **6**, outstanding beneath its lower surface by a sufficient amount to rest upon the upper surface of blocks in the course below and to space the block above from the blocks below. The height of the spacer lugs **6** should be less than the height of the buttons **5**, so that the buttons will always enter the proper cups **4**, and serve to locate the blocks above with relation to the blocks below. The spacer lugs leave a slight crevice between the blocks when laid upon one another in courses, which crevice will serve for the reception of grouting and bonding of stucco.

The blocks are laid up in manners typically illustrated in Figures 1 to 5, inclusive. It will be convenient to designate the wall A as the main wall structure and the walls B or B' as partition walls, within the definitions above. In the wall structure A, the blocks are merely laid up in running courses, each composed of two series or tiers. In what may be taken as the first or exterior tier a series of blocks **1** are end-abutted, the first course resting upon a suitable footing F, and in the second or interior tier, the blocks are similarly laid up but at half

block spacings, that is to say, overlapping by one-half block, or four modular units, the blocks in the same course in the exterior tier. In so doing, the hooks 3*a* of each block in the interior tier are interengaged or interhooked with the hooks 3*b* of the blocks in the exterior tier, and the other hook 3*b* of the blocks in the interior tier are each interhooked with the hook 3*a* of a different block in the exterior tier. The manner of interfitting the blocks is very clearly shown in Figures 1 to 5, inclusive, and can be ascertained much more readily by inspection of these figures than from any verbal description.

At the end of the wall structure A, a half block 1' interengages with the single unmatched hook 3 of the terminal block 1, in the manner shown in Figure 1, for example, and thereby finishes the terminus of the wall smoothly.

A partition wall B, such as meets the wall A at a corner as shown in Figures 1, 2 and 5, has its blocks laid up in identically the same way, and at the butted joint between the walls the terminal blocks 1 and 1' of the partition wall B merely abut the side of the terminal block in the wall structure A. This mere abutment furnishes no bond between the walls A and B, and without a proper bond would be a wholly unacceptable weakness.

Passing over the employment of the bond unit for the moment, it will be observed in Figure 2 that the blocks in the next course are laid up in substantially the same manner, both in the wall structure A and in the partition wall B, substantially the only difference being the employment of a half block 1' which is of the opposite hand from the half block in the course below. In the second course, the buttons 5 enter the cups 4 in the blocks of the course below, but since the blocks in the second course are all set to break joint by a half-block spacing with the blocks in the course below, it will be clear that the buttons 5*a* and 5*b* in the course above enter the cups 4*c* and 4*d* in one block in the course below, and the buttons 5*c* and 5*d* of this same block in the upper course enter the cups 4*a* and 4*b* of a different block in the course below. In this manner, the block in the course above is located by and helps to maintain proper location as between the two different blocks in the course below, and to prevent relative movement of the latter two blocks in any horizontal direction. Again, as in the first course, the blocks in the second course in the partition wall B merely abut the terminal block or blocks in the second course of the main wall structure A. Again, there is no bond in this second course, and the lack of binding would continue all the way up the corner, were no bonding unit employed.

Bonding units of one kind or another have been proposed for masonry construction in general, generally for cross-bonding the independent stretcher blocks of a given course but in different tiers, or for longitudinally bonding all stretcher blocks of a course in a single tier, but not across corners to bond together the blocks in different wall curtains. Often it has been necessary to form the block to accommodate the bonding unit, rather than the reverse. The bonding unit of this invention must accommodate itself to the block units such as may be specifically formed for interlocking in three directions, in such manner that such interlocking of the blocks it not interfered with, and the bonding unit is required only at corners, where the blocks cannot interlock except by employing special units, reliance being placed elsewhere upon the normal interlocking directly between the blocks of standard design. By the employment of this interlocking or bonding unit all need of special corner blocks, or of blocks specially formed to accommodate a bonding unit, is eliminated, yet the wall is strongly bonded at all usual corners, whatever the lay-up of the blocks at such corners. The bond unit need be made up of only a single standard shape, usable in all usual corner bonds and in every tier and course thereof, and likewise the blocks can all be of a single standard shape, or halves thereof.

The special bonding unit comprises a bond strip 7 formed of thin material, usually of sheet metal, from which it can be readily stamped. It is of general T-shape, having a cross arm 8 extending at both sides of and braced by brace bars 12 from a centrally located stem 9. The stem is provided with anchor members 10, later described more specifically, to engage the two interhooked block units below it in a given course of the wall A, and the cross arm 8 is similarly provided with anchor members 11 which likewise engage the two interhooked block units in the same course, but of the wall B. Furthermore, these same anchor members of the stem and of the cross arms in like fashion engage the two interhooked block units in the course above in walls A and B respectively. These anchor members might engage the block units in only one course, so long as the blocks of the courses above and below interlock (as by the cups 4 and buttons 5) as between themselves; also, it would be immaterial in such case whether the anchor members engage the block units of the upper or the lower course. The result, the immobilizing of the block units in each wall at the joint, relative to one another and relative to the other wall, and the distribution of side stresses from either wall to the other, would be the same in either case.

Actually the anchor members 10 and 11, in the form shown, engage the block units in the course above and also the block units in the course below, in each wall A and B. These anchor members, as best shown in Figure 5, in their preferred form are constituted by holes of a size to fit snugly about certain buttons 5, together with metal downturned from the holes, or formed as downturned collars surrounding the holes, and of a size to be received in the cups 4 which the same buttons enter. The four anchor members 10 of the stem are spaced from one another by a single modular unit. They engage the cups 4*c* and 4*d* of the terminal whole block unit 1, and also the cups 4*c* and 4*d* of the terminal half block unit 1' of wall A in the first course (see Figure 1), and also engage the buttons 5 of like terminal block units in wall A, in the second course. At the same time the anchor members 11 of the cross arm 8, being also spaced from one another by one modular unit, and from the last anchor member 10 by two and one-half modular units, engage the cups 4*c* and 4*d* of each of the terminal block unit 1 and of the terminal half-block unit 1' in the first course of partition wall B, and the buttons 5 of like terminal block units in the second course of wall B. A like bond strip similarly connects the upper edges of terminal block units in the second course of each of walls A and B, as shown in Figure 2, and so on up. The relationship of such a bond strip 7 to the lower edge of block units in two such walls A and B is shown in Figure 5.

Since the bond strip 7 and its anchoring members 10 and 11 are of thin material, the bond strip can be received in the space between courses, such as is provided by the spacer lugs 6, without displacement of the blocks vertically, and can be received within the cups without displacement of the buttons or their blocks laterally. When so received, each bond strip interlocks both with the blocks in the course below and with the blocks in the course above, and, of course, interlocks at the top and bottom of each course across the joint. The buttons are of slightly smaller cross section than the cups so as to afford clearance therebetween for reception of the anchor elements depressed from the bonding strip.

The location and function of the bond strips is identical where the wall structure A and the partition wall B' meet at a corner intermediate the ends of the wall structure A. Any such joint may be made at spacings of one-half the length of a standard full length stretcher block 1.

Such a wall is normally laid up by setting the blocks upon one another in the manner already indicated, using a bond strip on top of each course at each abutted joint.

Ordinarily, no mortar or grout is used in the laying up, although this is not to say that the use of a thin grout or wash is prohibited. Such a wash may desirably be placed upon the upper edge of each course and permitted to run into the cups, where it will be displaced and will surround the buttons of the blocks in the course above when the latter are set in place. Alternatively, or additionally, when the wall is completed, a grout can be placed within the joints or over the entire exterior surface of the wall. Such a grout can be blown into place by a cement gun, and, particularly when so placed, will penetrate somewhat into the crevices, vertical and horizontal, between the blocks, including the crevice where one wall abuts the other. Thus, it will serve to bond the blocks further and to prevent their displacement, and is desirable in any event as a seal to prevent entrance of moisture, dirt and the like into the crevices, and as a seal against passage of drafts through the wall. When such grout is so placed, the crevices between blocks virtually disappear, and the bond strips become invisible. The entire wall surface is smoothly finished, for there are no gaps of greater width than the narrow crevices defined by the spacer lugs **6** and by the standard length of the stem portion **9** of each bond unit **7**, or such as are determined by the spacing longitudinally caused by the locating cups and buttons, by their interengagement.

It has been mentioned that the bond units **7** are provided with brace bars **12** between the stem **9** and the ends of the cross arm portion **8**. Unless care is taken to prevent it, these and a portion of the stem might interfere with the spacer lugs **6**, as is best seen in Figure 5, wherefore the brace bars **12** are not formed as solid gussets of metal, but the metal is cut out to leave apertures **13**. Thereby, as may be seen in the dot-dash position of the bond strip in Figure 5, certain of the spacer lugs **6** will pass through these apertures **13** and interference is avoided.

Similar principles may be incorporated in a curved wall, for instance, in building a silo, as is illustrated in Figure 7. Here, there will be no necessity of using bond strips unless a partition wall is abutted against the curved wall, yet nevertheless, the interlocking afforded by the hooks and by the cups and buttons will serve to resist strongly any outward bursting stresses which may be caused by the presence of material within the silo. In the silo, the shaft could be made of the normal blocks, and by its mass would tend to prevent outward displacement of the terminal blocks of the curved wall. These latter could be further secured by bonding them to the terminal blocks of the shaft walls by the standard bond unit, slightly bent or deformed to fit.

There has been no illustration of the abutment of two walls at an angle other than at a right angle. Except for the silo shaft, mentioned above, this in any event would be a special case, and would require specially constructed block units, and would, in addition, require a specially made bond unit. If, however, there is a sufficient need for so abutting two walls, it becomes a simple matter to make up special block units with angled ends and to provide angled bond units to join two such walls abutting at other than a right angle.

The preferred form of the block unit itself is shown in Figures 8 to 10, inclusive wherein elements bear double-primed reference numerals similar to the numerals applied to corresponding elements in the preceding figures. This form differs from the basic unit of the preceding figures primarily in that its walls, other than the end walls, are made somewhat thinner, yet the hooks **3″** and planar vertical walls **10″** are made to interfit snugly by the employment of spacer ribs **14**, which project inwardly from the interior surface of the planar wall **10″** and from the interior surface of the hooks **3″**. The effective thickness of the block's parts is still the same as before, notwithstanding the decrease in actual thickness thereof. Preferably, these spacer ribs do not extend downwardly from the block's upper edge more than about one-third the height of the block, and taper off to leave a wider space between the lower edge of the block, as best seen in Figure 10. This affords greater space for circulation of air and for thermal insulation, and it permits the entrance of grout for better bonding, provided sufficient grout is blown into the crevices to penetrate so far. In addition, as may be best seen in Figure 9, the spacer ribs **14** on the hooks **3″** are so located as to overlap one another, and further to prevent endwise separation of the blocks.

I claim as my invention:

1. A wall construction including a first wall structure of blocks disposed end to end in courses and extending continuously in a line and a second wall structure of similar blocks similarly disposed, as in said first wall structure, and directed at an angle to the first wall structure and at one of its ends adjoining the latter, each block in both wall structures having cups and buttons on their respective horizontal surfaces which interfit with like buttons and cups of blocks in the courses above and below, bond strips each of a thinness to fit between courses, interposed between the courses of each of the two wall structures and spanning the junction between the first and second wall structures, said bond strips having apertures through which pass the buttons from button-bearing blocks of one course into the cups of blocks in the adjoining course, and the bond strips also being formed with outstanding anchors about the margins of its apertures, which are received in the cups, the cups, buttons, anchors and apertures interlocking the blocks in successive courses and the two wall structures against lateral separation, to unite the whole into the said wall construction.

2. A wall construction including a first wall structure of blocks each having a vertical exterior wall, end walls directed inwardly from the opposite ends of said exterior wall, and hooks directed from the inner ends of the respective end walls towards but stopping short of the opposite hook, and spaced from the exterior wall, said blocks being disposed end to end in like inner and outer tiers in each course, the hooks of each two end-to-end disposed blocks in the outer tier being interhooked with the respective hooks of a single block in the inner tier, and the hooks of blocks in the inner tier being similarly interhooked with the hooks of blocks in the outer tier, the blocks in said first wall structure extending continuously in a line, a second partition wall structure of similar blocks similarly disposed and interhooked into two like tiers, as in said first wall structure, the partition wall structure being directed at an angle to the first wall structure and at one of its ends adjoining the latter, the several blocks in the two wall structures having on their horizontal surfaces cups and buttons located, by the stated interhooking of the blocks, in alignment transversely of the exterior wall with like buttons and cups of the interhooked blocks, at medial lines between the end walls of each pair of interhooked blocks, and the second wall structure including a terminal hooked half block in one tier of each course at the junction with the first wall structure, also formed with cups and buttons located in the wall structure in the specified alignment with those of the terminal whole block in the second wall structure, and bond strips of a thickness to fit between courses and each generally of T-shape, interposed between courses of each of the two wall structures and traversing the junction between the first and second wall structures, each bond strip being of a size and oriented with the cross arms of the T directed transversely of the terminal blocks of the second wall structure and in registry with the transversely aligned cups and buttons of such terminal blocks, and the stem of the T directed transversely of the adjoining blocks of the first wall structure and in registry with the transversely aligned cups and buttons of such adjoining blocks,

each bond strip having apertures for passage of buttons of blocks in one course into complemental cups of blocks in the next course, to interlock the two wall structures through said bond strips as the latter are interlocked by the interengaging cups and buttons which interlock the successive courses in each individual wall structure.

3. The combination of claim 2, wherein the hooks of each block in a given tier are spaced apart at their ends by a distance equal to the thickness of two end walls plus necessary clearances, to receive between them the two end walls of two interhooked blocks in the opposite tier.

4. The combination of claim 2, wherein the exterior wall and the hooks of each block in a given tier are spaced apart by a distance equal to the thickness of the hooks of interhooked blocks in the opposite tier, plus necessary clearances.

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