June 27, 1939. B. LONDON 2,164,137

BUILDING CONSTRUCTION

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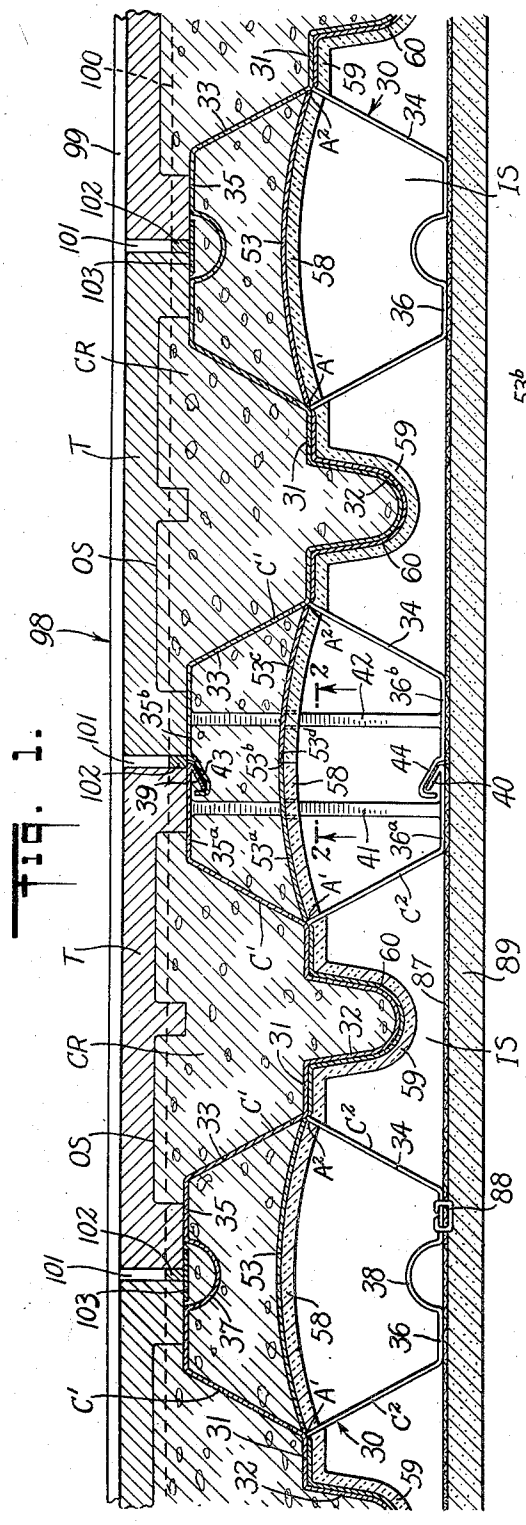


Fig. 1.

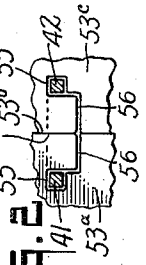


Fig. 2.

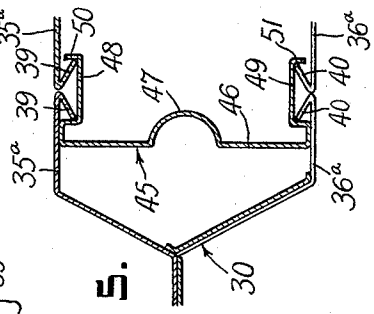


Fig. 5.

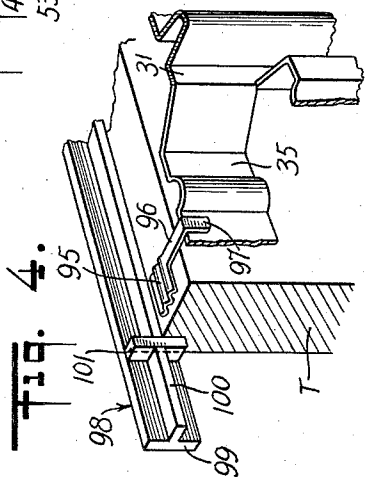


Fig. 4.

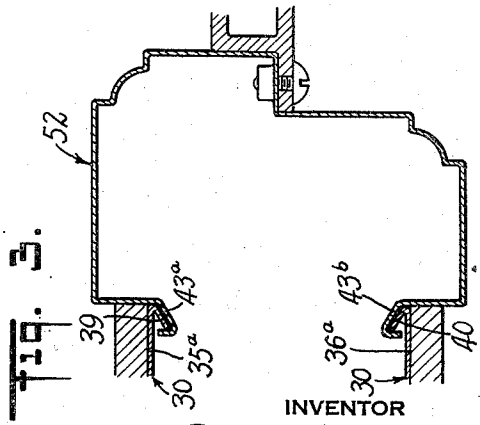


Fig. 3.

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Fig. 6.

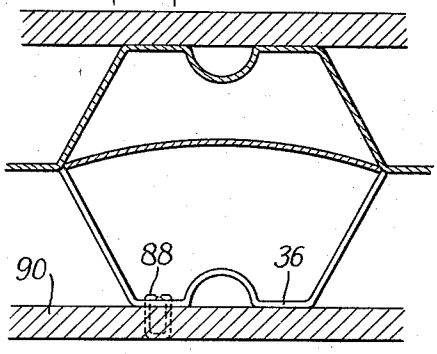


Fig. 7.

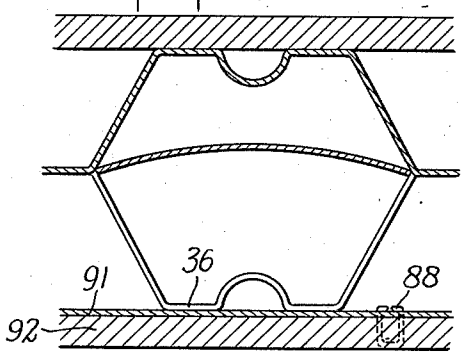


Fig. 8.

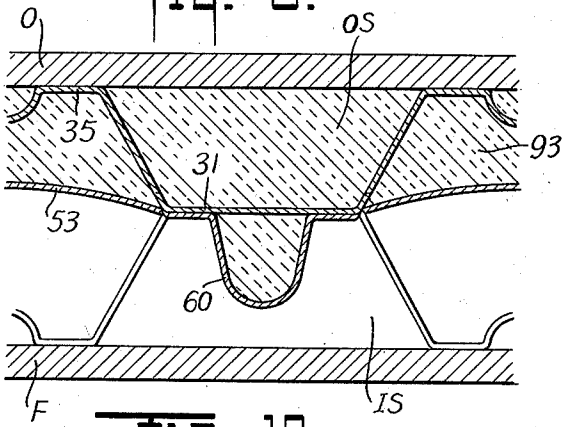


Fig. 9.

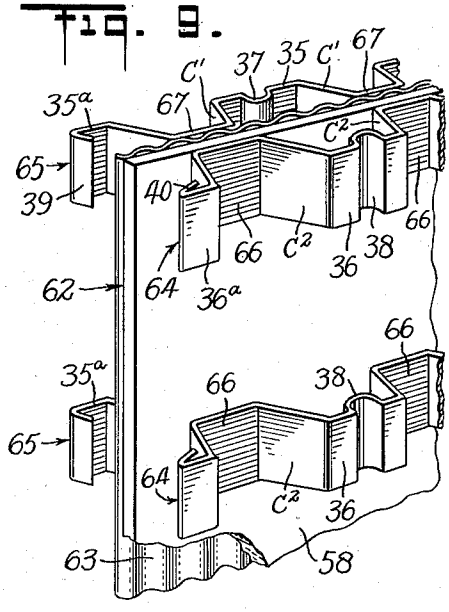


Fig. 10.

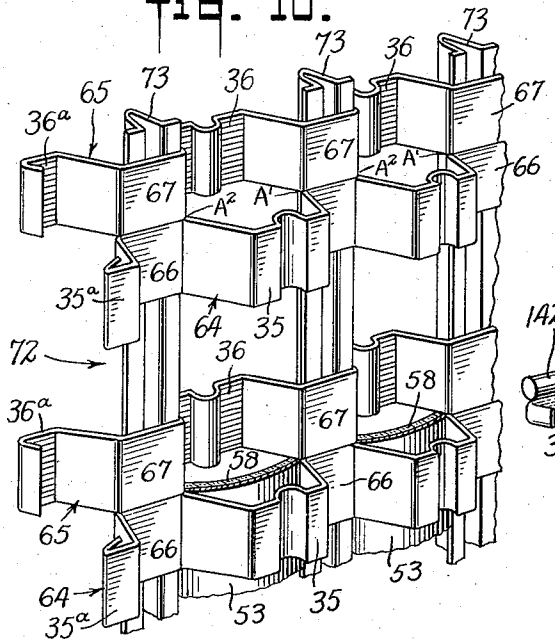
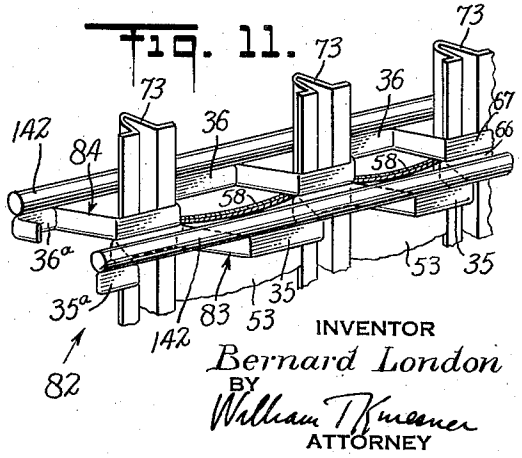


Fig. 11.



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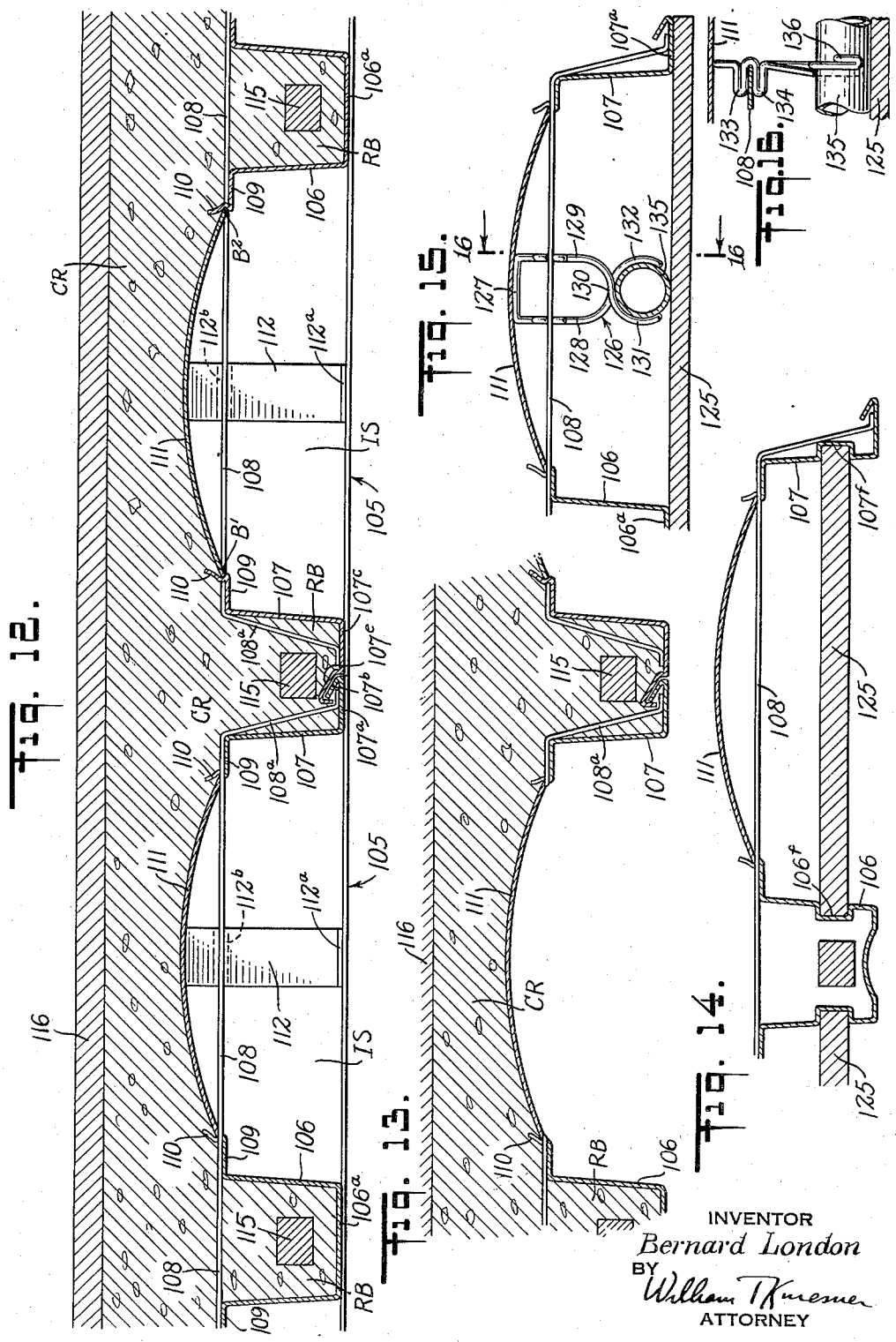


Fig. 12.

Fig. 15.

Fig. 16.

Fig. 13.

Fig. 14.

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Fig. 17.

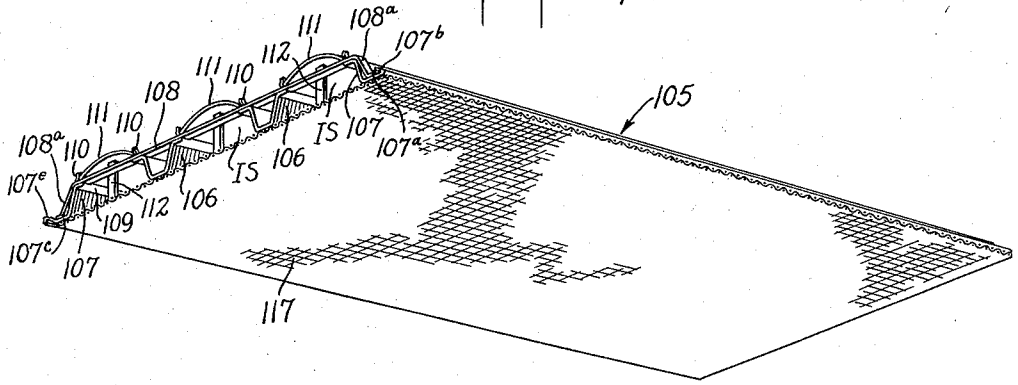


Fig. 18.

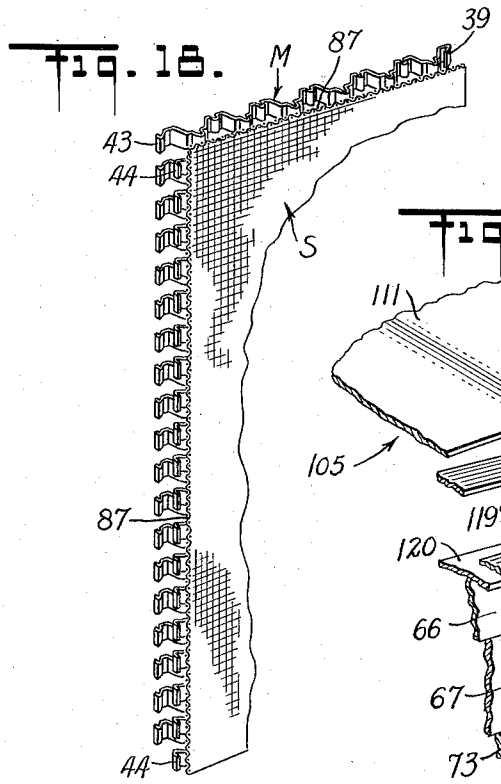
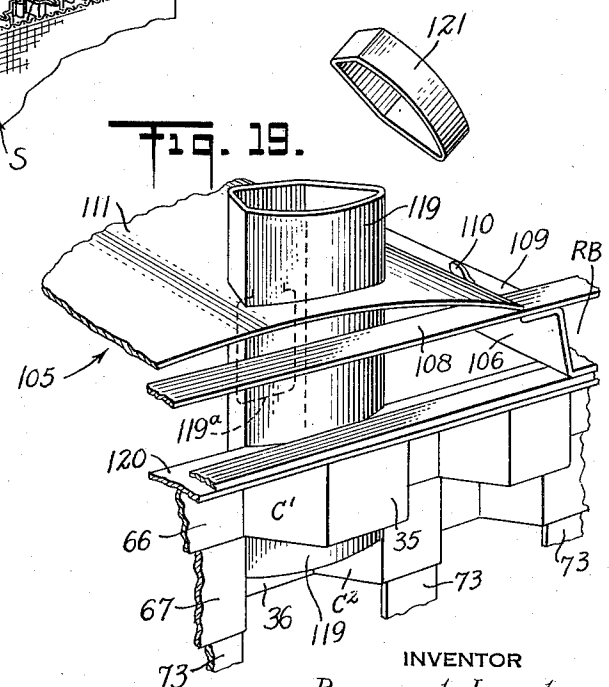


Fig. 19.



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Fig. 20.

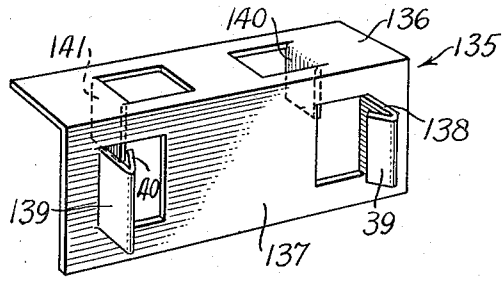


Fig. 21.

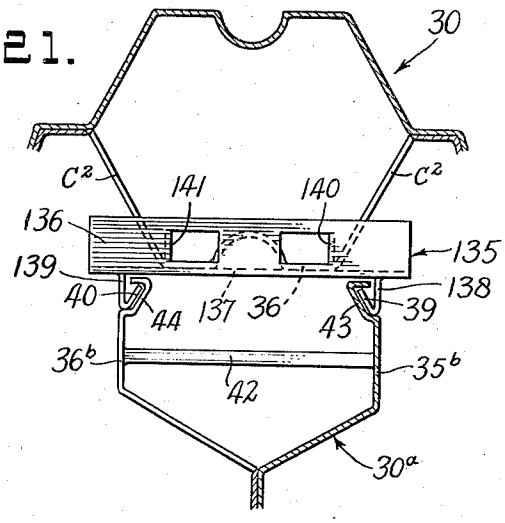
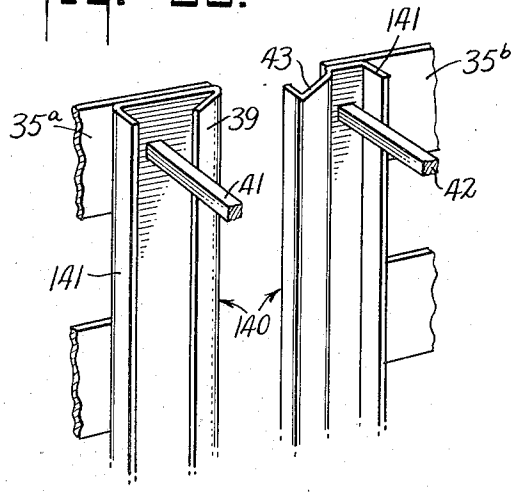


Fig. 22.



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Patented June 27, 1939 2,164,137

UNITED STATES PATENT OFFICE

2,164,137

BUILDING CONSTRUCTION

Bernard London, New York, N. Y.

Application March 5, 1938, Serial No. 194,051

31 Claims. (Cl. 72—71)

This invention relates to building construction.

One of the objects of this invention is to provide a building construction the component parts of which will be capable of inexpensive fabrication and of rapid and inexpensive assembly. Another object is to provide a building construction that will be practical, inexpensive, durable, fireproof, and that will achieve, in a thoroughly practical and inexpensive way, improved facility of construction.

Another object is to provide structural elements or units that will be light and strong, capable of rapid and inexpensive prefabrication and of ultimate assembly, and capable of wide flexibility or range of choice of building materials capable of being associated therewith.

Another object is to provide a simple, practical and inexpensive building construction for the efficient and inexpensive use therein of metal, such as sheet metal, in association with various or usual materials used in building construction. Another object is to provide building elements of metal, such as sheet metal, capable of efficient and inexpensive incorporation in building construction, particularly in association with various building materials. Another object is to provide practical and inexpensive structural units of metal and certain building materials, such as lathing, for example, capable of speedy and simple assembly, unit by unit, and of quick and simple interconnection with each other. Another object is in general to improve heretofore known structural methods and building constructions and to provide structural elements and units capable of achieving low cost building or housing construction. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, arrangements of parts and in the several steps and relation and order of each of the same to one or more of the others, all as will be illustratively described herein, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings in which are shown certain of the various possible embodiments of the mechanical features of my invention,

Figure 1 is a transverse sectional view of a wall structure, illustratively a horizontal sectional view of an outer wall of a building;

Figure 2 is a detached vertical elevation, as seen along the line 2—2 of Figure 1;

Figure 3 is a fragmentary sectional view like that of Figure 1 showing a preferred wall construction in association with a window-frame, door-frame, or the like;

Figure 4 is a detached fragmentary perspective and partly sectional view of a portion of the wall structure;

Figure 5 is a horizontal sectional view showing an attachment relatable to the core mold of my invention for reversing certain connecting parts;

Figure 6 is a fragmentary view like that of Figure 1 showing a different form of wall surfacing;

Figure 7 is a view like that of Figure 6 illustrating another form of wall surfacing;

Figure 8 is a horizontal sectional view showing a modified form of metal core mold;

Figures 9, 10 and 11 are fragmentary perspective views of modified forms of core mold;

Figure 12 is a transverse sectional view of a wall structure, illustratively a ceiling and floor structure and being more specifically a vertical sectional view;

Figures 13, 14 and 15 are views like that of Figure 12 showing certain possible modified forms;

Figure 16 is a fragmentary elevation as seen along the line 16—16 of Figure 15;

Figure 17 is a detached perspective view of a wall core mold, such as is preferably employed in a ceiling and floor;

Figure 18 is a detached perspective view of a core mold structure such as is preferably employed in making up a side wall;

Figure 19 is a fragmentary perspective view showing the assembly of core mold structures of the side wall and ceiling type, prior to the pouring of concrete;

Figure 20 is a perspective view of a detachable attaching device;

Figure 21 is a plan view showing two core mold sections at right angles to each other and interconnected by the use of a device like that of Figure 20, and

Figure 22 is a perspective view of the adjacent end portions of two core mold sections showing a preferred form of attaching means therefor.

Similar reference characters refer to similar parts throughout the several views in the drawings.

Referring first to Figure 1, there is shown and generally indicated at 30 a core structure preferably made up of sheet metal and which, in so far as carrying out certain features of my invention are concerned, may take the general form of that

shown in Figure 4 of, and described in, my Letters Patent No. 2,076,472, to which reference may be made for details of its general construction. For present purposes it will suffice to note that this core structure **30**, made up of sheet metal, comprises a plurality of spaced vertical continuous sheet metal portions **31** which are preferably ribbed as at **32**, preferably by pressing the sheet metal of the portion **31** out of its plane and to give it illustratively a U-shaped cross-section. This is desirable where the sheet metal employed is of relatively thin gage, giving the vertical portions **31** rigidity and resistance against bending and adapting them for action like a column.

The sheet metal intervening these vertical column portions is slit or cut horizontally to form a suitable number of strap-like horizontally connecting portions which are pressed or bent alternately out of the plane of the intervening portions **31**, as is better shown in Figure 4 of my above-mentioned patent, and in Figure 1 herein the strap-like portions will be seen as including the strap-like portions **33** that are pressed outwardly to one side of this intermediate plane and the strap-like portions **34** that are pressed outwardly to the other side of this plane; thereby I provide a plurality of spacing parts, preferable plane-faced, as at **35** and **36**, which lie in respective planes parallel to each other but spaced apart, the portions **35** and **36**, moreover, appearing in the core structure **30** in horizontal and vertical rows.

Preferably, the connecting portions of these strap-like parts that connect these spacing portions **35** and **36** to the horizontally spaced vertical column portions **31** are inclined to the plane of the intermediate portions **31**, substantially as shown in Figure 1; thereby, the connecting portions C^1—C^1 and the planes thereof, for the spacing portions **35**, make respective angles with the connecting portions C^2—C^2 and the respective planes thereof, of the spacing portions **36**, the apexes of these two angles being indicated at A^1 and A^2 and extending throughout the vertical dimension of the core **30** and being substantially coincident with the junctions of the opposed connecting portions with their respectively adjacent column portions **31**. These angles will thus be seen to provide two opposed substantially continuous V-shaped channels extending throughout the vertical dimension of the core section, all for a purpose later described.

Preferably, the spacing of the plane of the spacing portions **36** from the plane of the intermediate parts **31** or from the plane of the sheet metal out of which the core structure **30** is made, is somewhat greater than the spacing of the spacing portions **35** from that plane; this difference, where and when desirable, may be achieved by appropriate crimping of the spacing portions **35** and **36**, as at **37** and **38**, and making one of such crimps, such as the crimp or rib **37**, of greater dimension or depth than the other.

The core **30** is of suitable length and breadth and preferably such that several or any desired or suitable number thereof may be assembled together to form a single wall. Thus, one such core section might have a width, in the direction of the length of a wall, of three feet and a length, in the direction of the height of the wall, of, for example, four feet, or even substantially the same as the height of the wall itself. Thus, for a eight-foot ceiling height, two core sections, one on top of the other, are appropriate or even a single core section of substantially eight feet may be used.

Preferably, the core sections terminate at their vertical ends in a manner to facilitate rapid interconnection of core sections placed side by side. Illustratively and preferably, and still referring to Figure 1, in which portions of two core sections **30** are shown joined together substantially at the center of that figure, the right-hand vertical end of the core section **30** terminates in opposed spacing portions 35^a and 36^a which in effective length or extent are substantially half of the spacing portions **35**, **36**, respectively, and these portions 35^a and 36^a are at their extreme ends flanged or bent inwardly as at **39** and **40** to form in effect a ratchet-like tooth at the end of each, the spacing portions 35^a and 36^a of adjacent horizontal rows thereof being held against distortion or bending by a cross-piece **41** preferably of strip-like sheet metal and secured as by spot welding. Throughout the right-hand end edge of each core section **30**, therefore, the spacing portions 35^a are maintained in alinement and so also the opposed spacing portions 36^a, and likewise the ratchet-like connecting parts **39** and **40**.

Each core section at its left-hand end edge likewise terminates in spacing portions 35^b and 36^b, opposed spacing portions of adjacent rows being held spaced by a reinforcing or bridging member **42**, comparable to the member **41**, but the ends of the spacing portions 35^b and 36^b are bent inwardly and then outwardly into the hook-like members **43** and **44**. Accordingly, and throughout the left-hand end edge of each core section **30** there project two laterally spaced rows of outwardly directed hook-like or latch parts, the parts **43** being in one row and the parts **44** in the other; these parts, moreover, are respectively juxtaposed to the ratchet-like parts **39** and **40** which likewise are alined in two laterally spaced vertical rows.

The parts, as is better shown in Figure 1, are, moreover, shaped so that when two adjacent core sections are moved together edgewise, or one moved toward the other, the ratchet-like parts **39** and **40** become interengaged and interlocked with the hook-shaped parts **43** and **44**, respectively, and the two adjacent core sections become interconnected and securely linked together throughout the entire adjacent vertical edges. The parts, moreover, being of sheet metal, have inherently sufficient yieldability to permit the cam-like or ratchet-like parts **39** and **40** to spread away from each other and to permit the companion hook-shaped parts **43** and **44** to yield or spring inwardly toward each other, for the purpose of permitting the interlocking or interengagement, the resiliency or springiness of the metal likewise causing these parts to spring back to substantially normal positions and become securely interengaged, as shown in Figure 1. Thus, adjacent core sections may be readily and rigidly interconnected, as by the actions illustratively above described.

Occasion might arise in practice where two adjacent core sections are brought together but presenting similar connecting parts. For example, the adjacent edges of two core sections might each present hook-shaped parts **43** and **44** or ratchet-like or cam-like parts **39** and **40**. To facilitate interconnection under such circumstances, I prefer to employ an attachment generally indicated in Figure 5 at **45** and it comprises a sheet metal part whose preferably plane

portion 46 is provided with a longitudinally extending bulge or rib 47 not only to strengthen it in one direction but also to increase its springiness or flexibility in another direction, namely, about the longitudinal central axis of the part 46; the opposed edge portions of the portion 46 are bent as at 48 and 49 to coact with one of the connecting elements, such as the ratchet-like parts 39 and 40, respectively, and are extended and bent as at 50 and 51 to provide hook-shaped parts corresponding to the hook-shaped parts 43 and 44 of Figure 1 and hence shaped to receive the ratchet-like parts 39 and 40 of an adjacent core section. Thus, by such an attachment device as the member 45 the above-described contingency that might arise in practice can be simply and quickly met.

In a manner analogous to the above-described interconnections of adjacent core sections, core sections may be connected to and thus secured to other parts or elements of the building construction, and in Figure 3 there is shown at 30 the right-hand vertical edge or terminus of a core section, presenting, by way of illustration, connecting devices or parts, such as the ratchet-like parts 39 and 40; generally indicated at 52 is a sheet metal frame, such as a window-frame of appropriate cross-section and external contour or configuration but constructed to present toward the connecting parts 39 and 40 similarly spaced but companion connecting parts, such as the hook-shaped parts 43^a and 43^b for respective interengagement or interlocking with the companion parts 39 and 40. In such manner any other element or part of the building structure, illustratively a window-frame, may be connected or secured to the core structure 30.

The core structure 30 which, as is preferably also the case with other core structures later described, is preferably prefabricated in sections of appropriate dimensions, as indicated illustratively above, but in so far as certain other features of my invention are concerned, I prefer to convert such a core structure, preferably at the time of fabrication, into what I shall term a "core mold", and where the core takes the form of that above-described in connection with Figure 1, I utilize the apexes A^1 and A^2 to function as seats for receiving a suitable sheet-like member 53. The member 53 is preferably of a length equal to the length or vertical dimension of the core section 30 and of a width preferably slightly in excess of the spacing between the apexes A^1 and A^2, and it is inserted in place as by first bowing it slightly and sliding it downwardly between the opposed vertically alined spacing portions 35 and 36 but with its respective vertical edges snugly received in the apexes A^1 and A^2. It may be secured in place in any suitable manner but if relatively dimensioned as just described, it becomes virtually force-fitted and hence frictionally held in place. In like manner, similar members 53 are inserted between opposed apexes throughout the remaining portions of the core structure, and it will be seen that, as is better shown in Figure 1, the members 53 become or are alined generally along the plane of the intermediate sheet metal portions 31; the latter are preferably imperforate, as are also the members 53, and together the parts 53 and the portions 31 form a substantially continuous uninterrupted and imperforate diaphragm or barrier throughout the entire extent of the core structure, dividing the latter by substantially continuous or imperforate sheet-like material along or throughout an intermediate and preferably approximately central vertical plane, for purposes later described in detail.

Where, as is preferred, the vertical ends of the core section 30 terminate in the connectible spacing portions 35^a—36^a and 35^b—36^b, as above-described, a similar sheet-like means, analogous to the member 53, is put in place and again preferably with its opposed vertical edges seated respectively in the apexes A^1 and A^2, the one being exposed along the right-hand vertical end of one core section and the other apex being exposed along the lefthand vertical end of the adjacent core section; such a sheet-like means may, under these circumstances, be put in place in course of constructing the building, or, as adjacent core sections are mechanically connected together, illustratively as by the means earlier above described.

But where cross-braces or bridging members, such as the members 41 and 42 of Figure 1, are employed, I prefer to put in position, in each vertical end of the core section, and preferably in course of fabrication, a barrier or sheet member dimensioned to become a counterpart or continuation of a corresponding sheet member similarly related to the adjacent vertical end edge of the adjacent core section.

Thus, referring to Figure 1, into the apex A^1 intervening the end spacing portions 35^a and 36^a, I seat a sheet-like member 53^a whose left-hand edge seats in the apex A^1 and whose right-hand edge, indicated at 53^b, terminates in a vertical plane through the right-hand alined vertical edges of the securing members 39 and 40.

In the apex A^2 at the left-hand vertical end of what is to be the adjacent core section there is seated the right-hand vertical edge of a sheet member 53^c whose left-hand vertical edge 53^d terminates in a plane through those parts of the companion securing devices 43, 44 which are to mate with the extreme end portions of the securing devices of the other core section.

Both sheet members 53^a and 53^c are cut out as at 55 (see Figure 2) to permit the cross-braces 41 and 42 to extend through the respective planes thereof and a preferred and illustrative way of achieving this interrelation may be like that shown in Figure 2 where the sheet metal, aside from being punched to provide the apertures 55, is also cut or slotted as at 56, thus to provide a sheet metal flap which may be bent along the dotted line indicated in Figure 2 in order thereby to permit entry of the cross-braces into their respective holes 55, whereupon the sheet metal flap is bent back into the plane of its sheet member, thus again closing off the hole 55 and preventing exit therefrom of the cross-member. This arrangement is preferable particularly where the sheet members 53^a and 53^c are put in place after the cross-members 41 and 42 have already been secured in position.

With the vertical end edges of the core sections thus provided with sheet members to divide or partition off the open spaces subtended by the portions that carry the securing members, the assembly of two adjacent core sections, preferably by the connecting or securing means above described and shown in Figure 1, brings about also a substantial abutting of the vertical edges 53^b and 53^d of the half-members 53^a and 53^c, and together the latter form a continuous or substantially imperforate barrier or dividing diaphragm for the vertical space encompassed by the core portions that are connected or secured together. Thereby the thus mated sheet members 53^a and

53c continue, across the junction between adjacent core sections, the continuous and imperforate dividing barrier or diaphragm formed by the successive and alternated sheet members 53 and vertical column-like parts 31—32 of each core section.

The sheet members 53 and also the sheet members 53a and 53c may be made of any suitable material. Preferably they are of sheet metal. However, under certain circumstances of use it may be desirable to make these sheet members of, or to associate with them, a suitable material or means capable of resisting the flow of heat. By way of illustration, a face of these sheet members may be lined with or have associated with it heat-reflecting or heat-insulating material, as is generally indicated in Figure 1 at 58, and because of the preferred method of employment of the core mold, as is later described, such material 58 is preferably associated with that side of the sheet members 58 that faces inwardly of the building to be constructed. The material 58 may be heat-reflecting foil or by way of further illustration may be of any suitable heat insulation medium preferably in sheet form, like fiber-board, or the like.

In like manner, the intervening column portions of the core mold are also preferably provided with heat insulating or reflecting means, as indicated at 59 in Figure 1, it being understood that the latter, like the material 58, may be secured in position in any suitable manner, as by the use of a suitable adhesive or cement, for example.

Under some circumstances, it may be desirable to strengthen the intermediate column portions 31—32, particularly where they are to carry a substantial vertical load, and in such case they may have interfitted with them and suitably secured thereto, as by spot welding or prongs, interfitted auxiliary column members 60 (Figure 1).

Also, under some circumstances, it may be preferable and less expensive not to stiffen the plane intermediate portion 31 (Figure 1) by putting the U-shaped rib 32 therein and to leave it straight or plane, as shown in Figure 8; in such case, the reinforcing member 60 of suitable heavy sheet metal is given an appropriate cross-section for resistance to bending, illustratively as shown, and has its flanged portions face to face with the unbent or plane sheet metal portion 31, being secured together in any suitable way, preferably by spot welding.

Before considering in detail the building construction employing the core mold above-described, it is to be pointed out that the latter may be constructed in various ways without departing from the spirit of my invention and in Figures 9, 10 and 11 I have shown several such possible other core mold constructions and particularly structures which have advantages in reducing cost and in simplifying the fabrication thereof. Thus, in Figure 9, the core mold generally indicated by the reference character 62 comprises a preferably flat sheet 63 of suitable material, preferably sheet metal, and of a length and width corresponding to that of the desired core section. Extending crosswise of one face of the sheet 63 and appropriately spaced vertically are sheet metal strap-like members 64, 64, etc., and similarly positioned on the other side or face of the sheet 63 are strap members 65, 65, etc., secured to the sheet 63 in any suitable manner as by riveting, spot-welding, or the like. The strap members on one face may be staggered with respect to the strap members on the other face. The strap members 65 on the rear face, as viewed in Figure 9, are formed to provide at intervals structures corresponding to the parts C^1, 37, 35 and C^1 of Figure 1 and the strap members 64 on the other face are likewise shaped to provide corresponding parts C^2, 36 and C^2, like those of Figure 1. It is at the intervening flat portions 66 and 67 that these strap-like sheet metal members contact the sheet 63 and are secured thereto.

If desired, and preferably, sheet 63 is ribbed vertically, preferably by corrugating it, as shown, thus giving its ribbed parts better load-carrying capacity, analogous to the column portions 31—32 of Figure 1, the ribbing being preferably so proportioned that the flat portions 66 and 67 each contact at least two crests where they are secured.

At the two vertical ends of the sheet 63 the strap members 64 and 65 terminate in half spacer portions like the parts 35b and 36b of Figure 1, at the left-hand edge, and the parts 35a and 36a at the right-hand edge, these parts being provided, as indicated in Figure 9, with securing devices like the parts 39—40—43—44 above described in connection with Figure 1. Thus, the sheet 63 forms a continuous and uninterrupted diaphragm or barrier throughout a middle portion of the core mold and the resultant structure may be utilized with substantially the same structural and other advantages as the core mold structure of Figure 1 and as is later to be described. The structure 62 of Figure 9 is less expensive to fabricate.

If desired, and preferably, at least one face of the sheet metal plate 63 is provided with heat insulating or reflecting means, and illustratively the front face thereof, as seen in Figure 1, is provided with such a medium indicated at 58, preferably in sheet form.

In Figure 10 a core mold structure generally indicated by the reference character 72 is shown; this structure comprises strap-like members 64 and 65 like those of Figure 9, but instead of mounting them directly to a single diaphragm sheet 62, the flat portions 66—67 thereof are laid flatwise against vertical sheet metal column members 73 of suitable configuration and suitable thickness to which they are secured in any suitable way as by riveting, spot-welding, or the like. With this construction there are again formed opposed apexes A^1 and A^2 and in these are received the opposed edges of sheet barrier members 53, the same as in Figure 1, and, as in the latter case, they may be lined with a heat insulating medium 58, if desired.

In Figure 11 the core mold structure shown is the same as that of Figure 10 but the strap members 64 and 65 which, incidentally, are preferably identical in shape and construction, are in the core mold structure 82 of Figure 11 in the form of a suitably heavy wire 83 and 84; this wire may be somewhat flattened out, if desired, and for that matter may be given any desired cross-section.

The core mold structures of Figures 10 and 11, like those of Figures 9 and 1, are at their ends or edges also and preferably provided with interengaging or interconnecting means, as was described fully in connection with Figures 1 and 9, so that adjacent core sections may be readily connected together or core sections and other structural elements, like the illustrative frame 52 of Figure 3, connected thereto.

All of the illustrative forms of core mold sections will thus be seen to present, on one face or side thereof, a plurality of appropriately distributed spacing portions **36** and likewise on the other face thereof with respect to the spacing portions **35**.

With such a core mold section, preferably prefabricated, the spacing portions **35** on one side and **36** on the other, may have related to them, or to only one set of them, in any suitable manner, any desirable structural wall material, such as metallic lathing, sheet metal, cement, tile, fibreboard, plaster-board, cardboard, so-called sheetrock, asbestos composition, or any other suitable building material; such materials in some instances are preferably dimensioned as to length and breadth to correspond to the effective length and breadth of the core or core mold and suitably secured thereto as at the spacing portions **36**, **36** etc., or at the spacing portions **35**, **35**, etc., or to both. This may be done in the course of completing the prefabrication of the core mold, thus resulting in a building unit which may be shipped to the job and utilized.

In Figure 1 I have shown the core structures as provided with metallic lathing **87** preferably spot-welded to the portions **36** or otherwise secured thereto, even by wire stapling, as indicated at **88** in Figure 1, and in Figure 18 is shown a perspective view on a small scale of such a resulting building unit comprising the metallic core or core mold structure M with the sheet-like building material S, preferably and illustratively in the form of metal lathing **87** secured across a face thereof, as above described, to illustrate one possible form of such building unit that can be prefabricated and shipped as such for incorporation in the building structure.

The units may be set end to end and their edges interengaged as in Figure 1 and as above described, and where they are provided with wall surfacing in the form of wire lathing, plastering may proceed, or where the surfacing is of sheet materials like sheet metal, plaster-board, or the like, the junctions of the latter may be sealed and finishing as by painting, papering, or the like, completed. In Figure 1 the plaster is indicated at **89**. In Figure 6 composition board or like sheet material **90** is shown as secured to the spacing parts **36**, **36** in any suitable way as by metal staples **88**; in Figure 7 the spacing portions **36** are shown as having secured thereto, in any suitable manner, sheet metal **91**, and if desired other sheet materials like plaster-board, or other composition board, shown at **92**, may be secured to the sheet metal **91** in any suitable way, as by the stitching **88**.

For example, and referring to Figure 8 where, for present purposes, the core mold structure there shown has its barrier portion made up of the sheet metal parts and the inserted sheet parts **53**, the inside facing F of the wall may be constructed in any way as by metal lath and plaster, composition board, and the like, as indicated above, and the outside facing O may also be constructed in any suitable way, preferably in both cases utilizing the spacing portions **35** and **36**, no matter which of the core mold structures is employed, to bring about a spacing of the two wall facings F and O. But that space will be seen to be divided into two spaces, an inner space IS and an outer space OS, separated by the dividing barrier **53—31**. The space OS may, if desired, be filled with any suitable material. Sometimes concrete may be poured into the space OS as will be later described in connection with Figure 1 and under other circumstances the space may be filled with a heat insulating medium like rock wool; the filling is indicated at **93** and does not invade the space IS. The latter may be utilized for accommodating piping, wiring, and also for air ducts, as will later be made clearer.

Where concrete is to be employed, I preferably proceed as indicated in Figure 1. Any suitable external veneer or building material may be employed, such as brick or tile, and in Figures 1 and 4 for illustrative purposes I have shown the use of tile T which on its side face and edges has a surface suitable to bind with concrete, mortar, or cement, or the like, and which upon its external face has any suitable surfacing which may, for example, be glazed, or the like. In carrying out this aspect of my invention, it will thus be seen that it is preferred to use a material, unless the external surface itself is to be cement, or stucco, or the like, which will suitably bind with cement, or which may in any appropriate way be interconnected with the concrete itself. The tile T is therefore illustrative of only one form of external surfacing or material which may be brought into the later described coaction with concrete, or the like, and the core mold.

Having interconnected and set up a suitable number of core mold sections, which, as is now clear, may take any of various forms within the spirit of my invention and several of which have been above described, it being understood further that by the term "core mold" I mean a core structure with an intermediate barrier or diaphragm, as distinguished from the core structure per se, suitable means are built up at an appropriate spacing in an outward direction from the plane of the barrier or diaphragm means (the latter being the parts **53—31—32** of Figure 1 or the sheet metal member **63** of Figure 9 or the members **53—73** of Figures 10 and 11) to form with the latter two spaced substantially unbroken retaining walls, with the connecting parts **33** of the core mold projecting into that space. That outer wall-forming means, in the illustration of Figure 1, comprises a suitable number of courses of tile T which are laid up in any suitable way and, if desired, with the aid of mats, supports, or the like. Preferably, only one or two horizontal courses of tile are laid at first, and then concrete, indicated at CR in Figure 1, is poured into the space to the depth of the one or two courses thus set up, whence succeeding one or two courses of tile are laid and additional concrete poured, and so on until the height of the core mold is reached. The concrete fills all of the space which corresponds, incidentally, to the space OS of Figure 8; but leaves the inside space IS hollow or vacant since the carrier or diaphragm means dependably holds the concrete from entry into the space IS.

The outer concrete retaining means, such as the tile T, may be given any appropriate spacing from the general plane of the barrier or diaphragm means, but it is more convenient to utilize the spacing portions **35** of the core mold to determine the spacing, and where tile T is employed, the tile, usually ribbed as indicated in Figure 1, is preferably laid up so as to rest against or contact with the numerous spacing portions **35** which, being alined, fall in a single plane. Also, where tile, brick, or the like, is employed, I prefer to employ also suitable interposed ties for linking the outer wall veneer to the core mold structure and in Figure 4 I have shown a possible form of such tie.

It is preferably a sheet metal stamping comprising a part 95 of appropriate area to rest between contiguous courses of tile and it is preferably corrugated in the direction shown, and since cement or mortar is employed in setting up the tile, the part 95 becomes, by reason of its corrugated shape, dependably interlocked with the mortar or cement. Extending inwardly from the part 95 is an arm 96 whose outermost end is bent downwardly as at 97 to form substantially a hook that engages over and against the inside face of one of the spacing portions 35. However, as in the preferred form, the space OS is filled with concrete, the setting of the concrete about the core mold and hook-shaped part 97 permanently locks the securing device against disengagement.

If desired and also as indicated in Figure 1, the spacing center to center of the spacing portions 35 may be substantially equal to the length of the tile, brick, or like material employed or a multiple thereof, or vice versa, thus bringing junctions or joints in alinement with both vertical and horizontal rows of spacing portions 35; thereby better and more rapid alinement and a structurally better structure results, and also the locating of the securing devices of Figure 4 is facilitated.

Where brick or like members are employed, and in order to insure proper spacing of the brick or tile, I prefer to employ, in setting up the various vertical and horizontal courses a guide or templet bar generally indicated in Figures 1 and 4 by the reference character 98. It may comprise a structural steel member 99 (Figure 4) T-shaped in cross-section and having a web 100 of a thickness equal to the spacing between adjacent courses. The web 100 is provided, at suitable intervals along its length, with cross-pieces 101 suitably secured thereto as, for example, by slotting the web 100 and setting the cross-piece 101 into the slot and securing it in place in any suitable way, the spacing between the cross-pieces 101 being the same as the length of the tile or brick to be employed.

Accordingly, after the lowermost or first course is set up, a member 98 is laid along the top edge in the course with the web 101 resting on top and the lower portions of the cross-pieces 101 projecting downwardly in between adjacent tile or brick of that course; the lower half of the horizontal web rests against the front face of all of the tile of that course.

The second course is laid upon the first, tile by tile, utilizing cement or mortar in the usual way, but the web 100 determines the spacing between the two horizontal courses and the cross-pieces 101 determine the spacing between the vertical courses. Thereby proper alinement and regularity are achieved and also the members 98 may be utilized to take part in bracing or holding the courses in position during the pouring of the concrete CR into the space OS as above described.

Or I may in this manner build up the various courses without using mortar or concrete at the joints, thereby utilizing the devices 98 to maintain the proper spacing between vertical and horizontal courses, and allowing the concrete poured into the space OS to enter to appropriate depths in the space between adjacent tile; or I may wish to prevent the entry of concrete in this manner and in such case I may utilize a material like calking compound, so-called metallic putty, or other plastic material, indicated at 102 in Figure 1, to close off these spaces at their inner edges or I may use strip material 103 (Figure 1) of paper, cardboard, or the like, appropriately held in place as by an adhesive, or both, to temporarily seal these spaces against the entry of the concrete CR.

The concrete CR fills the space OS, all of the metallic parts of the core mold, such as those that appear from Figures 1, 8, 9, 10 or 11, for example, that are exposed to or within the outer space OS, become completely embedded in the concrete and the concrete, moreover, binds itself to the interiorly exposed faces and surfaces of the tile, brick, glass, porcelain, terra-cotta, plastic or vitreous composition, or other material employed, and when set, the concrete not only forms a strong bond between the outer wall veneer where the latter is to be employed and the core mold structure, but also is by the metallic parts of the latter reinforced and strengthened. Also, connecting devices, such as the parts 39—43 of Figure 1 and corresponding parts of Figures 3 and 5 become embedded in the concrete and disconnection thereof is permanently precluded. Upon the removal of the guide or templet parts 98, the tile, brick, or the like, may be pointed up in any known manner.

The diaphragm or barrier portions of the core mold thus take part in molding or shaping the concrete portion CR of the building construction. The sheet material 53 is preferably sheet metal, as above indicated, but it will now be clear that it may be made of other materials, such as suitably heavy cardboard, fiber-board, composition board, or the like. If not made of such material, and particularly if made of sheet metal, the heat insulating or reflecting means 58 above described is preferably employed and also the heat insulating or reflecting means 59 utilized in order thermally to insulate or isolate the space IS from the outer wall portions, particularly from the concrete CR.

Ultimately the inside wall facing is applied and where the core mold has secured to the spacing parts 36 thereof wire lathing 87, of the usual expanded metal kind, the application of plaster and lime, and the like, in the usual way may be proceeded with in the usual way. The portions of the plaster or mortar that protrude through the wire lathing 87 may also interengage with the distributed spacing portions 36 of the core mold and wherever sections of the latter are jointed, as at 40—44, adjacent to which the wire lathing 87 is butt-ended, the plaster forms a continuous uninterrupted coating and by its action also acts to hold the connecting devices 40—44 against disconnection.

Of course, as already indicated above, the spacing portions 36 of the core mold may have secured thereto other wall surfacing, such as the sheet metal 91 of Figure 7, or the composition board 90 or 92 of Figures 6 and 7, or any other suitable wall surfacing material, some illustrative embodiments of which are above noted, and thus I am enabled to provide a great flexibility or range of choice of materials for inside wall surfacing.

Where the wall is to function as an outside wall, the inside space IS may be closed off at the respective ends of the wall and thus may function as a dead air space, to contribute toward heat insulating action; in such case, the insulating media 58 and 59 might not be necessary. However, I prefer to utilize the inside space IS as a duct for the passage therethrough of conditioned air, heated in any suitable way for winter

service and cooled in any suitable way for summer service, and in such case the inside wall surfacing is a material of good heat conductivity, such as sheet metal or plaster, for example, for by the structural features above described which makes it possible to provide an inside space IS that is continuous throughout the entire area of the wall, being substantially unobstructed by the connecting strap-like sheet metal parts **34**, the inside wall surfacing, such as the plaster, may be directly exposed to the heating or cooling medium passed through the space IS, such as heated air in winter and cooled air in summer. By this arrangement, the entire inside wall surface is utilized in winter to transfer heat from the heating medium within the space IS to the interior of the room, and in the summer when the medium circulated through the space IS is, for example, cooled air and hence a heat-abstracting medium, the entire inside wall area is utilized to abstract heat from the atmosphere inside of the room. Thus, in the one case I am enabled to maintain a temperature gradient to cause the flow of heat through the entire wall surfacing into the room in the winter time and out of the room in the summer time; under these circumstances, it is desirable to have the diaphragm or barrier parts of the core mold provided with the heat insulating or reflecting means **58** and **59**, as above described, thus to block the flow of heat through the external wall portion, such as the concrete CR, from interfering with the particular heat gradient maintained according to the season of the year.

In so utilizing the inside space IS, I may also, if desired, permit the flow of air through appropriate passages or openings or registers (not shown) suitably positioned or distributed throughout the inside wall surfacing, such as the plaster and lath **87—89** of Figure 1, to effect transfer of air between the space IS and the interior of the room, thus, in effect, utilizing the space IS also as a duct for moving air as a heating or cooling or conditioning medium into or out of the room. Of course, it will be understood that the same or similar use of the space IS may be made where the outer space OS is otherwise used than for concrete CR, as, for example, as it is used as in Figure 8, to contain a heat-insulating medium such as pourable mica pellets, rock wool, or the like.

In accordance with my invention, also, I prefer to utilize analogous principles of construction in making up the ceiling and floor structure of the building and, in Figures 12–17 I have shown structural elements interrelated to form the ceiling and flooring. Turning first to Figure 12, I have there shown portions of two core mold sections **105** which are preferably made up in sizes or units of appropriate length and width; thus, each section may be three or four feet wide and, for example, six or eight feet long, and in Figure 17 one such section is shown in perspective with, however, a wall surfacing means related thereto. The size of the section is preferably proportioned to be economical in fabrication, convenient in shipping and to avoid cumbersome in installation.

As better appears from Figures 12 and 17, each section comprises a suitable number, illustratively two, sheet metal U-shaped parts **106** preferably approximating in cross-section a square or rectangular shape, as indicated, and two end sheet metal parts **107**, **107** representing in shape and outline respective halves of a part **106**. The parts **107**, **106**, **106**, **107**, as they appear in Figure 17, are arranged in parallelism and are secured together in that relationship by a suitable number of strap iron members **108** extending transversely thereof and spaced throughout their length. The upper portions of the four channel-like sheet metal parts **107**, **106**, **106**, **107**, are bent over to form horizontal flanges **109** that are alined in a single horizontal plane and it is across these flanges **109** that the transverse members **108** rest, being secured thereto as by riveting, spot-welding, or the like. The spacing of the transverse strap iron members **108** from each other may be on the order of, for example, one or two feet.

The extreme end edges of the horizontal flanges **109** are bent upwardly, as at **110**, throughout their length which is interrupted or cut away only at such intervals as are necessary to accommodate the transverse members **108**. The upwardly bent flanges **110** are given a shape better shown in the right-hand portion of Figure 12 from which it will be seen that they are crimped into angular form to provide an angular channel or the apex of an angle, there being pairs of such channels or apexes but facing each other, as at B^1 and B^2 in Figure 12. Into these facing channels or apexes B^1 and B^2 are received the respective left and right-hand longitudinal edges of a sheet member **111**, preferably made of sheet metal and so dimensioned that normally it is of greater width than the spacing between the apexes B^1 and B^2. The sheet member **111** is bowed or arched in order to seat its opposed longitudinal edges into these channels B^1, B^2 whence its tendency to straighten out, like the action that takes place with the members **53** of Figures 1 and 6–8 and 10 and 11, forces its edges securely into these channels and holds the sheet member **111** securely in place. The member **111**, as also the members **106** and **107**, are preferably imperforate and together form a continuous and uninterrupted diaphragm or barrier-like part.

If desired, a suitable number, preferably corresponding to the number of cross-members **108**, of vertical tension and compression members **112** may be incorporated in the construction, each secured in any suitable way, as by welding, to a cross-member **108**. In vertical length, as they appear in Figures 12 and 17, the members **112** are such that the upper end, preferably slightly curved, engages against or under the middle of the arched sheet member **111** and its lower end is constructed in any suitable way to make engagement with a wall material later described. The members **112** may be secured to the cross-straps or parts **108** in any suitable manner, as, for example, by welding, and these parts, together with the arched sheet member **111**, coact like a truss and resist bending or distortion, the cross-sectional shapes of the parts **106** and **107** and also of the arched sheet member **111**, the latter being interlocked with the bead-like flanges **110**, also resist bending but about a different axis. Preferably, member **112** has an intermediate U-shaped bend **112b** in which member **108** is seated.

In this manner a core mold section or unit of several arched sub-sections may be constructed and dimensioned, as already above indicated, to form a single entity, as shown in Figure 17; along its longitudinal edges, however, it is preferably constructed for interlocking or interconnection with an adjacent and similar unit or section and

for this purpose an illustrative means of interconnection may be constructed as shown in Figure 17 and better in Figure 12. There it will be seen that the right-hand part 107 of one section terminates in a horizontal flange 107a which at its extreme end is bent as at 107b to form a ratchet-like securing member generally similar to the members 39 and 40 of Figure 1, and to improve the truss effect or action, the right-hand end of the strap 108 is bent downwardly as at 108a and is secured to the flange 107a in any suitable way as by welding, thereby also bracing the longitudinally extending connecting part 107a—107b.

The left-hand half member 107 likewise terminates in a horizontal flange 107c and its outer portions throughout its length are bent up as at 107e to form a hook-like catch or securing part like the parts 43 and 44 of Figure 1. Thus, adjacent core mold sections may be interconnected as shown in Figure 12, the parts being so proportioned that thereby the horizontal portions or flanges 107a and 107c of the longitudinal end members 107, 107 and the horizontal portions 106a of the intermediate channel-shaped members 106 all fall in the same plane, and where the construction is employed for a ceiling and floor, an appropriate number of such core sections are thus set together and suitably supported from their under sides, as by a temporary or false ceiling or underpinning scaffolding, throughout the desired extent of the ceiling-floor, with end portions of the sections resting upon the upper ends of the vertical or side walls which, where they are outside walls, are preferably constructed as was described above in connection with Figures 1–11.

With the ceiling-floor thus made up of a suitable number of core mold sections 105, 105 etc., and temporarily supported as above indicated at least at those portions intermediate or in between side walls of the room, building, or space, the ceiling-floor core mold is ready for the pouring of concrete or the like, as indicated in Figure 12 at CR. The concrete CR is poured into the upwardly open channels formed by the members 106 and the companion half members 107—107, these channel parts being dimensioned to provide a cross-section of concrete appropriate to give a beam or truss effect which may be improved or strengthened where and if desired by any appropriate reinforcement preferably in the form of steel members which may take any suitable cross-section or shape and in Figure 12 they are diagrammatically indicated at 115, these members being set into place in any suitable manner prior to the pouring of the concrete. The latter is poured onto the core mold structure to a suitable or appropriate depth, illustratively as suggested in Figure 12, covering over the horizontal flange portions 109 of the channel members and also the arched sheet members 111, the arched cross-section of which and its coaction with the other truss members earlier above described giving these parts adequate strength not only to support the concrete but also and finally to act as cross-trusses between adjacent beam structures made up as above described of the channel members 106, 107—107, and the concrete therein with or without the reinforcement 115. Also, the concrete is molded into arch-like effect with resultant structural strength and advantages. On top of the concrete flooring diagrammatically indicated at 116 of any appropriate or desired character may be laid, if desired.

The setting of the concrete achieves a dependable interlocking of the metallic parts of the core mold structures with the concrete as, for example, by way of the parts 110 (Figure 10), the cross-bracings 108a of the members 108 which extend downwardly and are secured to the horizontal flange portions 107a and 107c, and with other parts.

Preferably, however, the units or core mold sections 105 are, in course of prefabrication, preferably provided with a suitable ceiling- or wall-forming material, various illustrative materials for which have been earlier above suggested. For purposes of illustration in Figures 12 and 17, I have selected wire lathing 117 as secured to the under side of each unit throughout its entire expanse, resting in a plane against the horizontal channel portions 106a and 107a and secured thereto in any suitable way, preferably by welding since the two parts are metallic. Also and preferably, the material 117 is secured to the lower ends of the depending or vertical members 112 which for that purpose are preferably bent over at their lower ends as at 112a to provide a plane area of suitable extent against which the material 117 may rest and to which it may be secured preferably by welding where both parts are of metal.

With the core mold sections thus provided with wire or expanded metal lathing to form a structural unit, the completion of the pouring of the concrete as above described will be seen to leave the under side or face of the ceiling-floor construction completely lathed, as was the case with the inside facing resulting from the core mold structure of Figure 18 and of, for example, Figure 1, where I have also illustrated the use of metal lathing at 87. Plastering in the usual way may hence be proceeded with, preferably concurrently with the plastering of the side walls.

Where, therefore, with a construction as just described, the ceiling-floor construction results in a plurality of uninterrupted and continuous channels or inside spaces IS (Figures 12 and 17), being the spaces between successive cross-beams, such spaces may also be utilized for the reception of piping, wiring, and otherwise in the same manner as was described above in connection with the inside spaces IS of Figures 1–11.

And where the inside spaces of the side wall are to be continued upwardly into the second or next story, and hence are to be connected with the inside spaces of the side wall structures, I prefer to achieve this in a manner indicated in Figure 19. Before, however, describing in detail that feature of my invention, it might first be pointed out that I prefer to proportion the spacings between the center lines of the composite beams RB of the ceiling-floor construction (Figure 12) in relation to the spacing between the center lines of the vertically extending metal parts, such as the parts 31—32—60 of Figure 1, or parts 31—60 of Figure 8, or the parts 66—67—63 of Figure 9, or the parts 73—67—66 of Figures 10 and 11, and which parts function, particularly in coaction with the coacting concrete, as columns, so that the opposite ends of the ceiling-floor beams RB of Figure 12 rest each upon one of these wall or column parts. For example, a first-mentioned spacing may be on the order of sixteen or twenty-four inches, that is, beam center to beam center, while the second-mentioned spacing may be eight inches, that is,

column center to column center. The one spacing is thus a multiple of the other and thus it is simple to make certain that a beam end coincides with a column or direct load transmission to the latter. In Figure 19 that relationship is indicated with respect to one beam and one column part.

I make up tubular sections or sleeves 119, preferably of sheet metal, and shape them to be slidably received within such of the upwardly exposed parts of the side wall that are to intervene two successive cross-beams RB as are bounded by the parts C^2, 36, C^2 and 53 or 58 of Figures 10 and 11, or the parts C^2, 36, C^2 and 63 or 56 of Figure 9 and slidably engage one such sleeve into each such part, utilizing sheet material 120 (Figure 19) to close off the intervening parts of the space IS of the wall. The end portions of the ceiling-floor units 105 (see Figure 17) that are to rest upon the upper edge of the one story side wall in which the concrete has already been poured, as above described, have their sheet metal arch portions 111 and the ceiling material, such as the lathing 117, cut out, as indicated in Figure 19, to receive therethrough the sleeves 119 which are of a length to project upwardly beyond the depth of concrete or like material that is to be placed above the core mold structure, the ends of the inside spaces IS of the later intervening the sleeves 119 being closed off in any suitable manner. A temporary cover 121 is put on the sleeves 119 and in pouring the concrete CR of Figure 12, the concrete flows all around the sleeves 119, connects with the concrete CR of the outer spaces of the side wall (see Figure 1), the tile or brick T being during this process extended upwardly enough, and thus the concrete of floor and side wall becomes connected but the sleeves 119 thus provide passageways through the ceiling-floor structure for connection with the inside spaces of the upwardly extended side wall structure that is preferably built up, as was above described in connection with Figure 1, the upwardly projecting portions of the sleeves 119 being utilized to be slidably received in appropriate strap-like parts of the side wall core mold structures, the latter being thus and thereby alined with the core mold structures of the side wall of the story immediately beneath. Thus, the inside spaces IS of the various stories of the side walls may be maintained uninterrupted and interconnected and if it is desired to connect these inside spaces with the inside spaces of the ceiling-floor structure of Figure 12, the sleeves 119 may be provided with knock-outs 119^a which may be broken out or openings may otherwise be provided in the sleeves 119 to open out into the space IS of the ceiling-floor structure.

As above indicated, it may be desirable not to provide the ceiling-floor core mold units 105 with a ceiling structure or surfacing like the part 117; in such case, the resultant ceiling-floor structure is preferably also devoid of the parts 112, and when installed and the concrete or like finishing material related thereto, as shown in Figure 13, the cross-straps 108 that extend underneath the arched sheet material 111 are cut off in any suitable manner. The resultant ceiling structure is one that is lined with the sheet material of the parts 106, 111 and 107, preferably sheet metal, and gives a beamed effect, as shown clearly in Figure 13, and intervening the beams gives the arched effect where the sheet material 111 is initially arched as shown. To this sheet material any suitable finish may be applied, either in the course of prefabrication of the core mold sections or after the structure is completed.

As above indicated, various sheet materials may be related to the core mold sections, illustratively the lathing 117 with its plaster; but prefabricated sheet materials, like composition-board, fiber-board, sheet-rock, and the like, may be utilized and may be related to the core mold units or sections in course of prefabrication or subsequently, in any suitable manner. For example, in Figure 14 the vertical portions of the channel members 106 and half channel members 107 may be bent to provide longitudinally extending grooves or channels 106^f and 107^f into which the sheet material indicated at 125 is received at its opposed longitudinal edges. The sheet members 125 may be put in place in course of prefabrication or in course of erection, and preferably the channels 106^f and 107^f are sufficiently shallow to permit the sheet members 125 to be primarily bowed and thus sprung into the opposed recesses.

Of course, other means may be employed to secure such sheet members 125 in place and they may, as shown in Figure 15, rest against the horizontal underportions 106^a and 107^a of the channel-shaped members 106 and 107 to which they may be secured in any suitable manner, either in course of prefabrication of the core mold sections or in course of erection. It may also be desirable to provide a support for such sheet material or sheet members 125 intermediate the cross-beam portions, in a manner as indicated above in connection with the members 112 but under some circumstances it may be preferable and convenient to provide for an automatic interengagement or interconnection between the sheet members and the intermediate support.

By way of illustration, such a support may take the form of that indicated generally at 126 in Figures 15 and 16, and it may be made up of a suitably heavy wire bent up as shown in these two figures to provide a horizontal portion 127 against which the center of the arched sheet member 111 may rest, and from this cross-part 127 there depend two arms 128 and 129 which cross each other, as at 130, whence they are curved as at 131 and 132 to form together an arc more than 180° in extent.

The arms 128, 129 are secured to the cross-brace 108 in any suitable way, illustratively by giving them back and forth bends, as indicated at 133 and 134 of Figure 16, between which the member 108 may be gripped, the latter member being secured rigidly thereto, if desired, as by welding.

Preferably a relatively heavy and springy wire is employed, and the upper face of the sheet members 125 are provided with suitable projecting means, preferably cylindrical or circular in external outline, illustratively in the form of a tube or cylinder 135 of any suitable material, metallic or non-metallic, secured to the sheet member 125 in any suitable way and appropriately positioned therealong, in relation to the core mold unit, so that, when the sheet member 125 is set up against the faces of the parts 106^a and 107^a, the part 135 cams itself into the tongue-like gripping arms 131, 132 of the device 126 of which any suitable number, illustratively one for each of the cross-members 108, may be provided. To aid in this camming action, the extreme ends of the arms 131, 132 are appropriately rounded over as by bending over the end of the wire, as indicated at 136 in Figure 16.

Conditions might arise or exist in practice where it becomes desirable to set up a structure, particularly a vertical wall structure, that extends at right angles to an existing wall structure but intermediate of its ends, where the wall structure embodies the core mold sections or constructions of Figures 1 and 6–11, for example; in such case, I provide means for quickly setting up and interconnecting two such core mold structures at right angles to each other, and turning now to Figure 21 let the reference character **30** represent a core mold structure like that of Figure 1, understanding, of course, that it may take other forms, such as those of Figures 6–11, and let **30a** represent a similar core mold structure to be set up at right angles to the structure **30**, thus to form ultimately and in the manner heretofore explained, two ultimately finished or complete walls at right angles to each other. The core mold structure **30a** terminates in end spacing members **35b** and **36b**, as in Figure 1, held spaced by the cross-members **42**, terminating respectively in the hook-shaped securing members **43** and **44**. To connect these hook-shaped members to the core mold section **30** I provide a device, preferably of sheet metal, such as shown better in Figure 20 at **135**. It is an easily made sheet metal stamping comprising a horizontal part **136** and a vertical part **137**. The latter has punched or stamped out of its plane and extending at 90° thereto, two tabs **138** and **139** whose spacing is the same as the spacing between the spacing portions **35b** and **36b**, and their outer ends are flanged over to provide the ratchet-like securing members **39** and **40** which, being similar to the members **39** and **40** of the opposite end of the core mold section, as shown in Figure 1, are therefore given the same reference characters.

The horizontal portion **136** of the device **135** has punched out of its plane and extended downwardly or vertically two ears **140**, **141** whose plane is at right angles to the plane of the vertical portion **137** and spaced from the latter by a distance substantially the same as the thickness of the sheet metal used in making up the spacing parts **35** and **36** of the particular core mold structure employed.

These ears **140** and **141** may therefore take in back of the spacing portion **36** of the core mold **30** of Figure **21**, the sheet metal thereof being snugly and tightly received between them and the vertical part **137**. The spacing between the members **140** and **141**, moreover, is preferably such that they are received in the apexes of the angles formed by the spacing portion **36** and the portions C^2 of the core mold **30** (see Figures 21 and 1).

Since the core mold **30** comprises a plurality of such spacing members **36** in the particular row of the latter corresponding to the plane of the wall to be built up with the core mold **30a**, as many such devices **135** are employed as desired, preferably one for each spacing portion **36** in that vertical row; the latter is thus provided with a vertical row of spaced securing devices **39—40**, spaced from each other ,the same as the vertical spacing between the pairs of companion securing devices **33—34** of the core mold **30a** and thus the two core molds may be snapped or secured together with an action and security similar to that described above in connection with Figure 1 and also Figure 5.

As above indicated, the terminal or half members **35a—36b** at one edge of the core mold and the terminal or half members **35b** and **36b** at the other vertical end or edge of the core mold may have the connecting or securing devices **39—40** and **43—44** respectively formed integrally therewith or as the extreme termini thereof; I may, however, achieve certain advantages, from manufacturing, structural and assembly viewpoints, by making up these connecting or securing devices separately from these terminal or half members, but make them up in the form of longitudinally or vertically extending sheet metal strips **140** (Figure 22), making these strips **140** of a length preferably the same as the height of the core mold sections, and let the terminal or half spacing members **35a—36a** and **35b—36b** terminate in preferably straight vertical and alined edges whose inside faces rest against the sheet metal members **140** (see Figure 22) to which they are secured in any suitable way, as by spot-welding.

As is better shown in Figure 22, the vertical members **140—140** respectively related to the half or terminal members **35a—36a** at the right-hand vertical end of the core mold have their right-hand edge portion, preferably throughout its entire length, bent inwardly to form a single continuous ratchet or tooth-like securing member **39**, while the members **140**, **140** thus secured to the half or terminal portions **35b** and **36b** have their left-hand edge portions, also preferably throughout their entire length, flanged and bent over to form a single continuous companion securing member **43** for the one and **44** for the other. These members **140**, thus carrying the securing devices, contribute to the mechanical strength and rigidity, also hold the terminal or half portions **35a—36a—35b—36b** in alinement and prevent them from being accidentally distorted or bent, as in shipment, and the formation of the flange-like securing devices gives the members **140** a rigidity against bending and good load-carrying capacity; in this latter respect, these members **140** may be still further strengthened as by flanging their respective remaining edges, as at **141**, at right angles throughout their length and inwardly toward the central plane of the core mold.

With this arrangement the cross-pieces **41—42** are preferably secured between opposed members **140**, **140** and appropriately spaced throughout their length, and also fewer of them can be employed than with the arrangement earlier above described.

In other respects, the handling, assembly, and the like, of adjacent core sections proceed as already above described, rapid and dependable interconnection of adjacent core mold sections being achieved in accordance with these general features of my invention. In this latter connection, it might be pointed out that in effecting such interconnection, it is preferable to interengage two companion connecting devices first, such as the devices **40—44**, leaving the device **43** (Figures 1 and 22) spaced to the right of the device **39** but in alinement with the cam-shaped face of the latter; if, thereupon, the one core member is swung into the plane of the other by pivoting about the general axis of the already interengaged securing devices **40—44**, the hook-shaped part **43** and the part **39** are cammed into interengaged relationship, the parts yielding as earlier above described.

With the use of members **140**, as in Figure 22, in connection with the terminal or end portions of the core mold, like that of any of Figures 1–11, free or terminal projecting parts are well pro-

tected against distortion, bending, or damage, as in handling, shipment, or the like it may be desirable, however, to strengthen or reinforce the horizontally extending strap-like or wire parts of the core mold section and this may be done in various ways. For example while in Figures 1 and 6–10 the spacing portions 35 and 36 are shown as having an intermediate looped or ribbed portion 37 and 38 (Figure 1), these may be omitted if desired, as is indicated in Figure 11. Also, and particularly where these parts are made up of relatively light material, such as relatively light wire, for example, the alined spacing portions 35 on one side of the central plane of the core mold may be interconnected and the alined spacing portions 36 on the other side of the core mold may be interconnected, illustratively by metal members 142, such as wire, bridged across them, preferably horizontally, and secured thereto in any suitable way, preferably by spot welding, as is shown in Figure 11.

Recurring to Figure 4, where tile and materials like glass, porcelain, vitreous materials, or the like, are employed, by the use of the member 98 and the inside joint-closing means 103 (Figure 1) I am enabled to achieve assembly of such parts and a bonding thereof with the cement that is poured against the inside face, as above-described, while leaving the spaces between adjacent tile or sections of these materials free from the entry therein of the concrete. When the concrete has set and the members 98 removed, the exterior wall facing thus presents the open spaces between the tile or parts of the materials thus employed, and these spaces I fill up with metallic putty, calking compound, or the like, and achieve a positively and permanently water-proof wall exterior. These jointing materials remain resilient and yield under contraction and expansion of the tile, glass, porcelain, etc., and thus opening up or cracking at the joints cannot take place. Prior practice, utilizing mortar or cement for pointing up the joints, does not effect water-proof junctions or joints but in accordance with these features of my invention I am enabled to achieve dependable moisture-proofness.

In pouring the concrete into the space OS, as earlier above described, any suitable means may be employed to guide the concrete into the relatively narrow space and preferably I employ a long trough having a plurality of discharge openings, preferably in the form of funnel-like members, preferably one for each of the various sub-areas, as viewed in Figure 1, into which the space OS is in plan view outlined by the parts of the core mold. Thus, one such discharge opening is shaped to be received over, and one such opening for each, area outlined by the parts 35, C^1, 53, C^1, and discharge openings, one for each, are provided to discharge into intermediate areas, such as the area bounded by the parts 31, 32, C^1, the tile, and C^1. Thereby, the concrete may be caused to drop into the space OS in comparatively small increments and distributed also throughout the horizontal length of the space, and if allowed to fall from an appropriate height, such as several feet, this method also effects a dependable compacting of the concrete throughout.

Also, it is possible, with a core mold construction according to certain features of my invention, to achieve unique and highly desirable mechanical integrity of wall construction, particularly at junctions of walls, ceilings, roofings, floorings, or the like, that make angles to each other, for weaknesses at junctions are eliminated, the concrete may be made continuous throughout and particularly at such angular or other junctions, and throughout the continuity such concrete, where such concrete is employed, the advantages are also achieved that the various mold sections and related parts carried thereby are by the concrete itself dependably held in proper relationship, and permanently so. Where two small sections are to come together to form a corner, I may continue the core mold construction around such a corner in accordance with the principles of corner core construction disclosed in my Patent 2,076,472, as in Figure 5 thereof; in that manner the concrete cast into the core molds of the two walls that form the corner may be carried through and around the corner by means of the corner core section, continuing the continuity of the concrete and eliminating weakness at the corner junction. Concrete may, of course, take any appropriate composition, such as Portland cement with sand, or with gravel, broken stone, cinder, or like elements of admixture.

Also, as above indicated, various frame or other building sections may be quickly and speedily joined to the core mold section, as was indicated above in connection wtih Figure 3; moreover, where door-frames, window-frames, or the like, are thus related to the construction, it is possible to make up such frames with complete trim, once and for all, and thus as a unit set them in place, connected as above described, to the core mold structure, and particularly if concrete is employed, an unusually permanent assemblage and construction are quickly achieved.

Thus, it will be seen that I have provided in this invention building construction in which the various objects above noted, together with many thoroughly practical advantages, are successfully achieved.

As many possible embodiments may be made of the mechanical features of the above invention and as the art herein described might be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matter hereinabove set forth, or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In building construction, in combination, a building wall or the like comprising a metallic core mold comprising a plurality of longitudinally extending spaced sheet metal means cross-sectioned to resist bending with sheet means bridged across between adjacent spaced means to form with the latter a substantially continuous barrier, said core mold having extending cross-wise of said spaced means but spaced from each other and to each side of said barrier-forming means a plurality of metal parts each comprising a spacing portion held spaced from said barrier-forming means by metal parts connecting said spacing portions to said barrier-forming means, thereby providing to each side of the general plane of said barrier-forming means a plurality of distributed spacing portions substantially alined along planes one to each side of said barrier-forming means, and means forming wall surfacing alined with said spacing partions, one on each side of said barrier-forming means, thereby forming two spaces one on each side of said barrier-forming means.

2. A construction as claimed in claim 1 in which at least one of said spaces is filled with a pour-

able material, said barrier-forming means preventing said material from entering into the other space.

3. A construction as claimed in claim 1 in which the wall surfacing means related to the spacing portions on one side of said barrier-forming means is bonded to said core mold by concrete that fills the space between it and said barrier-forming means, thereby embedding said spacing portions and the parts connecting them to said barrier-forming means.

4. A construction as claimed in claim 1 in which the wall surfacing means related to the spacing portions on one side of said barrier-forming means is bonded to said core mold by concrete that fills the space between it and said barrier-forming means, thereby embedding said spacing portions and the parts connecting them to said barrier-forming means, said last-mentioned wall surfacing means comprising sectionalized means whose contiguous edge faces are spaced apart and the space therebetween filled with a waterproof substantially permanently yielding or non-hardening material.

5. A construction as claimed in claim 1 in which the wall surfacing means related to the spacing portions on one side of said barrier-forming means is bonded to said core mold by concrete that fills the space between it and said barrier-forming means, thereby embedding said spacing portions and the parts connecting them to said barrier-forming means, said last-mentioned wall surfacing means comprising a plurality of individual members having cement means interposed between adjacent edge faces thereof, and tie members embedded in said cement means between contiguous faces thereof and extended inwardly into mechanical connection with said core mold, being also embedded in the concrete in the said space.

6. A construction as claimed in claim 1 in which said longitudinally extending spaced sheet metal means of said core mold and said metal parts are integral, being formed out of plane sheet metal with said parts pressed out of the plane thereof, and said sheet means comprises individual sheet-like members inserted between opposed outwardly pressed spacing portions and held in substantial alinement with the intervening parts of said plane sheet metal that form said longitudinally extending spaced sheet metal means.

7. A construction as claimed in claim 1 in which said longitudinally extending spaced sheet metal means of said core mold and said metal parts are integral, being formed out of plane sheet metal with said parts pressed out of the plane thereof, and said sheet means comprises individual sheet-like members inserted between opposed outwardly pressed spacing portions and held in substantial alinement with the intervening parts of said plane sheet metal that form said longitudinally extending spaced sheet metal means, the parts that connect opposed spacing portions to the latter and that extend oppositely away from the general plane of said sheet metal forming angles less than 180°, and, being alined, thereby to form trough-like channels opposed to each other, opposite edges of said inserted sheet means being seated in opposite trough-like channels.

8. A construction as claimed in claim 1 in which said longitudinally extending spaced means comprise a plurality of individual metal members that are held in spaced relation by said plurality of metal parts, means being provided to secure the connecting parts of each spacing portion one to each of two spaced metal members.

9. A construction as claimed in claim 1 in which said bridging sheet means and said plurality of longitudinally extending spaced sheet metal means are integral throughout, being formed of an unbroken sheet metal, securing means being provided for securing the connecting parts of opposed spacing portions to opposed faces of said unbroken sheet metal.

10. A construction as claimed in claim 1 in which said bridging sheet means and said plurality of longitudinally extending spaced sheet metal means are integral throughout, being formed of an unbroken sheet metal, the portions of which corresponding to said longitudinally extending spaced means being pressed out of its plane to give it a cross-section to resist bending, and means securing the connecting parts of said spacing portions thereto.

11. A construction as claimed in claim 1 in which said bridging sheet means and said plurality of longitudinally extending spaced sheet metal means are integral throughout, being formed of a continuously corrugated sheet metal each of said longitudinally extending spaced means comprising at least one corrugation, said spacing portions being secured to said corrugated sheet by said connecting parts.

12. In building construction, in combination, a built-up core mold comprising a plurality of individual longitudinally extending spaced means of sheet metal, each substantially U-shaped in cross-section, with individual sheet means having connections to and bridging between the ends of adjacent arms of successive spaced means and along a general plane spaced from the bases of said U-shaped means, with concrete filling said U-shaped means and extending across said sheet means to terminate in a plane spaced from the plane of the bases of said U-shaped sheet metal means.

13. In building construction, in combination, a built-up core mold comprising a plurality of individual longitudinally extending spaced means of sheet metal, each substantially U-shaped in cross-section, with individual sheet means having connections to and bridging between the ends of adjacent arms of successive spaced means and along a general plane spaced from the bases of said U-shaped means, with concrete filling said U-shaped means and extending across said sheet means to terminate in a plane spaced from the plane of the bases of said U-shaped sheet metal means, and means forming wall surfacing supported by said U-shaped means along a plane alined with the plane of the bases thereof, thereby forming a space between said sheet means and said wall surfacing means.

14. In building construction, in combination, a core mold comprising a plurality of longitudinally extending spaced means of sheet metal, each substantially U-shaped in cross-section, with sheet means connected to and bridging between the ends of adjacent arms of successive spaced means and along a general plane spaced from the bases of said U-shaped means, with concrete filling said U-shaped means and extending across said sheet means to terminate in a plane spaced from the plane of the bases of said U-shaped sheet metal means, said sheet means being of sheet metal, and successive U-shaped means being provided with opposed channel-forming

means for receiving respectively the opposed edges of said sheet metal sheet means.

15. A construction as claimed in claim 13 provided with means connected across said space and connected to said wall surfacing means to aid in supporting the latter intermediate of said U-shaped means.

16. In building construction, in combination, a wall unit, of which a plurality when assembled may form a wall-like part of a building, said unit comprising a core mold that comprises a plurality of spaced substantially parallel metal portions to function as beams or studs, said portions having extending, from one to the other, sheet means to form with the latter a substantially continuous barrier, said core mold having a plurality of distributed spacing means on each side of said barrier and spaced therefrom and having secured thereto and spaced by said distributed spacing means from the general plane of said sheet means wall surfacing structure thereby forming a space between the latter and the plane of said sheet means, said sheet means and said portions forming a substantially continuous barrier for preventing a pourable material, on one side thereof, from entry into said space, said core mold with its said wall surfacing structure and hence said unit being of a length and breadth such that a number thereof when alined edge to edge form said part of the building.

17. A construction as claimed in claim 16 in which said wall surfacing structure comprises lathing coextensive in area with that of said core mold whereby, upon the assembly together of a plurality of such units, to form the desired wall or ceiling area, the lathing of all of said units becomes alined and ready for the reception of plaster.

18. A construction as claimed in claim 16 in which said wall surfacing structure comprises sheet material such as sheet metal, prefabricated building sheet material, said sheet material being coextensive in area with that of said core mold whereby upon the assembly together of a plurality of such units, to form the desired wall or ceiling area, the sheet material of all of said units becomes alined and substantially in edge to edge relationship, and said barrier-forming sheet means of one wall unit forms a continuation of the sheet means of an adjacent unit.

19. In building construction, in combination, a core structure providing a plurality of metallic spacing portions to each side of a substantially central plane thereof, opposed ends of said core structure terminating in two alined edges spaced to each side of said central plane and each of said two edges having attaching means, thereby providing at each end of said core structure two spaced attaching means, the means at one end being companion to the means at the other end, whereby core sections placed end to end present, each to the other, said two alined spaced edges with their respective two attaching means for respective interconnection, thus to connect adjacent core sections together along two spaced lines of connection.

20. In building construction, in combination a core structure providing a plurality of metallic spacing portions to each side of a substantially central plane thereof, opposed end edges of said core structure having attaching means, the means at one end edge being companion the means at the other end edge, whereby core sections placed edge to edge may be interconnected by the companion attaching means, the attaching means at one end edge comprising means having the form of a ratchet tooth and the attaching means at the other end edge comprising means shaped to receive and interlock with attaching means of the kind at the opposite end.

21. In building construction, in combination, a core structure providing a plurality of metallic spacing portions to each side of a substantially central plane thereof, opposed end edges of said core structure having attaching means, the means at one end edge being companion the means at the other end edge, whereby core sections placed edge to edge may be interconnected by the companion attaching means, the attaching means at one end edge comprising a plurality of members having a form like a ratchet tooth and the attaching means at the other end edge comprising a substantially corresponding plurality of means having a configuration to receive therein and interlock with the companion attaching means.

22. In building construction, in combination, a core structure providing a plurality of metallic spacing portions to each side of a substantially central plane thereof, opposed end edges of said core structure having attaching means, the means at one end edge being companion the means at the other end edge, whereby core sections placed edge to edge may be interconnected by the companion attaching means, the attaching means at one end edge comprising a sheet metal member having a flange to give the effect of a ratchet tooth, said member with its flange extending longitudinally of said end edge and throughout a substantial extent thereof, and the attaching means at the other end edge comprising a sheet metal member extending longitudinally thereof and throughout a substantial extent of said end edge and having flange means of a configuration to form a seat for receiving and interlocking with the ratchet toothed flange of an attaching means like that at the other end edge.

23. A core mold as claimed in claim 12 in which opposed longitudinal edges are provided respectively with companion interconnecting or attaching means, whereby adjacent core molds may be connected together.

24. In building construction, in combination, a building wall, or the like, comprising a metallic core having a plurality of longitudinally extending spaced metal means cross-sectioned to resist bending and a plurality of wall surfacing supports alined in two parallel planes one to each side of the general plane of said spaced metal means, said supports terminating at an edge of said core in securing devices, a frame for a window, door, or the like, having sheet metal trim to take against said edge of said core and provided with companion fastening devices to interengage with said fastening devices of said supports.

25. A construction as claimed in claim 24 in which said supports are metallic and have their fastening devices integrally formed therewith, the yieldability of the metal of said supports coacting in the interengagement with the fastening devices of said frame.

26. In building construction, in combination, a core mold comprising a plurality of longitudinally extending spaced means of sheet metal, each substantially U-shaped in cross section, with sheet means connected to and bridging between the ends of adjacent arms of successive spaced means and along a general plane spaced from the bases

of said U-shaped means, with concrete filling said U-shaped means and extending across said sheet means to terminate in a plane spaced from the plane of the bases of said U-shaped sheet metal means, said sheet means bridging between the ends of adjacent arms of successive spaced U-shaped means being curved to be convex toward the plane in which said concrete terminates, thereby to give said sheet means an arch-like effect.

27. In building construction, in combination, a core mold comprising a plurality of longitudinally extending spaced means of sheet metal, each substantially U-shaped in cross-section, with sheet means connected to and bridging between the ends of adjacent arms of successive spaced means and along a general plane spaced from the bases of said U-shaped means, with concrete filling said U-shaped means and extending across said sheet means to terminate in a plane spaced from the plane of the bases of said U-shaped sheet metal means, said U-shaped means supporting wall surfacing means along the plane of the bases of said U-shaped means.

28. In building construction, in combination, a core mold comprising a plurality of longitudinally extending spaced means of sheet metal, each substantially U-shaped in cross-section, with sheet means connected to and bridging between the ends of adjacent arms of successive spaced means and along a general plane spaced from the bases of said U-shaped means, with concrete filling said U-shaped means and extending across said sheet means to terminate in a plane spaced from the plane of the bases of said U-shaped sheet metal means, said adjacent arms of said U-shaped means having portions thereof conformed to form supports for wall surfacing material in sheet form, and wall surfacing material in sheets bridged across between adjacent arms and held by said supports.

29. In building construction, in combination, a core mold comprising a plurality of longitudinally extending spaced supporting members having extending between adjacent members means forming a substantially continuous barrier, said core mold having distributed at least to one side of said barrier-forming means a plurality of metal parts each comprising a spacing portion held spaced from said barrier-forming means and substantially alined along a plane substantially parallel to the plane of said supporting members, and wall surfacing means comprising sectionalized means alined by and against said spacing portions, contiguous edge faces of said sectionalized means being spaced apart and the space therebetween filled with a waterproof substantially permanently yielding or non-hardening material.

30. In building construction, in combination, a core mold comprising a plurality of longitudinally extending spaced supporting members having extending between adjacent members means forming a substantially continuous barrier, said core mold having distributed at least to one side of said barrier-forming means a plurality of metal parts each comprising a spacing portion held spaced from said barrier-forming means and substantially alined along a plane substantially parallel to the plane of said supporting members, wall surfacing means comprising sectionalized means alined by and against said spacing portions, and concrete filling the space between said barrier-forming means and said sectionalized means for interlocking with said spacing portions and for bonding thereto said sectionalized means.

31. In building construction, in combination, a core mold comprising a plurality of longitudinally extending spaced supporting members having extending between adjacent members means forming a substantially continuous barrier, said core mold having distributed at least to one side of said barrier-forming means a plurality of metal parts each comprising a spacing portion held spaced from said barrier-forming means and substantially alined along a plane substantially parallel to the plane of said supporting members, wall surfacing means comprising sectionalized means alined by and against said spacing portions, contiguous edge faces of said sectionalized means being spaced apart, concrete filling the space between said barrier-forming means and said sectionalized means, and a waterproof substantially permanently yielding or non-hardening material filling the space between said contiguous edge faces of said sectionalized means.

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