

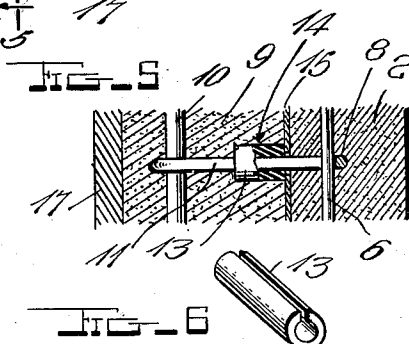
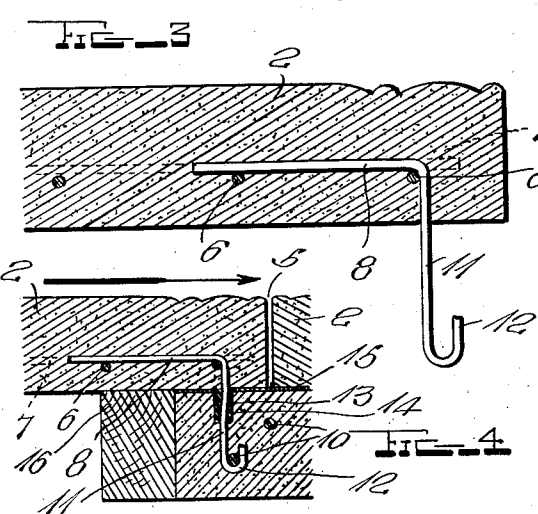
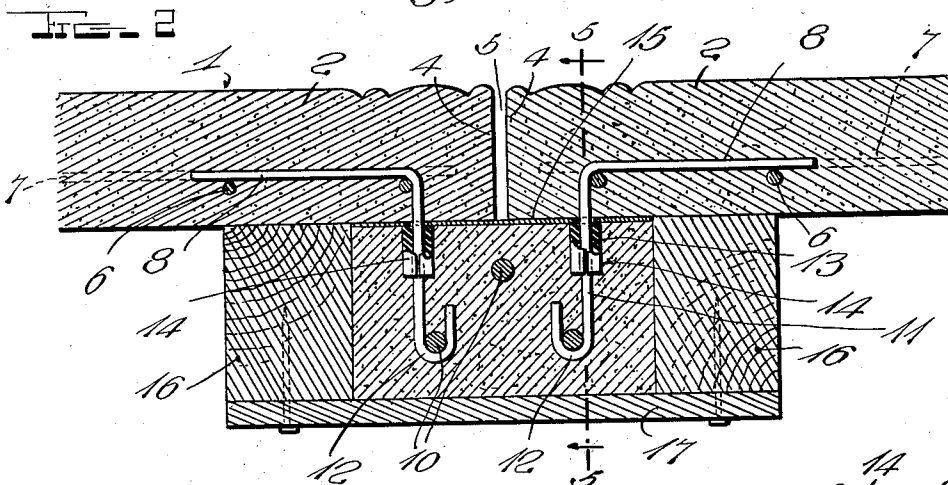
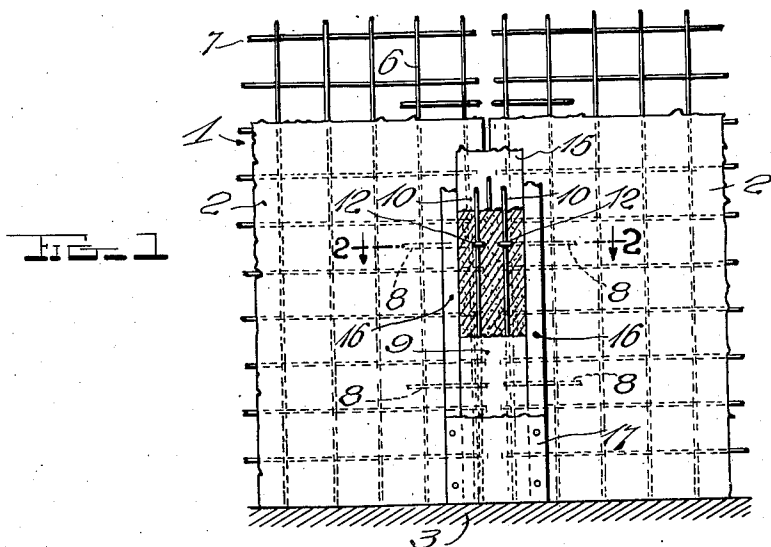
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J. J. EARLEY ET AL

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BUILDING STRUCTURE AND METHOD OF PRODUCING THE SAME

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INVENTORS
John J. Earley,
Basil G. Taylor,

BY *Ames & Jones*
ATTORNEY.

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BUILDING STRUCTURE AND METHOD OF
PRODUCING THE SAMEJohn J. Earley and Basil Gordon Taylor,
Washington, D. C.

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19 Claims. (Cl. 72-107)

This invention relates to improvements in houses and other building structures, and particularly to a novel construction of automatic expansion joint between component units of the walls or other like parts of such structures, and to a method of producing the same.

In the construction of the walls and like parts of buildings, particularly those in which the walls are formed of assembled panels or slabs or like units of precast concrete or other materials secured to columns, posts or like supports of concrete or other materials, a grave difficulty is encountered in the formation of joints between the panels or slabs, which must be suitably constructed to compensate for expansion and contraction of the component materials in order to avoid injury thereto and to the general structure while at the same time sealing the joints against the entrance of moisture and the actions of the elements. The joint constructions commonly employed are open to the serious objection that they fail to provide for proper free expansion and contraction of the units under climatic changes so that stresses and strains are set up which result in injury to the wall forming units, and sometimes to the general structure, and cause leakage at the joints therebetween.

The primary object of our invention is to provide a wall structure comprising wall forming units, in the form of panels or slabs of precast concrete, stone or other materials, which are attached to supporting columns or posts by novel means furnishing a joint connection which securely combines the wall forming parts into a perfect wall, but leaves such parts free to move with the expansion and contraction of their component materials, whereby injuries to the walls and to the general structure due ordinarily to expansion and contraction will be avoided.

A further object of the invention is to provide a construction of fastening and sealing means forming an automatic expansion joint whereby a construction of joint is produced which, while allowing free expansion and contraction of the wall elements, will at all times maintain the joint sealed against the entrance of air, moisture and other actions of the elements.

A still further object of the invention is to provide a novel method of assembling the wall forming elements and forming an automatic expansion joint of the character described so as to make a perfect wall.

In the accompanying drawing we have shown, for purposes of exemplification, a certain construction of wall, and means employed in the con-

struction thereof for carrying our invention into practical effect, without, however, limiting the invention to the particular structure and means disclosed only as a practical exemplification. In the said drawing:—

Fig. 1 is an inside elevational view, with parts broken away and in section, of a portion of a wall embodying our invention.

Fig. 2 is a horizontal section through the wall, taken on line 2—2 of Fig. 1, on a greatly enlarged scale.

Fig. 3 is a horizontal section through one of the panels or slabs and showing one of the fastening members of the joint carried thereby.

Fig. 4 is a horizontal section, similar to Fig. 2, through adjoining panels or slabs and a supporting column of a complete wall, illustrating one action of the expansion joint.

Fig. 5 is a section on line 5—5 of Fig. 2.

Fig. 6 is a perspective view of the elastic sleeve or thimble.

In the illustrated example, we have shown a portion of a wall 1 constructed of slabs or panels 2, assembled upon a suitable foundation 3 of concrete or other suitable material. The panels may be of any suitable dimensions and be of precast concrete, stone or other suitable materials. They are placed in position so that adjacent edges 4 thereof will be left spaced to provide a joint gap 5 of suitable width to allow the slabs to have free movements under expansion and contraction.

The panels or slabs 2 shown in the present instance are of reinforced concrete, each slab having embedded therein a mesh-like reinforcement of vertical reinforcing rods 6 and horizontal reinforcing rods 7, which may be suitably united, as by welding, at the crossing points, to provide a rigid reinforcing structure. At suitable intervals apart or at properly spaced elevations the panels or slabs 2 are provided adjacent their edges 4 with fastening members 8 for attaching them to an inside supporting column or post 9, which fastening members have their body portions embedded in the panels and welded or otherwise firmly secured to certain of the reinforcing rods 6 thereof.

The column or post 9 is formed of concrete having embedded therein vertical reinforcing rods 10, which may be connected and reinforced by horizontal reinforcing rods, if desired. This post 9 rests at its base upon the foundation 3 and may extend upward to the roof line of the building in rear of the panels and in abutting contact therewith to equal degrees on opposite sides of the joint 5. The fasteners 8 are pro-

vided with shank portions 11 which extend inwardly at right angles from the panels and into the column 9 in which they are firmly embedded, and these shanks 11 are provided at their extremities with hooks or other engaging elements 12 which are bent about or otherwise engaged with certain of the reinforcing rods 10 of the column, whereby the panels are securely fastened to the column against any possibility of physical displacement.

Disposed about the fastener shanks 11 are bushings or thimbles 13, which in the present instance are shown as split sleeves of rubber, resilient metal or other suitable elastic, flexible or resilient material, the bushings being split to permit of their ready application to the shanks, but in practice the bushings may be of other suitable form and material and wound or otherwise applied to the shanks. These bushings or thimbles are of sufficient length and diameter to definitely space portions of the shanks 11 from the concrete material of the column and to form within the column spaces or recesses 14 which open at their outer ends through the outer side of the column and which are occupied by the bushings 13. In practice, the fasteners 8 are made of metal of a suitable tensile strength and of a degree of resiliency sufficient to allow the limbs or shanks 11 to bend or flex universally within required limits, namely, those limits adapting those portions of the shanks which are enclosed in the recesses 14 and held spaced from the column material by the elastic bushings 13 to bend or flex in any direction to permit free movements of the panels or slabs 2 either vertically or horizontally. By this means while the slabs 2 are firmly tied to their supporting column 9 so that they can not become physically displaced, they are at the same time united thereto by a fastening or joint construction of universally flexible type within certain limits to permit them to move freely to compensate for expansion and contraction of the concrete under temperature changes, whereby stresses and strains in and between the wall parts commonly produced in ordinary joint structures are avoided, as well as resulting liability of injury to or displacement of the wall parts. It will be understood, of course, that the bushings 13 may be made of any permanently durable elastic or resilient material to serve continuously as elastic reinforcements for the free and flexible portions of the shanks 11. If, however, the physical structure of the bushings should be destroyed by any cause, the elastic permanency of the joint will not be affected, since in this event the recesses 14 will allow the free portions of the shanks 11 to have freedom of motion therein.

Fig. 4 shows, for example, the capability of movement of a panel to compensate for expansion in one direction, that is, horizontally toward an adjacent panel, in which the shanks of its fasteners bend or flex in such direction. It will, of course, be understood that in the contraction of the same slab 2, in which it moves away from the adjacent panel, the fasteners of the contracting panel will bend or flex in the opposite direction. Similarly, if the panel should expand or contract in a vertical direction, its fasteners will bend or flex upwardly or downwardly. Thus the fastening connections provide a joint which allows the panels to individually or conjointly expand or contract to the same or different degrees either vertically or horizontally or, in other words, provide a joint which is universally flexible so as to automatically permit and compensate for expansion

and contraction of the panels in any and all directions in which they contract and expand under climatic changes.

Arranged between the opposed surfaces of the panels and column 9 is a joint closing strip 15 of metal foil, fibre or other suitable material of a durable and preferably impervious character. This strip bridges across the outer face of the column, is tightly clamped between the same and opposed portions of the inner faces of the slabs and closes the inner side of the joint gap 5. The function of this strip in the completed structure is to seal the joint against the access of air and moisture and by being tightly clamped between the panels and column it effectually closes all voids therebetween, thus preventing entrance of moisture by capillary attraction and in all other respects making the joint weatherproof. As it hermetically seals the inner side of the joint space any moisture flowing into the gap will simply flow downward through the gap, which will act as a drain gutter, and discharge at the foundation line, and any water, such as rain water, blown or forced into the gap, as during a storm, will encounter a pocket of air at the sealed side of the gap and will be deflected thereby and drain down through the gap. By this construction the filling of the gap with cement, mortar or a like sealing medium for the purpose of excluding wind and water is rendered unnecessary, with the advantage that the gap may be left open except at its inner side where it is sealed to permit free movements of the panels in expanding and contracting. This strip further serves as a mold lining and in conjunction with the panels as one wall of a mold employed in casting the post 9 in situ, as hereinafter described.

In accordance with our invention, we provide a novel method of assembling the wall parts, including a novel method of forming the column 9 and producing the fastening connection between the same and the panels whereby the automatic expansion joint is formed, and whereby a permanently tight joint seal is secured. It is difficult to ensure sufficient accuracy in form and alignment of parts for these purposes without adjustments, and to provide an efficient construction, in case the column is first precast as a unit and fastened in place prior to assemblage of the wall panels, and we, therefore, cast this column in situ and form the joint in a manner which avoids all difficulties in this connection, and which we will now proceed to describe. In carrying out this assembly method the panels 2 are first set in place upon the foundation 3 in proper alinement and with their proximate edges 4 spaced to provide the gap 5. A mold for casting the column behind the panels is then formed in any suitable manner. If a wooden framing is used for convenience in the erection of the building, studding posts 16 forming a part of this framing may be disposed as shown to form the side walls of the mold and to such studding posts one or more boards or plates 17 may be secured to form the inner wall of the mold. These parts are arranged as shown in position to utilize the panels to form the outer wall of the mold, into which the portions of the fastening members 8 projecting from the panels extend. At a suitable stage in these proceedings the reinforcing rods 10 are placed in position and held firmly from displacement in any suitable manner, the hooked ends 12 of the fastenings 8 being engaged with the proper rods, and the bushings 13 and sealing strip 15 fitted in position in proper order. The concrete mixture

is then filled into the mold in any suitable manner and allowed to set, after which the studding 16 and boarding 17 may be removed or not as desired. It will be evident that the strip 15 in this column molding operation serves the dual function of closing the gap 5 against the escape of concrete thereinto and as a smooth lining for the outer mold wall and which, particularly if made of pliable metal or other pliable material, will close any possible voids in the surfaces of the panels and formed column and provide a smooth surface for an accurate formation of the outer surface of the column in exact parallel relation to the opposed surfaces of the panels. Thus when the column is molded the strip will be tightly clamped between the same and the panels to hermetically seal the joint, while the hooked ends of the fasteners 8, which are doubly secured by engagement with the rods 10 and by being invested in the concrete, will hold the panels firmly secured to the column against any possibility of outward movement or displacement relative thereto. At the same time the panels are also held by the fastenings from undue shifting displacement relative to each other, while being permitted to have free movement in all directions, through universal flexion of the shanks 11 in the recesses 14, under expansion and contraction due to temperature variations.

It will thus be seen that our invention provides a construction and method whereby a wall structure of the character described may be produced which is of great strength and free from liability of displacement of its parts while embodying expansion joints which are perfectly sealed against the entrance of wind and moisture and allow automatic expansion and contraction of the parts in a most efficient manner to compensate for temperature variations and prevent damage or injury to the wall structure. While the structure and method as disclosed are preferred, it will, of course, be understood that such variations therefrom as fairly fall within the scope of the appended claims may be made without departing from the spirit or sacrificing any of the advantages of the invention. For example, the hooks 12 upon the fasteners 11 may be omitted and other means employed to secure the fasteners to the rods 10 and in some cases an engaging connection between the fasteners 11 and rods 10 may be entirely omitted and reliance placed for a holding connection upon the physical bond between the fasteners 11 and the concrete of the column in which they are embedded. Also the structural formation of the tie connections may be changed to suit varying conditions so long as the essential features of the invention are preserved.

What we claim is:—

1. In a building construction, the combination of wall panels having marginal portions thereof arranged adjacent each other with a joint space therebetween, a support in rear of said panels and bridging across said joint space, and a fastening connection between each panel and said support, each fastening connection comprising a unitary member of inherently resilient material having terminal portions respectively fixed in the panel and support and an intermediate portion joining said terminal portions but free from connection with the panel or support to permit free universal movements of said panel relative to the support under expansion and contraction.

2. In a building construction, the combination of wall panels having marginal portions thereof

arranged adjacent each other with a joint space therebetween, a support in rear of said panels and bridging across said joint space, a layer of sealing material between the panels and support and bridging across and closing the inner side of said joint space, and fastenings between said panels and said support connecting the panels with the support to permit free movements of said panels relative to the support under expansion and contraction.

3. In a building construction, the combination of wall panels having marginal portions thereof arranged adjacent each other with a joint space therebetween, a support in rear of said panels and bridging across said joint space, and fastening connections between said panels and said support having portions fixed in the support to hold the panels from outward displacement relative to the support and portions free from engagement with the support for flexion to permit free movements of said panels relative to the support under expansion and contraction.

4. In a building construction, the combination of precast concrete wall panels having marginal portions thereof arranged adjacent each other with a joint space therebetween, a molded concrete column in rear of said panels and bridging across said joint space, a layer of sealing material between the panels and column and bridging across and closing the inner side of said joint space, and fastenings between said panels and said column having portions fixed in the panels and column to hold the panels from outward displacement relative to the column and portions lying within the column but free from engagement therewith for flexion to permit free movements of said panels relative to the column under expansion and contraction.

5. In a building construction, the combination of wall panels having marginal portions thereof arranged adjacent each other with a joint space therebetween, a support in rear of said panels and bridging across said joint space, and fastening members extending from said panels into the support and having portions rigidly connected with the support and other portions free from connection with the support, the support being formed with recesses to allow flexing movements of the latter-named portions of the fastenings whereby to permit free movements of said panels relative to the support under expansion and contraction.

6. In a building construction, the combination of wall panels having marginal portions thereof arranged adjacent each other with a joint space therebetween, a support in rear of said panels and bridging across said joint space, a layer of sealing material between the panels and support and bridging across and closing the inner side of said joint space, and fastening members extending from said panels into the support and having portions rigidly connected with the support and other portions free from connection with the support, the support being formed with recesses to allow flexing movements of the latter-named portions of the fastenings whereby to permit free movements of said panels relative to the support under expansion and contraction.

7. In a building construction, the combination of wall panels having marginal portions thereof arranged adjacent each other with a joint space therebetween, a concrete column arranged in rear of said panels and bridging across said joint space, fastening members embedded in the column, and fastening members fixed at one end

to the panels and extending therefrom into the column and having their opposite ends fixed in the column and engaged with the fastening members therein to hold the panels from outward displacement relative to the column, the intermediate portions of said first-named fastening members lying within the column being free from engagement with the column so as to be free for flexion to permit free movements of said panels relative to the support under expansion and contraction.

8. In a building construction, the combination of precast concrete wall panels having marginal portions thereof arranged adjacent each other with a joint space therebetween, a molded concrete column arranged in rear of said panels and bridging across said joint space, and fastenings invested in the panels and between said panels and said column including fastening members having portions rigidly invested in the column to hold the panels from outward displacement relative to the column and portions lying within but free from engagement with the column for flexion to permit free movements of said panels relative to the support under expansion and contraction.

9. In a building construction, the combination of precast concrete wall panels having marginal portions thereof arranged adjacent each other with a joint space therebetween, a molded concrete column arranged in rear of said panels and bridging across said joint space, a layer of sealing material between the panels and support and bridging across and closing the inner side of said joint space, and fastenings invested in the panels and extending between said panels and said column including fastening members having portions rigidly invested in the column to hold the panels from outward displacement relative to the column and portions lying within but free from engagement with the column for flexion to permit free movements of said panels relative to the support under expansion and contraction.

10. In a building construction, the combination of wall panels having marginal portions thereof arranged adjacent each other with a joint space therebetween, a concrete column arranged in rear of said panels and bridging across said joint space, a layer of sealing material between the panels and column and bridging across and closing the inner side of said joint space, and fastenings extending between said panels and said column and having terminal portions fixed in panels and column to hold the panels from outward displacement relative to the column, the column having recesses therein and said fastenings having intermediate portions lying in said recesses and free from engagement with the column for universal flexing movements to permit free movements of said panels relative to the support under expansion and contraction.

11. In a building construction, the combination of wall panels having marginal portions thereof arranged adjacent each other with a joint space therebetween, a concrete column arranged in rear of said panels and bridging across said joint space, a layer of sealing material between the panels and column and bridging across and closing the inner side of said joint space, fastenings extending between said panels and said column and having terminal portions fixed in panels and column to hold the panels from outward displacement relative to the column, the column having recesses therein and said fasten-

ings having intermediate portions lying in said recesses and free from engagement with the column for universal flexing movements to permit free movements of said panels relative to the support under expansion and contraction, and elastic fillers between said portions of the fastenings within the recesses and the walls of said recesses.

12. In a building structure, the combination of wall panels having marginal portions arranged to form a joint space therebetween, a molded concrete column arranged in rear of said panels and bridging across said joint space, said column having recesses therein, and fastening members having end portions fastened within the panels and column to hold said portions from physical separation and displacement and flexible intermediate portions extending through the recesses in the column and free for flexing movements therein to permit free movements of the panels under expansion and contraction.

13. In a building structure, the combination of wall panels having marginal portions arranged in spaced relation to provide a joint gap therebetween, a concrete column arranged in rear of said panels and bridging across said joint space, a sealing strip extending across the joint space and arranged between the opposed surfaces of the panels and column, the column being provided with recesses therein, and fastening members fixed at their ends in the panels and column and having flexible intermediate portions in the column extending through and free for flexion within the recesses to permit free movements of the panels for expansion and contraction.

14. In a building structure, the combination of wall panels having marginal portions arranged in spaced relation to form a joint gap therebetween, a concrete column molded in situ in rear of the panels and having reinforcing members therein, said column bridging across said joint space and having recesses therein opening through its side facing the panels, fastening members fixed to the panels at one end and invested in the column at their opposite ends and having flexible intermediate portions extending through the recesses in the column and free for flexing movements therein to permit expansion and contraction of the panels, elastic bushings within the recesses and between the same and said flexible portions of the fastening members, and a sealing strip disposed between the opposed faces of the panels and column and bridging across the joint space.

15. The method of assembling and uniting wall elements of a building structure so as to securely unite said elements and form an automatic expansion joint therebetween, which consists in disposing wall forming panels having fastening elements capable of universal flexion projecting from their inner faces, so that adjacent marginal portions of said panels are arranged in juxtaposition but spaced to form an intervening joint gap, and molding in situ a concrete supporting column on the inner side of the panels so as to bridge across the joint gaps and so as to invest portions of said fastenings therein while leaving said gap open and leaving other portions of said fastenings free for flexion in the column to permit movements of the panels relative to each other and to the column under expansion and contraction.

16. The method of assembling the component parts of a wall or other part of a building structure so as to securely unite the same against physical separation while providing an automatic ex-

pansion joint therebetween, which consists in disposing panels with marginal portions in spaced relation to provide an expansion gap therebetween, forming a mold in rear of the panels one wall of which includes disposing a strip of sealing material against the rear faces of the panels and bridging across the joint space, disposing forming elements for coaction with said strip to form a mold in rear of the panels, and forming in said mold a concrete column retaining the sealing strip in permanent position as a joint sealing medium and uniting the panels and fastening means in the process of formation of the column so that portions of the fastening means will be free for flexion in the column to permit free movements of the panels under expansion and contraction.

17. In combination, a wall panel, a concrete support having a recess therein, a unitarily continuous tie connection between the panel and column including terminal portions rigidly anchored in the panel and slab and a universally flexible limb of circular cross-section connecting said portions and passing through said recess and free for flexing movements therein to permit free movements of the panel under expansion and contrac-

tion, and an elastic gasket in said recess and enclosing said limb.

18. In a wall, ceiling or like building structure, a support having a recess therein, a wall or ceiling forming slab, and a mechanical articulating fastening connection between the support and slab comprising an inherently resilient member having terminal portions fixed respectively in the support and slab and an intermediate portion extending through the recess in the support and free from connection with the support and slabs and universally flexible in said recess to permit free relative movements of the support and slab.

19. In a wall, ceiling or like building structure, a support having a recess therein, wall or ceiling forming slabs, and a mechanical articulating fastening connection between each slab and the support comprising an integrally continuous inherently resilient element having terminal portions respectively fixed in the support and slab and an intermediate portion extending through the recess in the support and free therefrom for universal flexion.

JOHN J. EARLEY.

BASIL GORDON TAYLOR. 25