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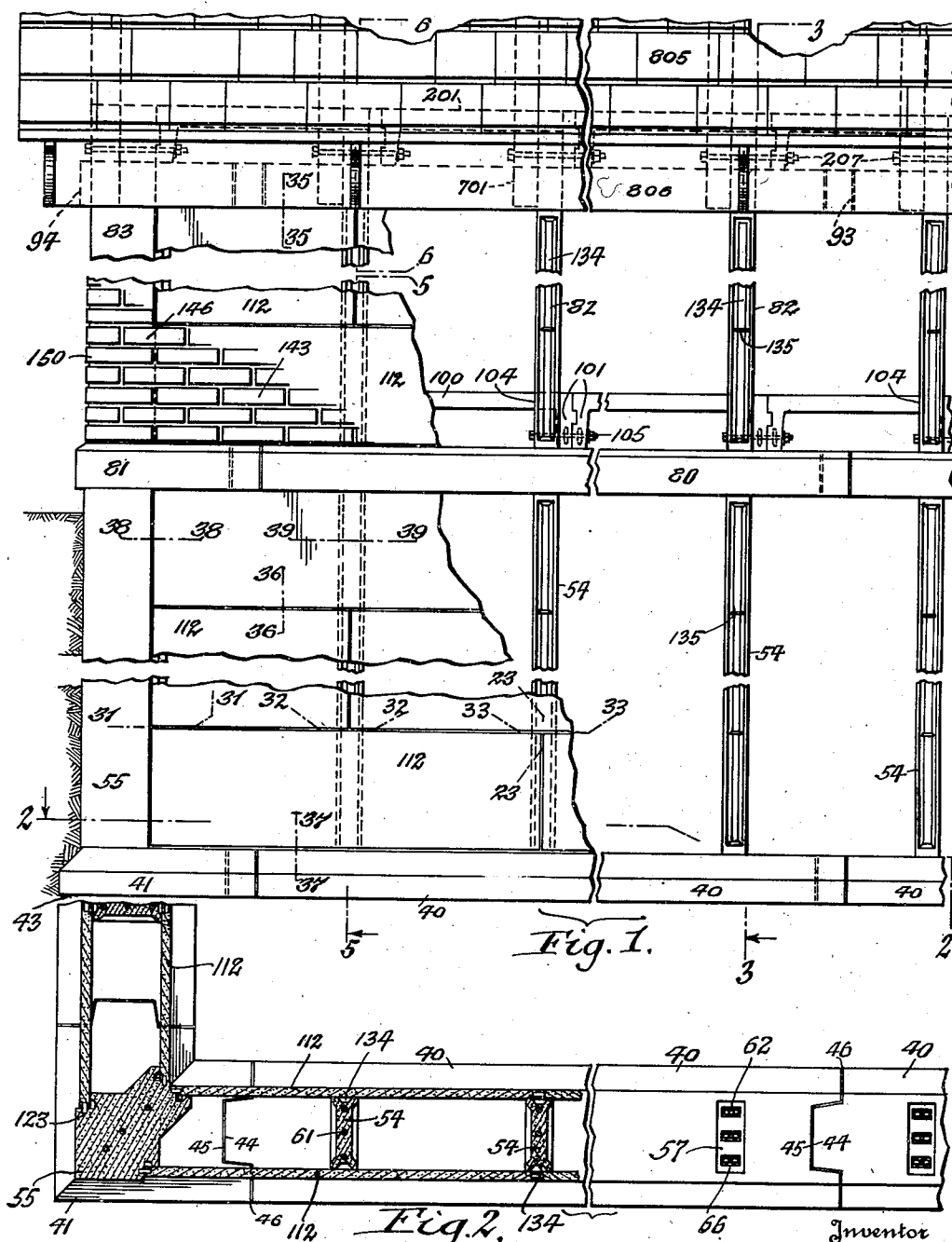
L. M. PARKHURST

2,100,451

BUILDING CONSTRUCTION

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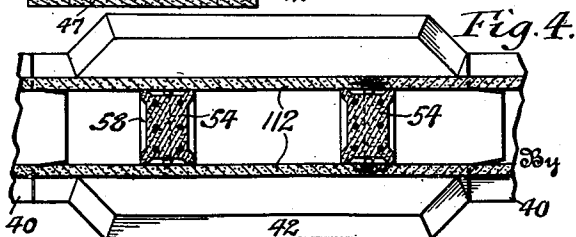
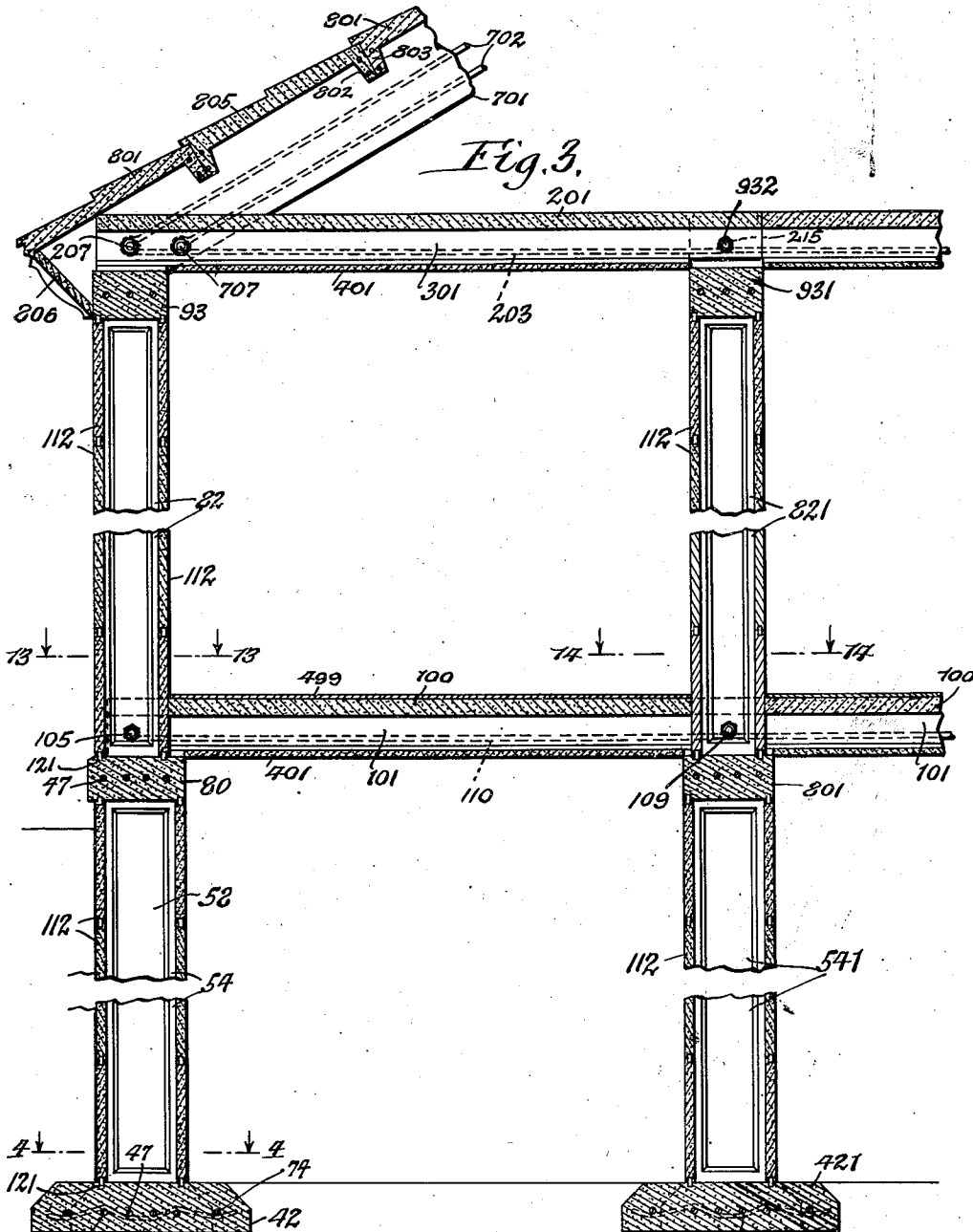
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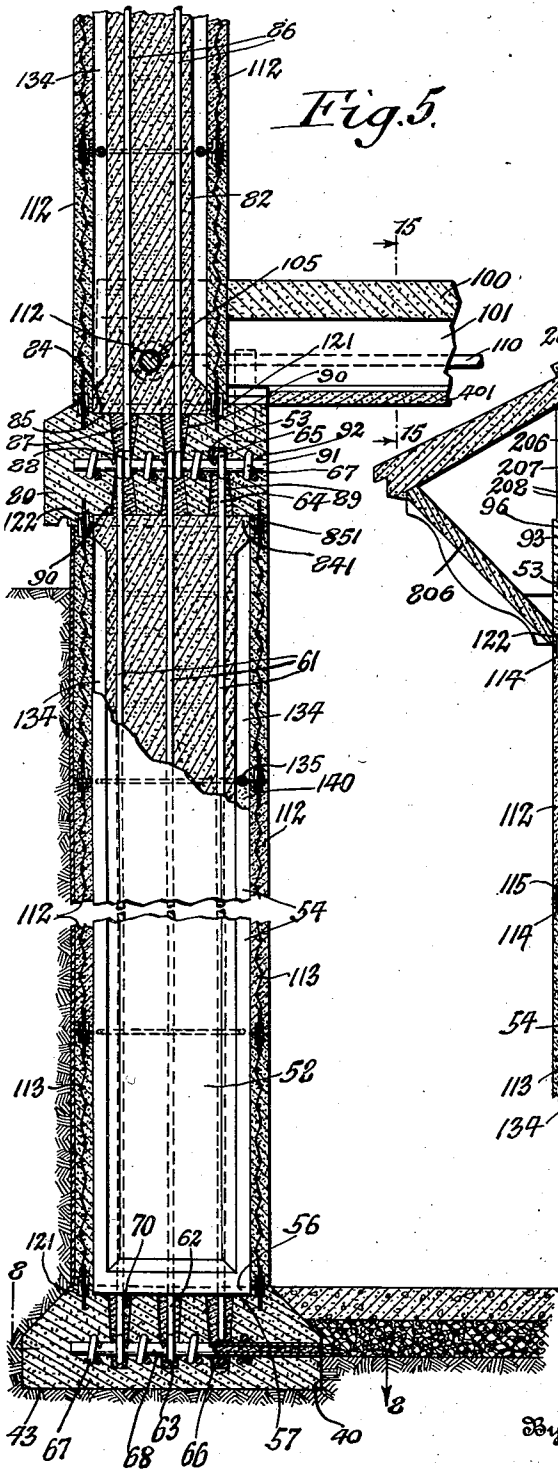


Fig. 5.

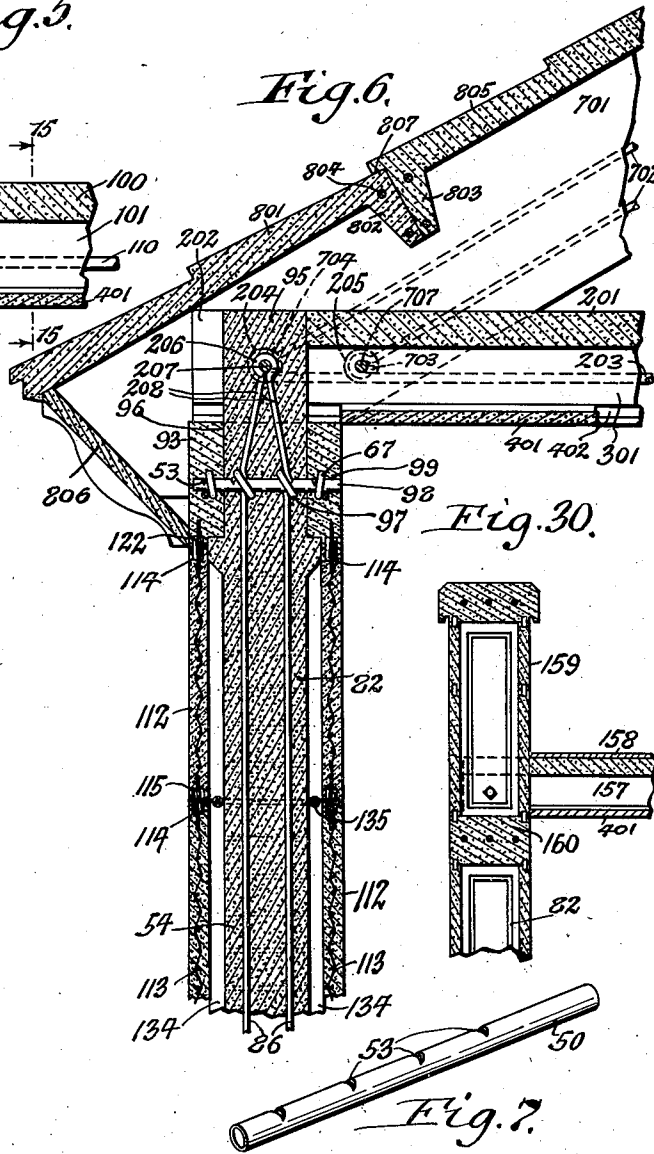


Fig. 6.

Fig. 30.

Fig. 7.

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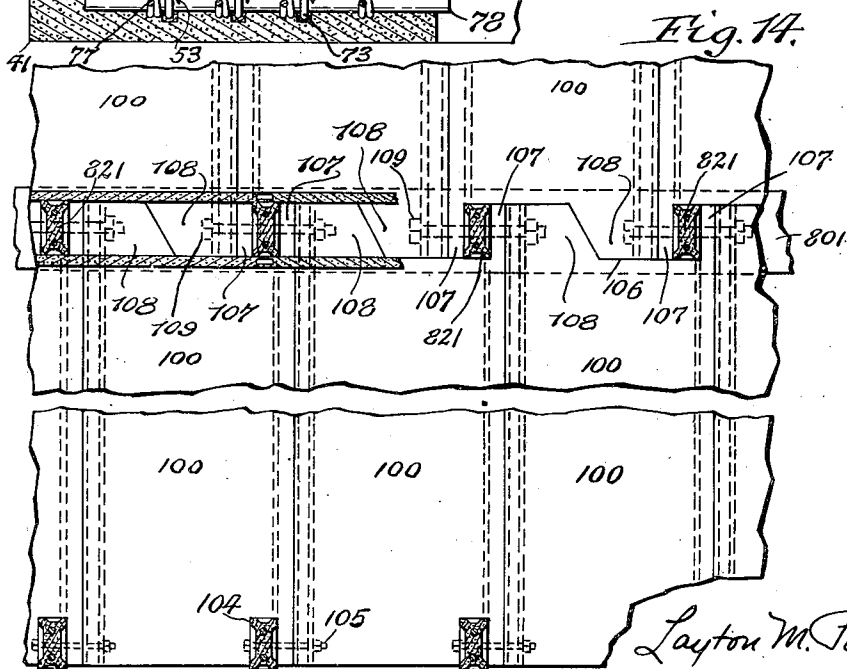
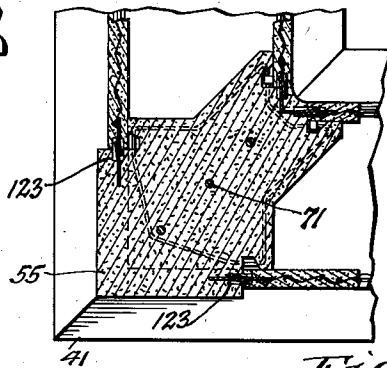
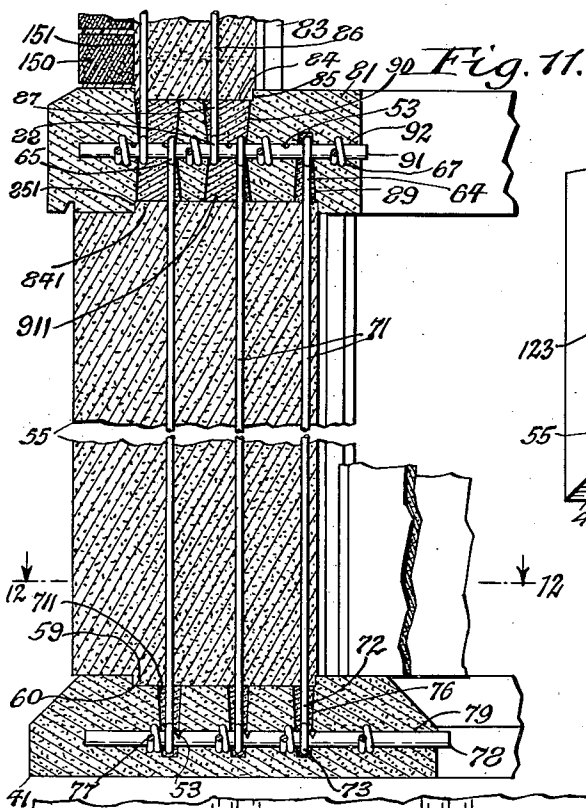


Fig. 14.

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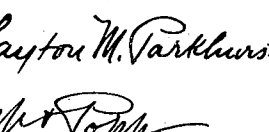
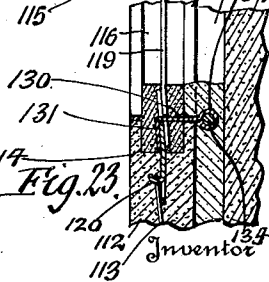
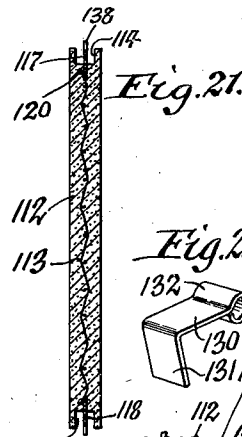
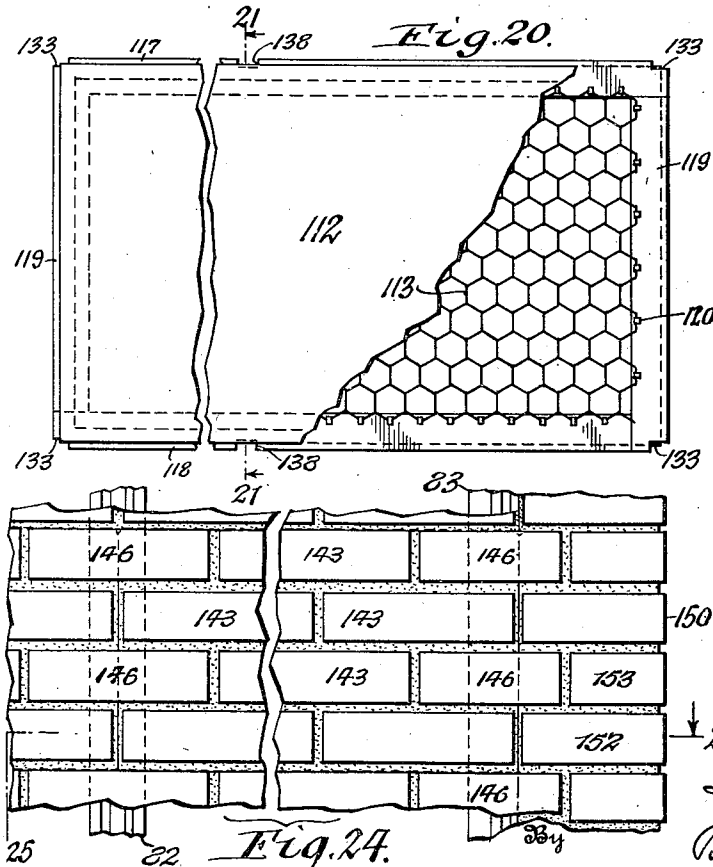
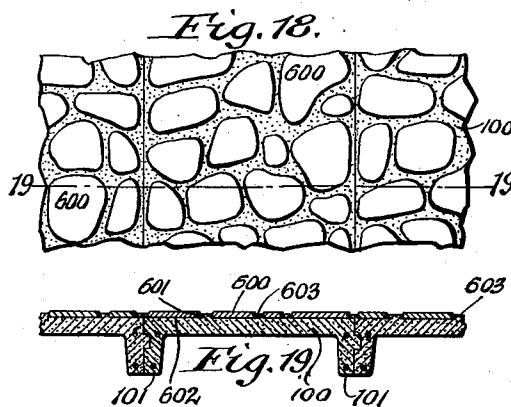
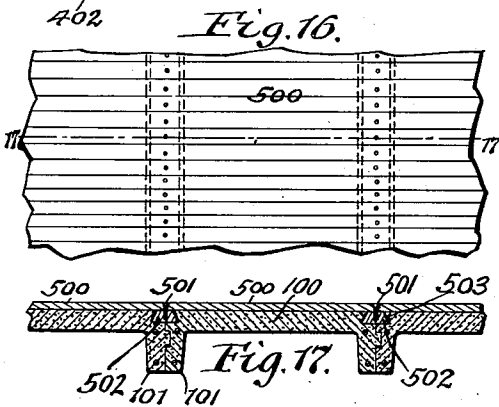
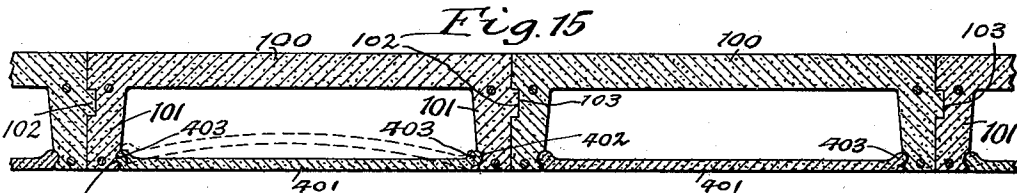
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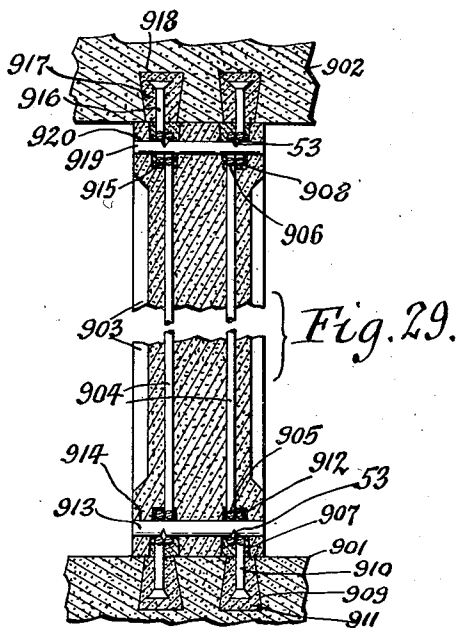
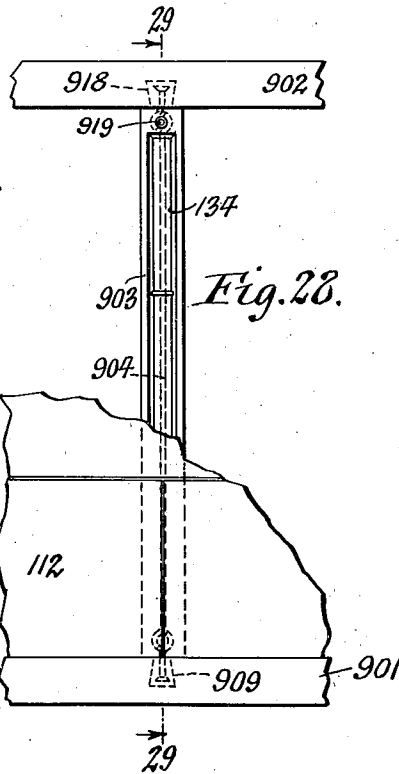
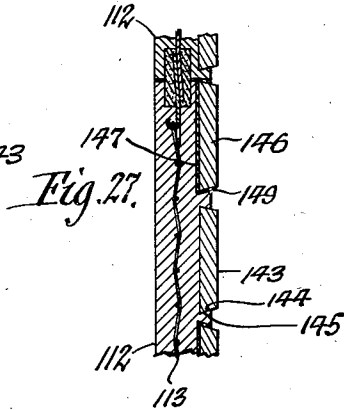
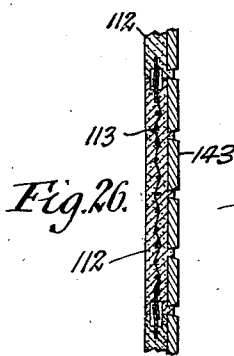
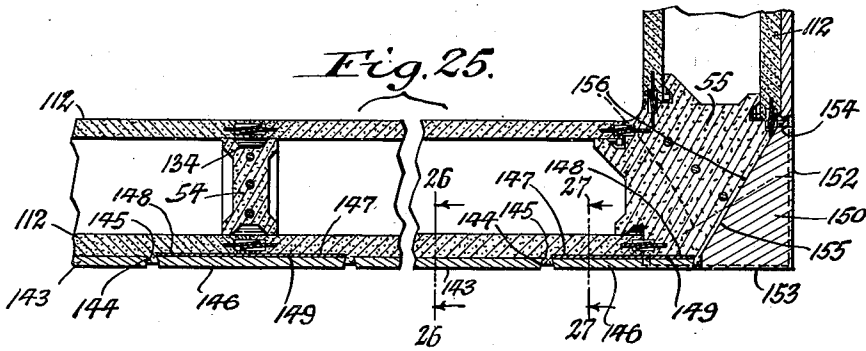
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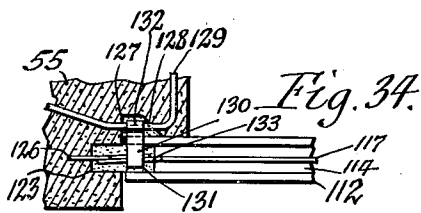
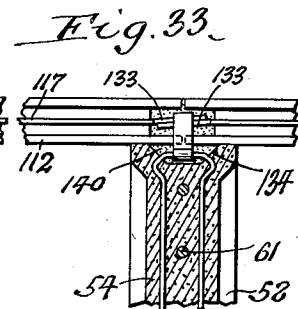
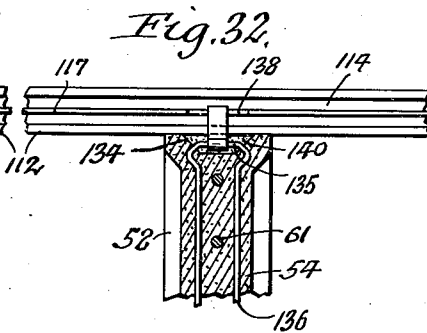
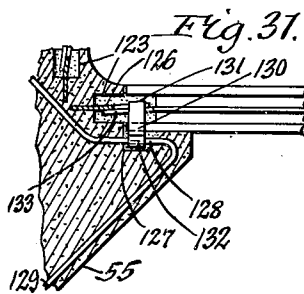


Fig. 39.

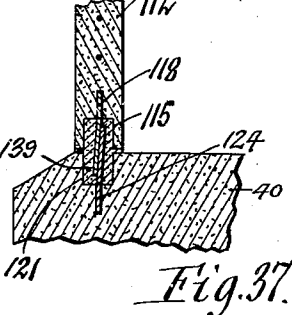
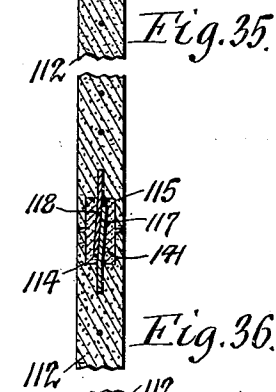
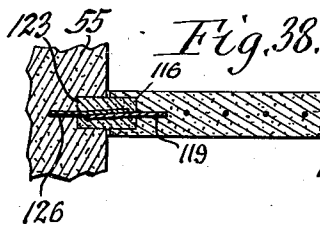
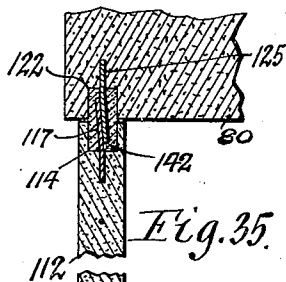
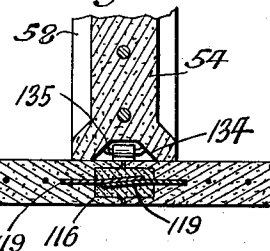
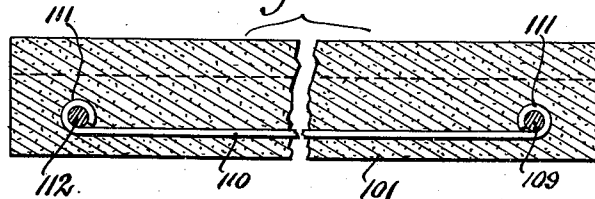


Fig. 40



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UNITED STATES PATENT OFFICE

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BUILDING CONSTRUCTION

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Application April 10, 1935, Serial No. 15,601

9 Claims. (Cl. 72—1)

This invention relates to a building construction in which the main elements are made principally of concrete and of such character that the same may be pre-cast or pre-formed in a factory and then permit of convenient and quick assemblage at the place where the building is to be erected, without any further fabrication other than that of connecting the several members with each other, cementing the joists between the same, and pointing the several joints of the building for finishing the job.

One of the objects of this invention is to provide pre-cast concrete members of this character with metal reinforcing elements embedded therein which are so constructed that the concrete members may be readily engaged with one another for erecting the building and the metal reinforcements therein may be connected with one another in such manner that the building when completed, virtually includes a metal frame, the various parts of which are tied together in such manner that a practically integral structure is produced and the several concrete members of the building are tied together so that the building as a whole is very strong and durable and capable of properly sustaining the loads or strains which may be placed upon the same.

Another object of this invention is to so connect the various concrete members and the reinforcing elements therein with each other and seal the joints between the same by means of cement so that all the parts of the metal reinforcements are completely covered, and the joints between adjacent concrete members are sealed for the purpose of preserving the reinforcement against deterioration, and also maintaining the structure in a tight and durable condition.

A further object of this invention is to provide an improved construction of the walls of the concrete building which permits of pre-forming the same at a factory and to be readily assembled with other members of the building on the job in a manner which is convenient and expeditious, and produces a very strong, durable and tight construction.

Another object of this invention is to provide improved means for mounting the panels of a ceiling on overhead beams or joists of the building.

A further object of the invention is to provide simple and efficient means for applying a covering to the floor of a building either in the form of wood or in the form of tiles.

Other objects of this invention are to improve

the construction of the building in various details, as will hereinafter more fully appear.

In the accompanying drawings:

Figure 1 is a fragmentary side elevation of a concrete building embodying my improvements and showing the same provided with an inclined roof.

Figure 2 is a horizontal section, taken on line 2—2 Fig. 1.

Figure 3 is a vertical section, taken on line 3—3 Fig. 1.

Figure 4 is a fragmentary horizontal section, taken on line 4—4 Fig. 3.

Figures 5 and 6 are fragmentary vertical sections, on an enlarged scale, taken on the correspondingly numbered lines in Fig. 1.

Figure 7 is a perspective view of one of the locking or coupling pins employed in this building construction for connecting adjacent concrete members and the metal reinforcements embedded therein, and enabling cement to be effectively introduced into the joints between these concrete members and the cooperating reinforcements for the purpose of forming a tight joint between the same and protecting the reinforcement against corrosion.

Figure 8 is a horizontal section of a part of the base of the building at the corner thereof, taken on line 8—8 Fig. 5.

Figure 9 is a horizontal section, taken on line 9—9 Fig. 10.

Figure 10 is a vertical section, taken on line 10—10 Fig. 9.

Figure 11 is a vertical section of a corner portion of the building, taken on line 11—11 Fig. 8.

Figure 12 is a horizontal section, taken on line 12—12 Fig. 11.

Figures 13 and 14 are fragmentary horizontal sections, taken on the correspondingly numbered lines in Fig. 3.

Figure 15 is a fragmentary vertical section, taken on line 15—15 Fig. 5.

Figure 16 is a fragmentary plan view showing the manner in which a wood flooring is secured upon the beams or joists of a concrete building in accordance with my invention.

Figure 17 is a vertical section, taken on line 17—17 Fig. 16.

Figure 18 is a fragmentary plan view showing a tile flooring on the joists or beams of a concrete building embodying my invention.

Figure 19 is a vertical section, taken on line 19—19 Fig. 18.

Figure 20 is a fragmentary side elevation of

one of the wall slabs or sections forming part of the wall of my improved concrete building.

Figure 21 is a vertical section, taken on line 21—21 Fig. 20.

5 Figure 22 is a perspective view of one form of clip suitable for securing the wall slabs or sections of the wall on the studs of the building in accordance with my invention.

Figure 23 is a fragmentary vertical section, on 10 an enlarged scale, taken on line 23—23 Fig. 1, and showing the manner in which the adjacent horizontal edges of two wall slabs or sections are secured to a stud.

Figure 24 is a fragmentary side elevation of the 15 corner portion of a concrete building embodying my invention and showing the manner in which a brick effect is produced on the exterior of the wall slabs and a corner stud or column of the building.

20 Figure 25 is a horizontal section, taken on the line 25—25 Fig. 24.

Figure 26 is a fragmentary vertical section, taken on line 26—26 Fig. 25.

25 Figure 27 is a similar vertical section, on an enlarged scale, taken on line 27—27 Fig. 25.

Figure 28 is a fragmentary side elevation showing the manner in which an internal partition is constructed in the building in accordance with my improvements.

30 Figure 29 is a fragmentary vertical section, on an enlarged scale, taken on line 29—29 Fig. 28.

Figure 30 is a fragmentary vertical section of the upper part of a concrete building showing a modified form of the roof portion thereof in 35 which the edge of the roof is provided with a parapet or fire wall.

Figure 31 is a horizontal section, on an enlarged scale, similar to a part of Fig. 2, and showing the means whereby one vertical end of 40 an inner wall slab is connected with the inner side of a corner, stud or column of the building.

Figure 32 is a similar view on line 32—32 Fig. 1, showing the means whereby an inner wall slab of the building is connected on its central part 45 with the inner side of one of the upright studs or columns of the building.

Figure 33 is a similar view on line 33—33 Fig. 1, showing the manner of mounting the opposing ends of two inner wall slabs on the inner side of 50 an intermediate stud or column.

Figure 34 is a fragmentary horizontal section, on an enlarged scale, similar to the outer corner part of Fig. 2, taken on line 34—34 Fig. 1, and showing the manner of mounting an end of an 55 outer wall slab to a corner stud.

Figures 35, 36 and 37 are fragmentary vertical sections, on an enlarged scale, taken on the correspondingly numbered lines in Fig. 1, and showing the construction of the means for sealing the 60 joints between the horizontal edges of the wall slabs and between the latter and the adjacent horizontal plates or blocks.

Figure 38 is a fragmentary horizontal section, on an enlarged scale, taken on lines 38—38 Fig. 1, showing the means for sealing the joints between the vertical edge of an outer wall slab and an adjacent corner concrete stud or column of the building.

Figure 39 is a similar view, taken on line 70 39—39 Fig. 1, showing the manner in which the vertical joints between adjacent outer wall slabs are sealed.

Figure 40 is a fragmentary vertical longitudinal section of one of the concrete joists showing the reinforcement therein provided with 75

means for connecting the same with another building member.

In the following description similar characters of reference indicate like parts in the several figures of the drawings:

5 The general organization of the main parts of the building embodying various features of my improvements comprise a plurality of horizontal courses of concrete plates or blocks, the lowermost one of which forms the base or footing of 10 the building, the uppermost one a part of the top of the building, and those intermediate of the lowermost and uppermost courses forming part of the intermediate stories of the building; studs, columns, pillars or posts arranged between 15 the plates or blocks of one course, and those of another course; joists or beams mounted on the upper courses of said plates or blocks and forming parts of the ceiling and floor of each story of the building; and a roof forming the upper 20 part of the building.

In the preferred construction the base, footing or foundation of the building comprises a plurality of lower plates or blocks 40, 41, 42, of 25 which the straight ones 40 and 42 are arranged end to end to form a longitudinal row which rests at the bottom 43 of the excavation constituting the bottom of a cellar or basement, while each base 41 is of angular form and located at a corner 30 of the building where it serves as a part of the connection between the end sections of two longitudinal rows of base blocks which are arranged at an angle to each other for the purpose of supporting the superstructure of adjacent 35 walls of the building arranged at a corresponding angle relative to one another.

Each of the lower plates or blocks of the footing or base is made of any suitable mixture of concrete and provided with a flat underside 40 whereby the same rests upon the bottom of the excavation or other surface adapted to support the same, and its upper side is also flat for the purpose of supporting the other structural members of the building which are mounted thereon.

The opposing ends of adjacent base plates or 45 blocks are preferably interlocked so as to hold the same against lateral displacement relatively to one another, this being preferably accomplished by providing each of the base plates at one end with a tenon 44 and at its opposite end 50 with a mortice 45, and in the assembled position of a plurality of such plates the tenon of each block engages with the mortice 45 of an adjacent block, as shown in Figs. 2, 4, 8 and 9.

In the completed condition of a footing or base 55 made up of plates or blocks of this character, the joints between adjacent plates are preferably filled with a sealing medium 46 of cement or the like, as shown for example in Figs. 8, 9 and 10, so as to render the joint between these members 60 tight and convert the several base members into one solid or unitary mass.

Each of these base plates is provided with a 65 metal reinforcement for the purpose of strengthening the same and preventing it from becoming fractured by any strains or loads to which it may be subjected while incorporated as part of the building.

In the case of the straight base plates 40 and 70 42 this reinforcement preferably consists of a plurality of longitudinal rods 47 of iron or steel which are preferably straight throughout the greater part of their length and embedded lengthwise within the concrete of the respective base 75

plate about midway between the upper and lower sides thereof.

In the case of the corner base plate 41 the reinforcing rods 48 are bent into angular form so as to follow the general contour of the respective plate.

The number of reinforcing rods in each of the base plates may vary according to the cross sectional dimension of the same and also the weight which is to be carried thereby, four of such rods being shown in the straight base plates, and a corresponding number of angular reinforcing rods being shown in the corner plate 41, in the construction shown in Figs. 8 and 9.

The reinforcing rods in each base plate extend to opposite extremities thereof and at that end of the base plate having the tenon 44 the adjacent end portions of the reinforcing rods are moved closer together and project into the respective tenon, while at that end of each base plate which contains the mortice 45 the adjacent ends of the reinforcing rods are spread apart and terminate in the respective end of this plate on opposite sides of the mortice 45 therein, as clearly shown in Figs. 8 and 9.

Means are provided for interlocking or coupling the adjacent ends of the concrete bodies of the base plates with each other and also connecting the metal reinforcements which terminate therein so as to produce a strong and durable base, and assure absolute rigidity of the same. In the preferred construction the end of each reinforcing rod is provided with a coupling which preferably has the form of an eye 49, and these eyes in one end of a base plate are arranged axially in line with each other and also in line with the eye couplings of the reinforcing rods in the opposing end of the adjacent concrete base plate. The opposing ends of two adjacent base plates and the eye couplings of the reinforcing rods therein are connected with each other by means of a locking or coupling pin 50, preferably of steel or iron, inserted in horizontal transverse openings 51, 52 formed respectively in one of the base plates on opposite sides of the mortice 45 therein, and in the tenon of the other base plate cooperating therewith, and also through the eye couplings 49 in the respective parts of these plates, as shown for example in Figs. 8 and 9.

The inner part of the pin opening 51 of each base plate extends to the inner side of the latter, but the outer end of this opening stops short of the outer side of the respective plate, as shown in Figs. 8 and 9. After a locking or coupling pin has been thus inserted in the cooperating ends of two adjacent concrete base plates and the eye couplings of the reinforcing rods therein, this pin is secured in these blocks and the reinforcement by forcing cement into the spaces between these members.

In order to secure a locking pin tightly in the opposing ends of two adjacent base plates and the extremities of the reinforcing rods therein and hold these parts rigidly in place relatively to each other, the locking pin 50 is preferably made of tubular form, as shown in Fig. 7, and the same is provided with one or more openings 53 leading from the bore of the same to the periphery thereof and the cement is introduced under pressure into the inner end of this pin, so that the same passes from the interior of the latter through the openings 53 and to the space between the periphery of the pin and the bore of the openings 51, 52 in the opposing ends of the base plates, and also

between this pin and the eye couplings of the respective reinforcing rods therein.

After this cement has hardened the same securely holds the locking pin in these plates and the reinforcements therein so that these parts are immovable relatively to each other, and the metal parts are virtually embedded in this cement so that they are protected against corrosion, and thus guards against weakening of the connection between these members.

If desired, additional reinforcing rods may be embedded in the concrete base plates in order to adapt the same to the load which may be carried thereby, for example as shown at the right end of Fig. 9, the wider base plate 42 may be provided with auxiliary longitudinal reinforcing rods 74 and also transverse reinforcing rods 75 which may be interwoven with each other and with the main reinforcing rods, as shown in this figure.

The numeral 54 represents the bodies of the lowermost intermediate studs, columns, piers or posts which are mounted vertically on the straight intermediate base plates 40, 42 of the building, and 55 represents the bodies of the lowermost corner posts, studs or columns of the building which are mounted, respectively, on the corner base plates 41. These studs are appropriately spaced from one another and the body of each is constructed of concrete, a sufficient number of the same being employed to form the basement or cellar part of the building and support the load which they are intended to carry.

In the preferred construction only one basement stud is employed at each corner of the building and rests on a single lower corner plate 41 and a plurality of intermediate studs are mounted on each intermediate base plate 40, although the number of studs on each of these plates may be either increased or decreased to suit some particular requirement.

When the load which is to be carried by any particular base plate is relatively light, the same may be made comparatively narrow, as shown at the right end of Fig. 8, and the left of Fig. 9, but if the load which is to be carried by some particular base plate is considerably greater than that which is to be borne by the narrow plates, then the respective base plate may be made wider than the adjacent narrow base plates, as shown at the right end of Fig. 9, and the central part of Fig. 4, in order to distribute the weight of the building substantially uniform over the foundation of the building.

Each of the lower intermediate studs 54 is provided at its lower end with a tenon 56 which is seated in a mortice or recess 57 on the upper side of the respective base plate upon which it is mounted, as shown in Fig. 5, and the transverse sides of the same are preferably hollowed out, as shown at 58, for the purpose of reducing the weight of the same and the amount of material contained therein without sacrificing the strength thereof.

The lower end of each corner stud or post 55 is likewise provided with a tenon 59 which engages with a mortice 60 in the upper side of the corner base plate 41, as shown in Fig. 11. By thus interengaging these studs with their respective base plates or blocks these members are held against horizontal displacement relative to each other and the assemblage of the same in their proper relative position is facilitated when erecting the building.

Each of the intermediate studs is preferably

made comparatively light in cross section, while each of the corner studs is made comparatively heavy, this cross section being determined according to the load which the studs are intended to carry.

In the concrete body of each of the intermediate studs a metal reinforcement is embedded, which in the present case comprises a plurality of vertical reinforcing rods 61 which are built into this stud by casting the concrete around the respective rods, while the latter are arranged within the mold and the plastic concrete is poured therein.

At its lower end each of the reinforcing rods is provided with an extension 62 which terminates in a coupling member 63 having preferably the form of an eye, and at its upper end each of these reinforcing rods has an upward extension 64 which terminates in a coupling member 65 having the form of an eye. The eye couplings at the lower ends of the companion reinforcing rods 61 are axially in line transversely of the respective stud, and the upper eye couplings 65 thereof are also arranged with their axes in line transversely of the respective stud.

Below the lower end of each of the intermediate studs 54 the respective base plate 40 is provided with a plurality of upwardly opening recesses 66, each of which receives one of the lower extensions 62 of a reinforcing rod in the respective intermediate stud and the eye coupling 63 thereof.

In the adjacent parts of this intermediate base plate the horizontal reinforcing rods therein are provided with couplings 67 having preferably the form of eyes which are arranged horizontally and transversely in line with the eyes 63.

The numeral 68 represents a locking or coupling pin which is inserted horizontally and transversely into an opening 69 which is formed in the base plate 40 and extends through the coupling eyes 67 therein, and also through the lower parts of a recess 66 in this plate and the coupling eyes 63 therein. The opening in the base plate which receives the locking pin 68 extends inwardly from the inner side of the base plate 40 but terminates short of the outer side thereof, as shown in Figs. 5, 8 and 9, and the locking pin therein is also preferably of tubular form, similar to the pin 50, and also provided with openings 53 extending from its bore to the periphery thereof, similar to those shown in Fig. 7, some of which openings may be arranged within the solid part of the base plate 40 and others in line with its recesses 66. Fluid cement is forced into this locking pin under pressure from the inner end thereof so that this cement passes through the openings 53 into the space between this pin and the bore of the opening 69 in the base block, and also fills each of the recesses 66, as indicated at 70, as best shown in Fig. 5, for the purpose of embedding these metal parts in cement and causing the lower end of this stud and the respective base plate to be rigidly connected with each other after the cement has become dry and hardened.

Each of the corner studs or columns is provided with a metal reinforcement consisting preferably of a plurality of upright rods 71 of steel or iron, each of which is provided at its lower end with a downward extension 72 terminating in a coupling member 73 having preferably the form of an eye, the eyes of the several downward extensions of the respective reinforcing rods being arranged on a horizontal line extending obliquely from the inner to the outer side of the respective corner of the building, as best shown in Figs. 8, 11, and 12.

Below the lower end of each of the corner studs or columns the respective corner base plate 41 is provided with a plurality of upwardly opening recesses 76, each of which is adapted to receive the lower extension 72 of one of the reinforcing rods 71 and the coupling eye 73 thereof, as shown in Fig. 11. The intermediate part of each of the angular reinforcing rods 48 of the corner base plate 41 is provided with a coupling eye 77 embedded in the concrete body of this base plate, so that the several intermediate eyes 77 of these angular reinforcing rods are axially in line with each other and with the eyes 73 of the lower extension 72, as shown in Figs. 8 and 11.

The numeral 78 represents a locking or coupling pin which passes horizontally through an oblique recess or opening 79 in the corner base plate 41 across the lower ends of the recesses 76 therein and also through the several intermediate coupling eyes 77 of the angular reinforcement rods 48, and through the coupling eyes 73 at the lower ends of the corner stud reinforcing rods 71, as shown in Figs. 8 and 11. The recess 79 in the corner base plate 41 extends to the inner side of this plate, but its outer end terminates short of the outer side of this plate, as shown in Fig. 8. After the corner stud 55 and the respective corner base plate have been assembled and their reinforcements have been connected by the locking pin 78 in the manner described, liquid cement 711 is forced into the inner end of the coupling pin 78 which is of tubular construction, similar to the pin 50, whereby this cement is caused to flow through openings in this pin, similar to the openings 53, into the space between the periphery of the pin and the surrounding part of this base plate, and also into the recesses 76, and thereby completely cover with cement the respective parts of the metal reinforcements of this corner plate and corner stud, so as to protect the same against corrosion and hold the same securely against displacement relatively to each other after the cement in which these members are embedded has become hardened.

On top of the basement or cellar studs 54, 55 are mounted a plurality of first floor or intermediate story plates or blocks 80, 81 which are usually arranged immediately above the level of the ground and are of substantially the same construction as the corresponding base plates or blocks 40, 41, each of said plates 80 being straight and adapted to rest with its underside on the upper end of one or more intermediate studs 54, and each of the plates 81 being of angular form and adapted to rest upon the upper end of one of the basement corner studs 55 and adapted to be connected at its opposite ends with the adjacent intermediate plates 80 of the respective walls of the building.

The bodies of these ground floor plates or blocks are made of concrete, the opposing ends of adjacent plates are interlocked with each other by tenon and mortice joints, each of these plates or blocks is provided with a metal reinforcement, and the opposing ends of the adjacent ground floor plates and the metal reinforcements therein are connected with each other by means which are substantially like those employed in connection with the base plates or blocks 40, 41, 42. The same reference characters and the description pertaining to the respective parts of the base plates are applicable to the corresponding parts of the first or ground floor plates, as appears in Figs. 1, 3, 5 and 11.

The numerals 82, 83 represent a plurality of

studs, posts or columns which form part of the outer walls of the first story above ground of the building, the studs 82 being comparatively light in cross section and located intermediate of the corners of the building, corresponding to the basement studs 54, and each of the studs 83 being comparatively heavy in cross section and located at one of the corner studs or posts of the building, corresponding to a corner post or stud 55 of the basement structure.

Each of these first story studs 82, 83 has its body constructed of concrete and is provided at its lower end with a tenon 84 which engages with a mortice 85 arranged in the upper side of the respective first floor plate, in substantially the same manner in which the lower ends of the basement studs are engaged with the base plates or blocks, thereby enabling these first story studs to be readily assembled with the first story plates and maintained against lateral displacement.

On its upper end each of the basement studs 54, 55 is provided with an upwardly projecting tenon 841 which engages with a mortice 851 in the underside of the respective first story plate, as shown in Figs. 5 and 11, thereby holding these members against lateral displacement.

Within each of the first floor studs a metal reinforcement is embedded which preferably consists of a plurality of upright steel rods 86, each of which is provided at its lower end with a downward extension 87 terminating in a coupling 88 which preferably has the form of an eye.

Each of the first floor plates 80, 81 is provided adjacent to its inner side with a downwardly opening recess 89 which receives the upper extension 64 of the innermost reinforcing rod 61, and each of these plates is also provided with a plurality of openings 90 in the central and outer parts thereof, which extend from the underside to the upper side of this plate, and are arranged over the upper end of the adjacent basement stud and underneath the lower end of the companion first floor stud, as shown in Figs. 5 and 11. The upper ends of the reinforcing rods in the central and outer parts of each of the basement studs project upwardly into the openings 90, and the lower extensions of the reinforcement rods 86 in the first story studs project downwardly into the openings 90 of the respective first floor plate, so that the coupling eyes 65 and 88 of the reinforcing rods 61 and 86 are axially in line with each other and with the eyes 67 of the reinforcing rods which are embedded in the respective plates.

A locking pin 91 is inserted horizontally and transversely into an opening 92 in the respective plate and passes through the coupling eyes 65, 67 and 88 of the reinforcing rods in the respective basement stud, first floor plate, and first story stud, as shown in Figs. 5 and 11.

Each of the coupling or locking pins 91 is of tubular form similar to the pin 50 shown in Fig. 7, and is also provided with openings 53 leading from the bore to the periphery thereof, so that upon forcing cement 911 into the interior of this locking pin, preferably from the inner end thereof, this cement will be discharged through the openings 53 into the space between the periphery of this pin and the bore of the opening 92, and also into the recesses 89 and openings 90 of the respective first floor plate, whereby these spaces are filled with cement, and the adjacent parts of the metal reinforcements therein are embedded in cement and securely held in place relatively to

each other after the cement has become hard, thereby uniting the upper end of each basement stud with the lower end of the companion first story stud, and also with the respective ground floor plate or block arranged between the ends of the concrete bodies of these studs.

The numerals 93 and 94 represent top or upper story plates which are mounted on the upper ends of the upper story studs, and the bodies of which are made of concrete like the base plates or blocks of the basement footing and the plates of the first or ground floor structure.

The top plates 93 are straight and arranged intermediate of the corner plates 94, corresponding to the intermediate base plates 40 and 80 and the corner plates 41 and 81 of the basement and first floor construction.

Each of these top plates is provided with a metal reinforcement similar to the concrete base plates of the basement structure and the plates of the first floor construction, and the same reference characters are therefore applicable thereto.

Each of the first floor studs 82, 83 is provided at its upper end with a tenon 95 which projects upwardly through an upright opening 96 in the adjacent part of the respective top plate, as shown for example in Fig. 6. The upright rods of the reinforcement in each of the first floor studs are provided within that portion of the tenon 95 which is arranged within the respective top plate, with coupling eyes 97 which, in the assembled position of the parts, are arranged axially in line with the corresponding coupling eyes 67 of the metal reinforcement in the respective top plate. A locking or coupling pin 98 is inserted horizontally and transversely in an opening 99 in the respective top plate and passed through the coupling eyes 67 in the respective plate and the coupling eyes 97 of the respective stud, for the purpose of mechanically connecting these parts. The coupling pin 98 is of tubular form, similar to the pin 50 shown in Fig. 7, and is also provided with openings 53, so that upon introducing liquid cement under pressure into the interior of the coupling or locking pin 98, this cement will flow through the openings 53 into the space between this pin and the adjacent parts of the respective top plate and such parts of the reinforcement which are exposed therein, thereby sealing the joints between these members so as to protect the same against corrosion and also hold them rigidly in place relatively to each other after the cement becomes hardened.

In the case of a comparatively narrow building in which the walls on opposite sides of any particular space is not too great, these walls may be the only support for the floor or floors of the building and the roof of the same, but when the span between the opposite walls of a building is so great as to render it necessary to have a support intermediate of the side walls, then additional supporting means are provided which are substantially of the same character as the side wall construction of the building heretofore described. In Figs. 3 and 14 such an additional inner vertical support for the floor or floors and the roof of the building is shown, consisting of an inner base plate or block 421 adapted to rest upon the bottom of the cellar or basement and form an inner footing for the building, an inner basement stud 541 resting at its lower end on the base plate 421, a ground floor plate 801 resting on the upper end of the basement stud 541, an inner ground floor stud 821 resting at its lower end on the inner ground floor plate 801, 75

and an inner top plate 931 mounted on the upper end of the inner ground floor stud 821, these several members having their bodies constructed of concrete and containing metal reinforcements which are constructed and connected in substantially the same manner which has been shown and described with reference to the corresponding members of the outer wall, shown in Figs. 1-12, and the same reference characters are therefore applicable to the corresponding parts in the drawings and the description relating thereto.

The main elements constituting the horizontal divisions of the building which is arranged above ground and provides a floor for the first story on its upper side and a ceiling for the basement on its underside, comprise a plurality of beams or joists which are arranged parallel and are of such length that they either span the space between two opposite upright walls of the building, or are of such length that they span the space between each of the upright walls of the building and an inner upright wall or partition provided for the purpose of distributing the load.

The body of each of these joists or beams is preferably constructed of concrete and of channel-shaped form in cross section, as shown in Figs. 3, 5 and 15, so as to provide a horizontal upper web 100 and two depending flanges 101 at opposite longitudinal edges of said web. The flanges of adjacent beams or joists engage with each other and are preferably interlocked by means of a tenon 102 formed on the flange of one of these beams and engaging with a recess or mortice 103 on the respective flange of the other beam, thereby holding these beams effectively against vertical displacement relative to each other.

Each of these joists or beams has the outer ends of its flanges resting on one of the ground floor plates, while its opposite or inner end rests either upon one of the inner ground floor plates 801, as shown in Figs. 3 and 14, or the opposite end of each of these beams may rest upon the ground floor plate on the opposite wall of the building.

As shown in Figs. 1 and 13 each of the horizontal joists or beams has the outer end of its web 100 provided with an outwardly opening notch or recess 104 immediately adjacent to the inner side of one of its flanges, which notch receives the lower part of one of the intermediate studs 82 of the outer wall. When a joist or beam is thus engaged with one of the studs of an outer wall the flange of the beam adjacent to the notch 104 engages the adjacent vertical transverse side of the respective stud, as shown in Figs. 1 and 13. Two adjacent joists are secured to each other and to the stud 82 by a bolt 105 passing through this stud and through the cooperating flanges of these studs, as shown in Figs. 1 and 13. When an inner supporting wall is employed the inner end of each beam rests upon one of the inner plates 801.

As shown in Fig. 13 each of the joists or beams is provided on the inner end of its web with a notch or mortice 106 so that this end of the joist is of bifurcated form and provides two arms 107, 108. In assembling two sets of joists of this character the arms 107, 108 on the inner ends of adjacent joists engage with each other and together form a tenon which engages with the mortice 104 in the inner end of a joist in the other set. The side of the notch 106 next to the arm 107 is adjacent to the respective flange of this joist and in the assembled condition of two sets of joists

the arms 107 of two joists of both sets engage with opposite sides of an inner stud 821, as shown in Fig. 14. Each of these studs is connected with the arms 107 engaging opposite sides of the same and also with the arms 108 engaging the arms 107 by a fastening consisting preferably of a bolt 109 passing through the stud 821 and through the four flanges 107, 107, 108, 108 forming parts of the adjacent four co-operating joists, as shown in Fig. 14.

Each of these joists or beams contains a metal reinforcement consisting preferably of a plurality of longitudinal rods 110 of steel or iron which are preferably arranged in the flanges of these beams. The lower reinforcing rods in the lower parts of these flanges are provided at their opposite ends with coupling eyes 111, the corresponding eyes of the two lower rods of the joist being horizontally in line with each other.

Each of the first or ground floor studs is not only connected with the adjacent ends of two joists by a bolt 105, but each of these bolts also preferably passes through a metal sleeve 112, embedded in the adjacent lower part of the respective stud and through the interengaging flanges of two adjacent joists and the outer coupling eyes 111 therein, as shown in Figs. 1, 3, 5, 13, 14, and 33. Each inner bolt 109 passes through the inner coupling eyes 111 of the respective joist. By these means the concrete body of these joists are supported and a mechanical connection is effected between the metal reinforcements therein and the reinforcement in the adjacent parts of the studs with which they cooperate.

On the upper sides of the top plates 93 of the outer walls and the top plates 931 of the inner walls are mounted a plurality of concrete beams or joists which in the present instance form the ceiling of the room below, while their upper sides form the floor of the attic of the building. The body of each of these joists is made of concrete and of channel form in cross section, so as to provide an upper horizontal web 201 and depending flanges 201 at opposite longitudinal edges of the web corresponding to the form of the joists or beams which constitute the horizontal ground floor division forming the floor of the first story and the ceiling of the basement below.

The joists 201, 301 are arranged parallel and have their adjacent vertical flanges in engagement and interlocked in the same manner as the first floor joists or beams, as shown in Fig. 15, and the inner and outer ends of their flanges engage on their undersides with the upper sides of a top plate 93 of one of the outer walls, and a top plate 931 of the respective inner wall, as shown in Figs. 3, 6 and 30.

At its outer end each of the webs 201 is provided with a notch 202 which receives the uppermost part of the tenon 95 of the adjacent outer stud 82, as shown in Fig. 6. Each of the joists 201, 301 is provided with a metal reinforcement which may consist of a plurality of rods or bars 203 arranged lengthwise in the flanges of this joist and each provided at its opposite ends with coupling eyes 204, 215. The outer one 204 of these coupling eyes is arranged axially in line with a coupling eye 206 embedded in the adjacent part of the tenon or shank 95 of the respective stud and formed on upward extensions 208 on the reinforcing rods 86 above the eyes 97 thereof, as best shown in Fig. 6. The eyes 204 of the horizontal reinforcing rod 203 in one of the uppermost joists of the building, and the eyes 206 of the respective outer stud are connected

with each other by means of a horizontal bolt 297 passing through the end portion of the respective top joist and the outer wall stud, and through the eyes 204, 206 of the reinforcements therein, thereby tying these metal parts together and rendering this part of the building strong and rigid.

The inner ends of the joists 201, 301 rests with their undersides on the top of the upper story top plate 931, and the opposing inner ends of two sets of these joists are notched and interlock with each other in the manner shown in Fig. 14 with reference to the first floor joists. The inner ends of the outer set of upper joists are connected with the upper end of the adjacent inner studs 821 by means of coupling bolts 932 passing horizontally through the inner eyes 215 of the reinforcement in these joists and the upper end of the reinforcement in the respective inner stud, corresponding to the manner in which this is done, as shown in Fig. 6.

If the building is used for factory purposes the underside of the joists may be left open or unfinished, but if the same is to be used for residential purposes and it is desired to finish the same, this may be done by mounting panels 401 on the lower edges of the flanges of each of the joists so as to extend across the channel or open space between these flanges. For this purpose each of these panels is preferably constructed of concrete, suitably reinforced if desired, and each of these panels is mounted on the flanges of the respective joist by providing the lower part of the inner sides of these flanges with longitudinal grooves 402, and providing the opposite longitudinal edges of each panel 401 with beads 403 which engage with the grooves 402. These grooves and beads 403 are preferably of round form in cross section, as shown in Fig. 15. The assembling of each panel with the respective joist is preferably effected by making the panel sufficiently thin so that it possesses the requisite elasticity to permit of first engaging one of the beads of the panel with one of the grooves of the joists, then bending the panel upwardly, as shown by dotted lines in Fig. 16, a sufficient extent to reduce its width and permit the opposite bead thereof to be engaged with its groove in the other flange of the joist, after which the panel is permitted to resume its normal flat or straight position, due to the resilience thereof, and cause both of its beads to be held in engagement with the grooves of the joist.

By this means a smooth finish is produced on the underside of the joists or beams in a manner which is extremely simple and inexpensive and does not require the use of any mechanical device for this purpose.

When the joists or beams form the uppermost horizontal division of a building, the upper sides of these joists may be left unfinished, as shown on the upper side of the top joists 201, 301 in Figs. 3 and 6. When, however, the upper side of the beams requires a flooring or covering so as to render the same suitable for residential or similar purposes, the upper side of the concrete beams or joists may be provided with floorings of various kinds. For example, as shown in Fig. 3, the upper side of the joists may be covered with an asphalt coating 499. As shown in Figs. 16, 17 a flooring of wood 500 may be laid over the concrete joists or beams, and this flooring may be held in place by fastening the same with nails or screws 501 to a plurality of cleats of wood 502, each of which is preferably of dove-tail or downwardly enlarging form and seated in

a correspondingly shaped groove 503, which is formed half and half in the opposing upper parts of two adjacent joists or beams. The cleat 502 is placed in the two halves of the groove 503 previous to assembling the respective joists, and after such assemblage the cleat or anchoring strip 502 is held in place with its upper side flush with the top of the joists, and thus permits of laying the wooden flooring over the same and the strips or cleats between them, preparatory to fastening the flooring to these cleats by means of the nails or screws 501.

Instead of providing the upper side of the joist with a wooden floor or covering this surface may be provided with decorative tile of any suitable character. For example, as shown in Figs. 18 and 19, the sections 600 of the tiling may have the form of irregular stones and each section of this tiling may be secured to the upper surface of the respective concrete beam or joist by providing each tile with a bevelled edge 601 so that opposite edges thereof are of downwardly diverging form and give the tile a dove-tail form in cross section. This tile is seated in a correspondingly shaped pocket in the upper surface of a joist, which pocket has a flat bottom 602 and undercut sides 603, as shown in Fig. 19. The tile sections may be thus mounted on the joists in this manner by first placing the tile sections in the desired position within a mold and then pouring the concrete into this mold so as to interlock with the tile sections and also form the concrete body of the joist.

After the concrete is hardened, the tile sections and the joists are permanently interlocked and no further fastening is required for holding these parts in an assembled position, thereby reducing the cost of manufacture and also providing an ornamental surface for the joists which is very strong, durable and wear-resistant.

Any suitable form of roof may be provided for the building, and one form, as shown in Figs. 1, 3 and 6, is constructed as follows:

The numeral 701 represents a number of inclined rafters which form part of the roof structure and each of which rests adjacent to its lower end on the upper side of one of the top plates 83. The body of this rafter is made of concrete and the same contains a metal reinforcement consisting, for example, of two metal rods 702 embedded in this rafter and provided at their lower ends with eyes 703, 704. The outer eye 704 of each upper rod 702 is arranged axially in line with the reinforcement eyes 206 in the adjacent outer stud 82 and the reinforcement eyes 204 of the adjacent roof joists, and receive the respective coupling bolt 297, as best shown in Fig. 3.

The inner eye 703 of this rafter is arranged axially in line with a coupling eye 205 formed on the inner part of the reinforcing rod 203 in the respective roof joists, and a coupling bolt 707 passes transversely through this rafter joist and eyes 703, 705 of the reinforcements thereof, for the purpose of further connecting these members with each other, as best shown in Fig. 6.

The covering of the roof construction, as shown in Figs. 1, 3 and 6, comprises a plurality of roof slabs or plates 801 which are arranged one above another in an inclined row on the upper side of the several rafters 701, and have their opposing edges provided with longitudinal flanges 802, 803 which project downwardly and may be connected with each other and with the rafters in any suitable manner.

The body of each of these roof slabs is constructed of concrete and the same contains a metal reinforcement consisting preferably of rods of iron or steel 804 embedded in the flanges of these slabs. The upper surfaces 805 of these roof slabs are preferably formed in imitation of wood or slate shingles in which the joints between the adjacent shingles in one row are arranged out of line with the joints of the shingles in an adjacent row, as shown in Fig. 1, and each upper row of roof plates overlaps the next lower row, as shown at 807 in Fig. 6. The lower ends of the rafters 701 project laterally somewhat beyond the top slabs 93, the lowermost roof slab 801 resting thereon and also extending beyond the outer side of this top slab so as to form an overhanging eave on the respective wall of the building. If desired, the space between the underside of the over-hanging part of the rafters and the roof plates or slabs may be enclosed by a molding 806 which is preferably constructed of concrete and may be reinforced and also held in an assembled position with reference to the adjacent parts of the roof slabs, the rafters, and the top plates 93 in any suitable manner.

If a partition is required in any particular part of the building where the regular studs of the building are not available for use in forming part of such a partition, means are provided for erecting auxiliary studs between any lower concrete member 901 and an upper corresponding concrete member 902 of the building, which means are shown in Figs. 28 and 29 and constructed as follows:

The numeral 903 represents the concrete body of an auxiliary post or stud engaged at its lower and upper ends with the lower and upper concrete members 901 and 902 of the building. Embedded in the body of this concrete auxiliary post is a reinforcement consisting preferably of one or more longitudinal rods 904 of steel or the like, which are provided at their lower and upper ends with coupling eyes 905 and 906 which terminate in pockets 907, 908 in the lower and upper ends of this stud or post. Below the lower and auxiliary post 903 the concrete member 901 is provided with one or more pockets 909 of dove-tail form.

The numeral 910 represents a coupling shank which is embedded in a cement filling 911 arranged in the pocket 909, this shank being provided at its upper end with a coupling eye 912 which is arranged axially in line with the adjacent lower coupling eye 905 of the reinforcement in the auxiliary post.

The numeral 913 represents a lower locking or coupling pin passing horizontally through an opening 914 in the lower end of the post 903 and through the coupling eyes 912 of the lower concrete member 901 and the lower eyes 905 of the reinforcement in the post. After the pin 913 has been thus placed, fluid cement is introduced under pressure into the pin 913 which is made of tubular form similar to the pin 50, which cement flows out through openings in the pin, similar to the openings 53 in Fig. 7, so as to fill the pockets 907 with cement and thereby hold these members securely against movement and also retaining the locking pin 913 in place after the cement becomes hardened.

In the upper pockets 908 similar coupling eyes 915 are arranged axially in line with the eyes 906 of the post reinforcement, each of the eyes 915 having an upwardly projecting shank 916

which is secured by means of a cement filling 917 in a dove-tailed recess 918 in the upper concrete member 902. The cooperating eyes 906 and 915 are connected with each other by means of an interlocking pin 919 passing through these eyes and through an opening 920 in the upper end of the post 903, which pin 919 is made of tubular form similar to the pin 50 shown in Fig. 7, and provided with openings 53 so that liquid cement may be forced into this pin from the exterior thereof and discharged through the openings 53 into the pockets 908 for filling the latter and embedding the eyes therein in cement, whereby these parts are rigidly connected after the cement has become hardened.

These auxiliary posts may be erected in any part of the building where additional support is necessary for some particular purpose, and these posts also serve as the supports for the walls of any partitions which may be required, or for any other purpose.

The space between the studs, pliers or posts or similar upright members of the building and the base plates, intermediate or story plates and top plates or similar horizontal members of the building, may be enclosed and the adjacent parts of the upright members may also be covered either on the inner side or outer side, or on both of these sides, by means which are preferably constructed as follows:

The numeral 112 represents the flat body of a wall slab or section forming part of the enclosure on one or both sides of the studs, posts, pliers or upright members of the building and extending across the space between these upright members and the horizontal building members cooperating therewith. Each of these wall slabs is preferably of rectangular oblong form, with the longer dimension arranged horizontally and the shorter dimension arranged vertically.

The body of the wall slab is made of concrete and the same is strengthened by embedding therein a metal reinforcement 113 having either the form of woven wire, as shown in Fig. 20, or of any other satisfactory construction. In its horizontal longitudinal edges this wall slab is provided with upper and lower longitudinal sealing grooves 114, 115, as shown in Fig. 21, and in its opposite vertical edges this slab is provided with vertical sealing grooves 116.

In mounting these wall slabs either on the inner side or the outer side of the upright members of a wall, and across the openings between the upright and horizontal members of the wall these slabs are arranged in a plurality of horizontal rows in which the horizontal edges of adjacent rows engage with each other, the lowermost row of slabs engage with the respective lower row of concrete plates, the upper edges of the uppermost row of slabs engage with the upper row of concrete plates, and the vertical edges of adjacent wall slabs engage with each other, while the vertical edges of the slabs at the extremities of each horizontal row engage with the upright corner studs, columns, posts or similar building member.

Intermediate the corners of the building the wall slabs engage either with the outer sides or the inner sides of the intermediate studs or columns, or with both of these sides.

The vertical joints between the wall slabs on either side of a wall are preferably so arranged that the joint between the slabs in one horizontal row are out of line or break joint with the joints in an adjacent row of slabs, similar

to the method which is pursued in laying bricks. The length of each wall slab, excepting the endmost slabs in alternate rows, is preferably equal to twice the distance between the centers of two adjacent upright studs or building members, such as the studs 54 and 82, and the corner posts 55 and 83, and the slabs are so mounted relatively to each other and the horizontal members of a wall that each full length wall slab has its central part extending across the side of a stud, while its opposite vertical edges overlap two upright studs or building members, and each half wall slab has its opposite vertical ends overlapping two of such upright building members in order to terminate the corresponding ends of the longitudinal rows of wall slabs vertically in line with each other.

The means for sealing the joints between the opposing edges of the several wall slabs and between the endmost slabs of the several rows and the cooperating upright building members, and between the upper and lowermost rows of slabs and the respective horizontal building members, are constructed as follows:

The numerals 117, 118 represent horizontal sealing strips arranged in the upper and lower horizontal grooves 114, 115 in the concrete wall slab and each having its inner edge embedded in the adjacent bottom of the groove in the respective part of the wall slab, while its outer edge projects beyond the edge of the slab, as shown in Figs. 20 and 21.

In each of the vertical grooves 116 of the wall slab is arranged a vertical sealing strip 119 of metal, the inner portion of which is embedded in the bottom of the groove of the respective edge of the slab, while its outer edge projects beyond the corresponding edge of the slab. The several sealing strips 117, 118 and 119 are connected with each other and with the reinforcement 113 of the slab by providing each of these sealing strips at its inner edge with hooks 120 which are formed thereon by striking up the metal thereof, and engaging the several hooks of these strips with the edge portions of the reinforcement 113, as best shown in Figs. 20, 21, 23, 26 and 27, whereby these strips not only add to the strength of the slab but are also held against displacement thereon.

The numeral 121 represents horizontal upwardly opening grooves arranged in the upper side of the horizontal concrete plates or building members at the lower end of the building openings between the studs or columns thereof, such grooves being employed on the upper side of each of the base plates or blocks 40 and on the upper side of each of the intermediate story plates 80, as shown for example in Figs. 5 and 37.

Similar horizontal grooves 122 are formed in the undersides of the horizontal concrete plates or members of the building at the top of the spaces between the studs or columns of the same, such grooves being employed for example on the underside of the top plates or blocks 80, as shown in Fig. 5, and the top plates or blocks 93 shown in Figs. 6 and 35.

Each endmost stud or column forming an upright concrete corner member of the building is provided with one or more vertical grooves 123, such grooves being shown for example on the inner and outer parts of the corner studs or columns 55 in Figs. 2, 12 and 25, and also in Figs. 31 and 34.

In each of the horizontal grooves 121 is arranged a lower horizontal joint or sealing strip

124 of metal which has its inner edge embedded in the concrete of the respective horizontal concrete building member 40 or 80 at the bottom thereof, while its upper edge projects above the upper surface of the same, as best shown in Fig. 37. In each of the upper horizontal grooves 122 is arranged an upper horizontal sealing strip 125 which has its upper edge portion embedded in the respective horizontal concrete building member, while the lower edge thereof projects below the lower surface thereof, as best shown in Fig. 35.

In each of the vertical grooves 123 of the upright concrete members of the building is arranged a vertical sealing strip 126 which has its inner edge embedded in the material of this concrete member, while its outer edge projects beyond the outer surface of the same, as best shown in Fig. 38.

In assembling the wall slabs on one side of the building wall the slabs of the lowermost row are engaged at their lower edges with the upper surface of the lowermost horizontal concrete plates or members so that the grooves 115 and 121 therein open toward each other and the outer edge portions of the sealing strips 118, 124 overlap one another, as best shown in Fig. 37. In this assembled position the opposing vertical edges of adjacent wall slabs also engage with each other so that the vertical grooves 116, 123 therein open toward each other, and the outer edges of the respective sealing strips 119 therein also overlap one another, as shown in Fig. 39.

Each outer vertical edge of the endmost wall slab engages with the vertical surface of the adjacent upright concrete member so that the vertical grooves 116, 123 therein open toward each other and the sealing strips 119, 126 therein overlap one another, as best shown in Fig. 38.

When the wall slabs are thus assembled on one side of the building wall the full-sized slabs and half-size slabs at the corresponding ends of the several rows of slabs terminate in a vertical line and engage with one of the end or corner studs, columns or posts of the building, some of the vertical joints between adjacent slabs intermediate the end studs, columns or posts of the building are in line with the centers of the intermediate studs, and some of the intermediate slabs of each row have their central parts extending across the side of an intermediate stud, as shown in Figs. 2, 4, 12, 25, 38, and 39.

After the lowermost horizontal row of slabs has been thus assembled these slabs are fastened to the respective upright concrete members of the building by the following means:

Each of the end studs, posts or columns of the building is provided with a fastening groove 127 which is arranged behind the outer edge portion of the endmost wall slab of a row, as best shown in Figs. 31 and 34. Extending horizontally across the groove 127 is an anchoring pin or bar 128 which preferably forms part of a reinforcement 129 embedded in the adjacent part of the respective vertical concrete member. This anchoring pin 128 is connected with the upper sealing strip 117 in the respective slab by means of a clip which preferably has a horizontal shank or body 130 projecting outwardly over the respective wall slab adjacent to the end thereof, a hook 131 at the outer end of the shank which engages with the outer side of the upper sealing strip in the upper groove of the respective slab, and an eye 132 arranged at the inner end of the

shank and mounted on the adjacent anchoring pin 128, as best shown in Fig. 31.

At the corners of the wall slabs the respective parts of the sealing strips are provided with notches 133 which receive the shanks 130 of the clips and permit the latter to clear the strip 117 and enable the latter to overlap the lower horizontal sealing strip of the next upper wall slab when the same are assembled.

Each of the intermediate upright studs is provided on its inner and outer sides with vertical grooves 134, and in line with each horizontal joint between the several rows of wall slabs an anchoring pin or bar 135 is arranged in this groove 134 and mounted on the adjacent part of the respective upright stud by forming this anchoring pin on a reinforcing rod 136 embedded in this concrete member, as shown for example in Figs. 25, 32, 33, and 35.

The opposing vertical edges of two wall slabs in each of the horizontal rows engage with each other opposite the groove 134 of the respective stud and these two wall slabs are secured to this stud by means of a clip similar to that shown in Fig. 22, which extends with its shank or body 130 over the upper end of the vertical joint between these two slabs, and engages its hook 131 with the outer side of the adjacent overlapping portions of the sealing strips thereof, while the eye 132 on the inner end of this clip is fastened to the anchoring pin 135, as best shown in Figs. 23, 32 and 33.

The body 130 of this clip is arranged in notches 138 in the corners of the sealing strips in order to enable this clip to clear the opposing strips of superposed wall slabs and enable these strips to overlap each other.

The intermediate part of each of the wall slabs which extends across one side of an intermediate stud is fastened to the latter by means of a clip having its body 130 projecting laterally over the upper edge of the respective wall slab and its hook engaging with the outer side of the central part of the upper sealing strip 117 therein, while the eye 132 at its inner end is arranged in the vertical groove 134 of the respective stud and mounted on the transverse anchoring pin 135 therein, as shown in Figs. 32, 33 and 39, the central part of each horizontal sealing strip being provided with a notch 138 for the reception of the clip, and enable the latter to clear the cooperating horizontal sealing strips and enable the opposing strips of the slabs to overlap, as shown in Fig. 23.

Preparatory to inserting the lower horizontal sealing strips within the grooves in the lowermost horizontal row of plates or building members and interengaging the sealing strips thereof, the cooperating grooves of these members are filled with liquid cement 139, and after the several slabs of the lowermost horizontal row are connected with the respective upright building members and their vertical sealing strips are engaged with each other, liquid cement 140 is introduced by any suitable means into these vertical grooves in the upright studs and in the slabs so as to seal the joints between these parts and hold the same reliably in place after the cement becomes hard.

After the lowermost row of slabs has been thus mounted on the lower horizontal row of concrete base plates or blocks or the like and the lower parts of the endmost and intermediate studs of the building, the wall slabs of the second horizontal row are mounted with their lower edges on the upper edges of the first row of slabs, and

engaged at their vertical edges with each other and the adjacent sides of the upright studs of the building, and the slabs of this second row are fastened at their vertical edges to each other and to the upright studs in the same manner as that just described with reference to the operation which is employed for this purpose in connection with the lowermost horizontal row of slabs with the lower plates and the corner and intermediate studs of the basement story.

When the second horizontal row of slabs is mounted with its lower edge upon the upper edge of the lowermost row of slabs, the lower horizontal groove 115 of each upper slab is arranged opposite the upper horizontal groove 114 of a lower wall slab, as shown in Fig. 36, and the opposing horizontal sealing strips overlap one another and the fastening clips clear these clips by extending through notches 133 and 138 thereof.

Preparatory to assembling the second horizontal row of wall slabs with the lowermost row of such slabs, a filling 141 of liquid cement is introduced into the cooperating horizontal grooves thereof so as to seal the joints between these two rows of slabs and also embed the cooperating sealing strips and clips therein for producing a tight and rigid joint between these members.

As each succeeding upper horizontal row or course of wall slabs is mounted on the preceding lower row or course and connected with the upright studs in the manner described, liquid cement is introduced into the vertical grooves of the upright studs so as to complete the sealing of the joints between the cooperating edges of adjacent wall slabs, and between the edges of the wall slabs and the upright studs for rendering the same tight and rigidly securing the slabs to these studs after the cement becomes dry and hard.

When mounting the wall slabs of the uppermost horizontal row the upper horizontal strips 117 of the slabs in this row are engaged with the downwardly projecting sealing strips 125 of the top concrete plates 80, 81 forming the upper side of this space in the wall of the building, and liquid cement 142 is then introduced into the cooperating horizontal grooves in the upper edges of the uppermost row of slabs and the underside of said concrete plates, as shown in Fig. 35, so as to seal the joints between these parts and secure the same in place.

If desired the exterior of the building may be constructed to simulate the appearance of a brick building. For this purpose each of the outer wall slabs of the building is provided with a plurality of rows of thin brick sections or tiles having the appearance of whole bricks but in reality only equal to ordinary bricks in length and height, but in width are only equal to a fraction of ordinary bricks. The whole brick sections 143 are permanently mounted on the outer side of each outer wall slab by beveling the edges of these sections, as shown at 144, and placing the same in the mold in which the respective concrete slab is cast, so that the latter when poured in plastic form into the mold will form undercut sockets 145 in which the rear parts of the brick sections are seated and permanently embedded therein, and provide a facing on the outer side of the slab when the same has hardened which resembles the usual appearance of bricks.

The brick sections in one row are arranged to break joints with those in adjacent rows and this in the absence of any other provision, would make it necessary to extend one-half of some of

the brick sections beyond one vertical edge of the respective slab and lap the same over corresponding blank brick spaces on the opposing vertical edge portion of an adjacent slab or corner stud which would be objectionable on account of the difficulty of manufacture and the liability of breakage.

To avoid this, dummy half-brick sections of rubber are placed in the mold wherever the vertical edge of a well slab terminates with half-brick spaces, so that the plastic concrete when poured in the mold to form the slab, will embed the rubber dummy half-brick sections. Upon removal of the hardened wall slab from its mold the dummy brick section is detached from the slab and after the latter is assembled with other wall slabs or with studs of the building wall, a separate adapter brick section 146 is placed with one part on a blank space 147 on the slab and another part on a blank space 148 on the adjacent slab or an adjacent corner stud, as shown in Figs. 1, 24, 25 and 27, each of these separate adapter sections being held in place on the slabs and studs by cement 149 or otherwise.

In order to finish the outer side of each corner of the corner studs or columns so that the same present the appearance of a brick structure in harmony with the brick facing on the adjacent outer wall slabs a plurality of brick sections 150 are arranged in a vertical tier and seated with their inner parts in recesses 151 on the outer corner of the respective corner stud or column, as shown in Figs. 1, 11 and 25. In mounting each of these corner brick sections on a corner column, its outer long side 152 is flush with a row of brick sections on one side of the building and its outer narrow end 153 is flush with the outer side of the brick sections on the other side of the building, as shown in Figs. 1, 24 and 25.

In order to provide a better support for the corner brick sections on the corner studs or columns than would be possible if whole bricks were used and still preserve the appearance of a brick building, each of the brick sections is made full width at one end, as shown at 153, while the opposite end 154 is relatively narrow and the inner longitudinal side 155 of each of these brick sections is inclined from its wide to its narrow end. The back 156 of each recess 151 which receives this brick section is correspondingly inclined and engaged by the inclined inner side 155 of the brick section. These parts are connected by placing the brick sections in a mold and pouring the plastic concrete therein so as to embed these brick sections and permanently connect them with the concrete corner stud. The recesses 151 in each tier are so constructed that the backs or bottoms 156 of the recesses are inclined alternately in opposite directions, as shown by full and dotted lines in Fig. 25, whereby the full outer corners of the brick sections are presented but the recesses 156 in the stud which receive the corner brick sections are so formed as to provide a good support for the corner brick sections without weakening the corner column or necessitating making the same unduly large in cross section.

Although the drawings only show a building having a basement and one story, it is to be understood the same features of construction can be advantageously employed in the erection of a building having a sub-cellar, or more than one story.

Instead of providing the building with an inclined roof, as shown in Figs. 1 and 6, the roof

may be made flat by covering the top of the upper set of beams or joists 157 with a flat roof 158, as shown in Fig. 30. When using a flat roof the top of the side wall may be provided with a parapet or fire wall 159 which is mounted on the concrete top plates or blocks 160 and which forms an upward extension of the respective side wall, the detail construction of which is substantially the same as that hereinbefore described and illustrated with reference to the outer wall of the building construction embodying these improvements.

As a whole the various new features of this building construction are very simple and capable of being pre-formed at low cost in a factory and readily assembled on the job by the use of unskilled labor, thus enabling a building to be erected at a minimum of expense which is not only superior to those heretofore known but also more durable and not likely to require frequent repairs.

I claim:

1. A building construction including adjacent concrete members reinforcements embedded in said concrete members and the reinforcement in one concrete member having an eye-shaped coupling which overlaps the correspondingly shaped coupling of the reinforcement in the other concrete member, a tubular locking pin arranged in a socket formed in said concrete members and passing through the eye couplings of the reinforcements therein and provided with openings leading from its bore to its periphery, and a cement filling adapted to be introduced into the bore of said pin and pass through the openings thereof and into the space between said pin, eye couplings and concrete members for sealing the joints between the same.

2. A concrete building construction comprising a plurality of concrete members of which adjacent members are provided one with a mortice and the other with a tenon engaging said mortice, reinforcing rods arranged in said concrete members and the rods in one member having eye couplings arranged in said tenon, and the rods in the other member having eye couplings arranged on opposite sides of its mortice, and said concrete members having openings which are aligned with each other and with the eye couplings of the rods in the respective concrete members, a tubular locking pin arranged in said openings and eye couplings and provided with openings leading from its bore to its periphery, and a filling of cement introduced into the bore of said pin and passing through the openings thereof to a space between said pin and the concrete members.

3. A concrete building construction comprising a concrete plate, a plurality of concrete studs resting on said plate, a plurality of concrete joists of channel form in cross section arranged side by side and each having its depending longitudinal flanges resting on said plate and the flanges of adjacent joists engaging one another and each joist having one of its flanges engaging one side of one of said studs and its web provided with a notch which receives one of said studs, and a bolt connecting each stud and the adjacent cooperating flanges of two joists.

4. A concrete building construction comprising a plurality of upright concrete studs each of which is provided with an upright groove and a plurality of anchor pins extending across said groove and arranged in a vertical row, wall slabs engaging with said studs, and clips each having

an eye receiving one of said anchor pins and a hook for retaining one of said slabs.

5 5. A concrete building construction comprising a plurality of upright studs, a plurality of wall slabs engaging said studs, a strip mounted on the edge of each slab and overlapping a similar strip on the edge of an adjacent slab, and means for securing said slabs to said studs.

6. A concrete building construction comprising 10 a plurality of upright studs, a plurality of wall slabs engaging said studs, a strip mounted on the edge of each slab and overlapping a similar strip on the edge of an adjacent slab, and means for securing said slabs to said studs, including 15 clips mounted on said studs and engaging the strips on the opposing edges of adjacent slabs.

7. A concrete building construction comprising upright concrete studs each provided with a vertical groove and a plurality of anchor pins arranged in a vertical row and extending across 20 said groove, a plurality of wall slabs arranged edge to edge and engaging the sides of said studs and provided on their opposing edges with grooves, strips mounted on the edge portions of said slabs 25 and projecting from the bottom of the grooves therein and the strips of adjacent slabs overlapping each other and provided with coinciding notches, clips having shanks arranged between the edges of adjacent slabs and passing through 30 said notches, eyes arranged on said shank and secured to said anchor pins and hooks on said shanks engaging the outer one of cooperating strips, and cement fillings arranged in the grooves of said slabs and embedding the strips and clips 35 therein.

8. A concrete building construction comprising upright concrete studs each provided with a vertical groove and a plurality of anchor pins arranged in a vertical row and extending across said groove, a plurality of wall slabs arranged edge 5 to edge and engaging the sides of said studs and provided on their opposing edges with grooves, strips mounted on the edge portions of said slabs and projecting from the bottom of the grooves therein and the strips of adjacent slabs overlapping 10 each other and provided with coinciding notches, clips having shanks arranged between the edges of adjacent slabs and passing through said notches, eyes arranged on said shanks and secured to said anchor pins and hooks on said 15 shanks engaging the outer one of said cooperating strips, cement fillings arranged in the grooves of said slabs and embedding the strips and clips therein, and reinforcements embedding in said slabs and each connected at its margin with the 20 strips on the edges of the respective slab.

9. A concrete building construction comprising a corner stud provided with a plurality of notches arranged in a vertical row and the bottoms of 25 said notches sloping alternately in opposite directions, brick sections secured in said notches, and each brick being narrow at one end and wide at the other end and having an inclined inner side engaging the bottom of one of said 30 notches and having a rectangular outer corner which is in line with corresponding corners of adjacent brick sections, the inner sides of successive bricks inclining alternately in opposite directions.

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