F. M. BARTON.

REINFORCED CONCRETE BUILDING CONSTRUCTION.

APPLICATION FILED JUNE 24, 1907.

1,155,461. Patented Oct. 5, 1915.

3 SHEETS—SHEET 1.

FIG 1

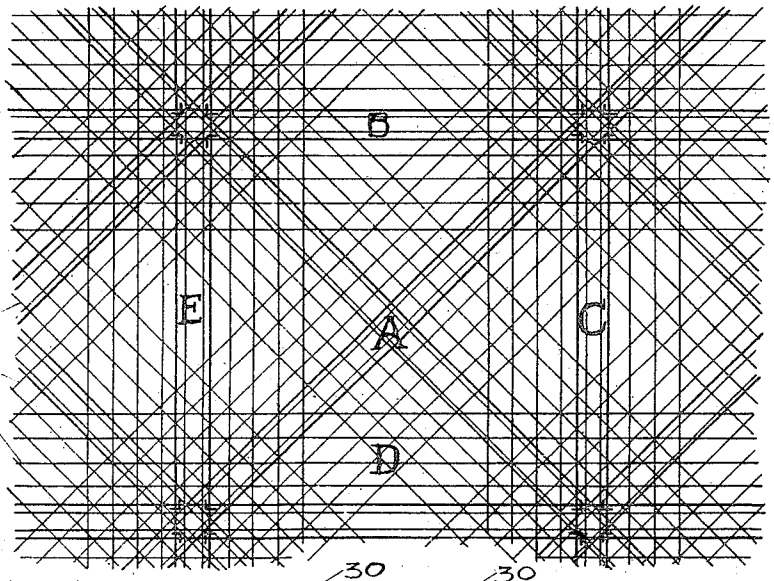


FIG 2

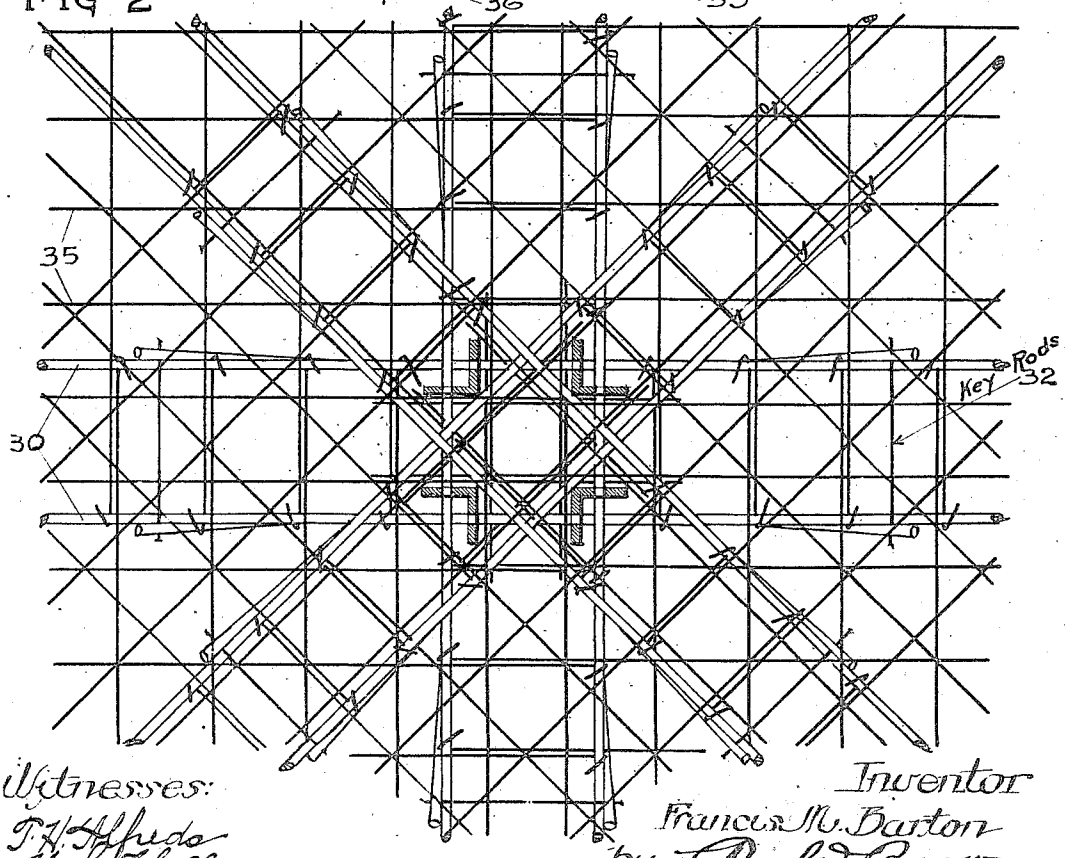
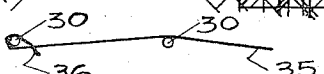


FIG 3



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3 SHEETS—SHEET 2.

FIG 6

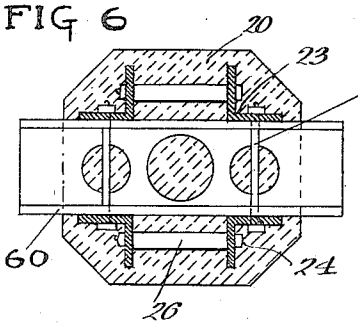


FIG 7

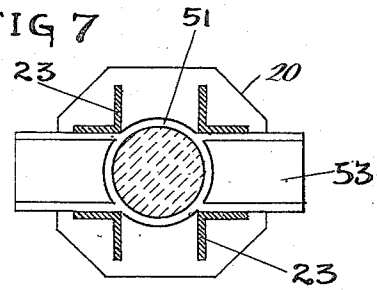


FIG 5

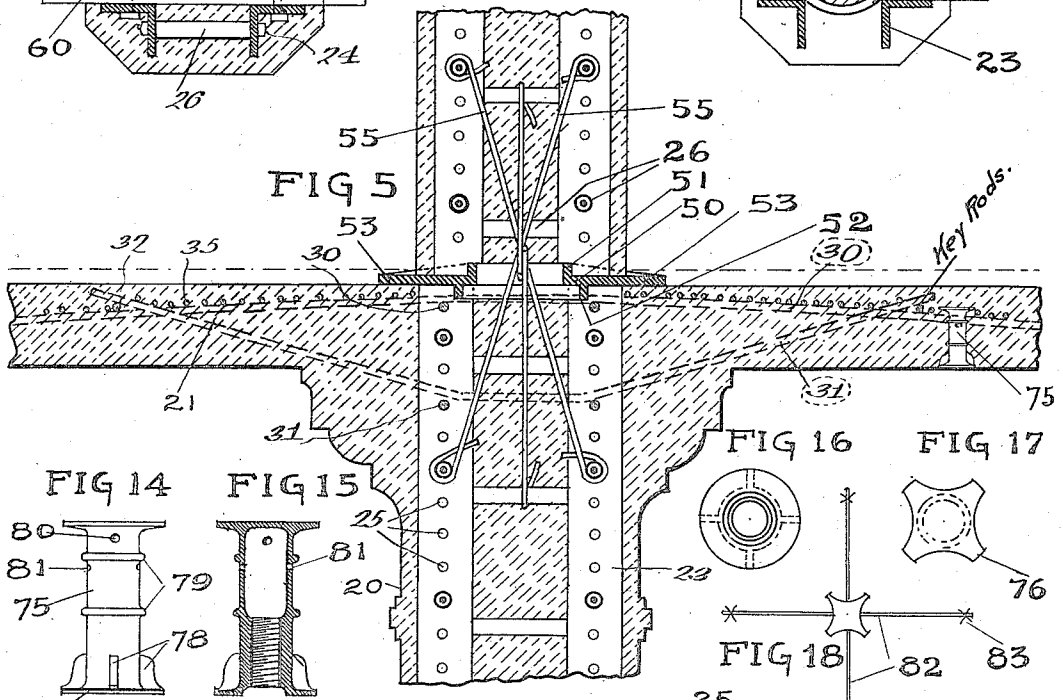


FIG 14

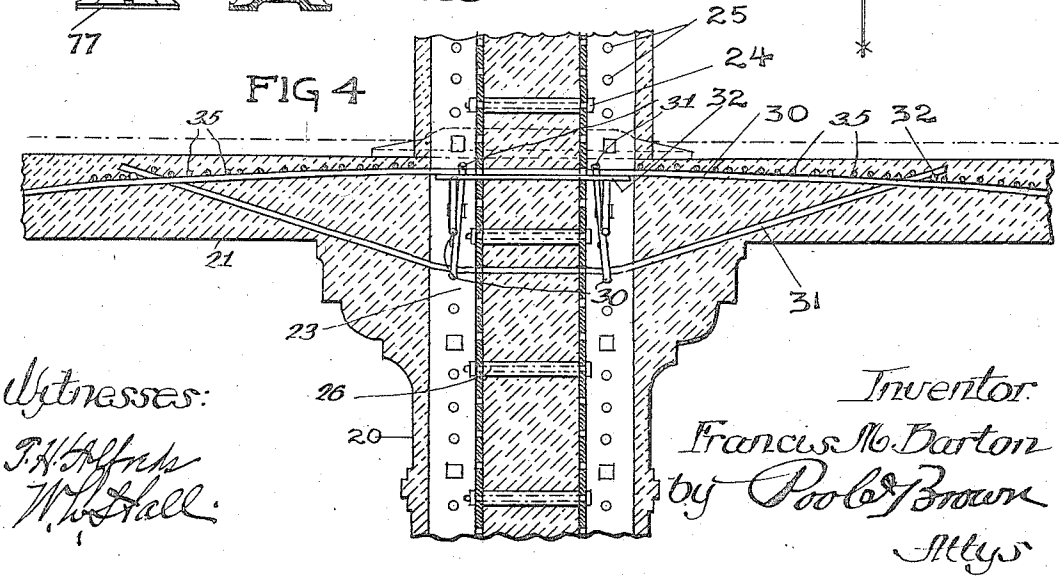
FIG 15

FIG 16

FIG 17

FIG 18

FIG 4



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3 SHEETS—SHEET 3.

FIG 8

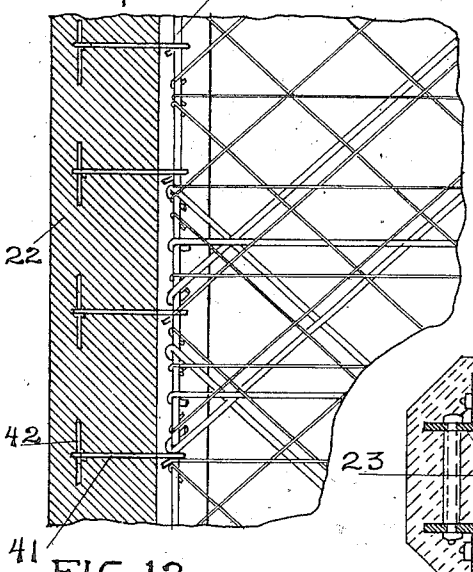


FIG 9

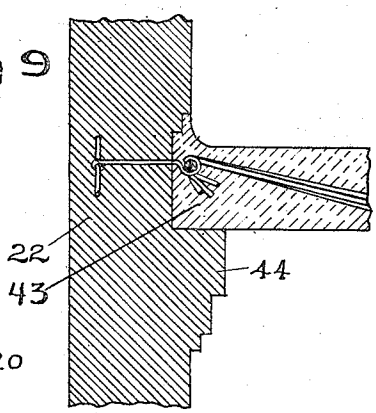


FIG 10

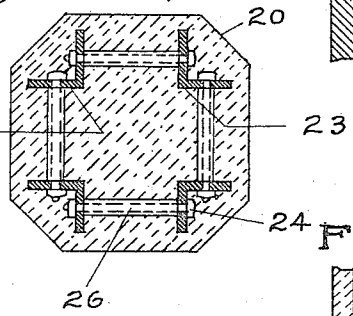


FIG 12

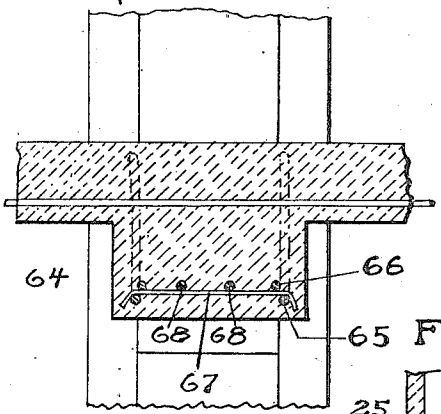


FIG 13

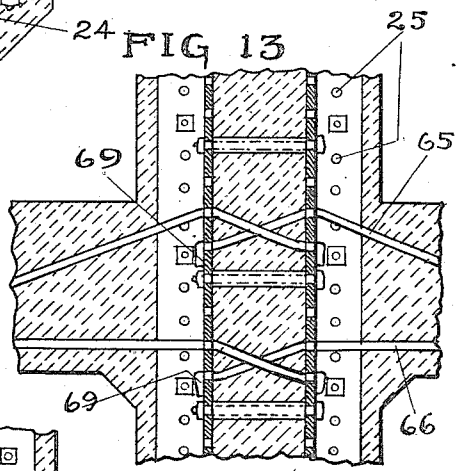
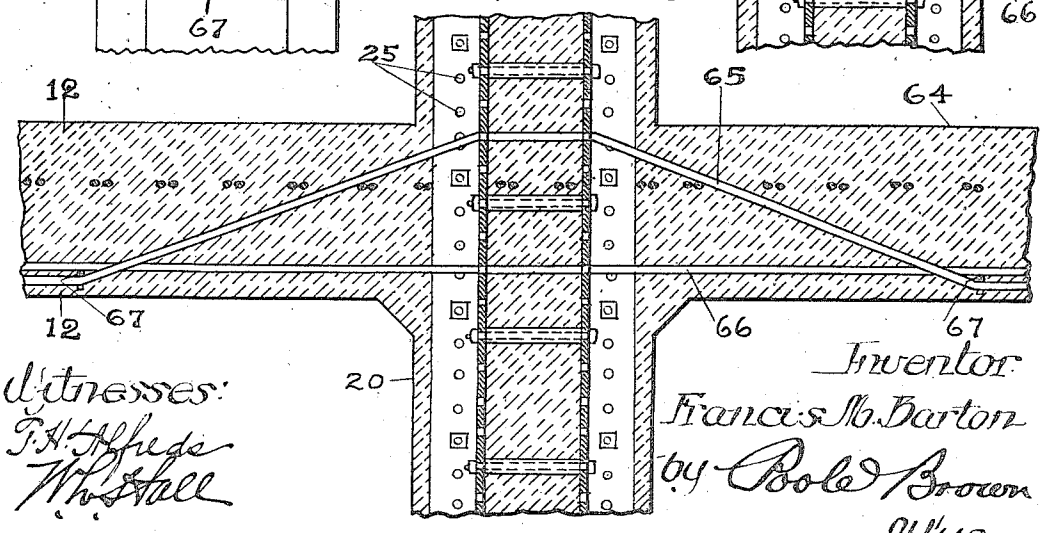


FIG 11



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REINFORCED-CONCRETE BUILDING CONSTRUCTION.

1,155,461. Specification of Letters Patent. Patented Oct. 5, 1915.

Application filed June 24, 1907. Serial No. 380,438.

To all whom it may concern:

Be it known that I, FRANCIS M. BARTON, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Reinforced-Concrete Building Construction; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the reference characters marked thereon, which form a part of this specification.

This invention relates to improvements in reinforced concrete building constructions for fire-proof buildings, and the invention consists in the matters hereinafter set forth and more particularly pointed out in the appended claims.

Among the objects of my invention is to simplify and reduce the cost of reinforced concrete building constructions, while maintaining ample strength in the construction to resist the stresses due to the different kinds of load brought upon the various parts of the structure; to provide an improved construction by which it becomes possible to reduce the thickness of the floor structure as a whole; to provide an improved floor slab for a column supported floor which is supported directly on the columns without the intervention of beams and girders that extend below the general line of the floor structure, and, further, to provide a construction which may be erected with facility and despatch.

As shown in the drawings:—Figure 1 is a horizontal diagrammatic view illustrating the arrangement of the reinforcing metallic bars or rods of the floor structure and their relation to four symmetrically arranged supporting posts. Fig. 2 is an enlarged detail of a portion of the construction shown in Fig. 1 associated with one column, and constituting what is hereinafter called a column-head. Fig. 3 is a detail hereinafter to be described. Fig. 4 is a fragmentary sectional view taken through one of the columns, its head and adjacent parts of the floor. Fig. 5 is a similar view illustrating the manner of bracing the metal parts of an upper column to a subjacent column. Fig. 6 is a cross-section of the column showing attached thereto a supporting plate for supporting the mold forms in which the concrete body surrounding the column core is molded. Fig. 7 is a cross-section of the column showing a centering plate by which the reinforcing or core bars of an upper column are centered above a column already set. Fig. 8 is a horizontal section, taken through a vertical wall showing the manner of anchoring the floor reinforcing rods or bars thereto. Fig. 9 is a vertical section of said wall and the adjacent part of the floor construction. Fig. 10 is a cross-section of a typical column. Fig. 11 is a fragmentary vertical section taken through one of the columns and a horizontal beam supported thereon, showing the reinforcing rods by which the beam is supported from the column. Fig. 12 is a transverse section taken on line 12—12 of Fig. 11. Fig. 13 is a view similar to Fig. 11 illustrating a modification. Fig. 14 is a side elevation of a socket sleeve adapted to be embedded in the floor structure and opening downwardly to constitute means for attaching a shaft hanger or like part thereto. Fig. 15 is an axial section of said socket sleeve. Fig. 16 is a bottom plan view, and Fig. 17 is a top plan view thereof. Fig. 18 is a top plan view illustrating the means of anchoring the socket sleeve in place.

As shown in the drawings, 20, 20 designate the floor supporting columns, 21 the floor and 22 the side wall of the building. The columns are composed of bodies of concrete in which are embedded reinforcing cores, each comprising four angle bars 23, 23 which, in the present construction, are arranged at the corners of a rectangle with their apices directed toward a common center. Said angle bars are connected to each other by means of bolts 24 extending through alined apertures 25 in the flanges thereof and provided with nuts engaging the screw-threaded ends of the bolts. The said angle bars are spaced by means of spacing sleeves 26 surrounding said bolts and engaging at their ends the adjacent flanges of the bars. The entire metallic structure thus formed constitutes a rigid core which is embedded in the concrete body of the column. The flanges of said core angle bars are provided with a plurality of the apertures 25 disposed throughout the lengths thereof, some of which receive said fasten-

ing bolts and others of which are designed to receive metal rods which reinforce the floor structure and serve to support the floor from the columns.

The floor structure comprises a slab-like body of concrete in which is embedded reinforcing metal bars or rods that extend between and are supported on the columns and are anchored to the side walls and like supports of the building, and a plurality of small film rods or suitable metal fabric laid over and supported on the main reinforcing rods in such manner as to produce a metallic net work of reinforcement of substantially uniform mesh extending throughout the body of the concrete structure.

In accordance with my present invention, the columns are provided with peculiar forms of heads constructed of said metal reinforcing rods, said rods radiating from the columns and extending into the floor slab and arranged in trussed relation with respect to each other adjacent to the heads so as to provide a proper support for the floor structure between the columns. Certain of the rods constituting said trussed heads may extend from column to column and constitute the cradle or tension rods of the floor slabs between the column heads. As shown in Fig. 4 of the drawings, the said column heads comprise upper and lower rods 30, 31, certain of which extend through the openings 25 of the core angle bars and extend radially from said columns. The rods are thus laced through the core bars of some of the columns and are attached to the bars of other columns, as in the manner shown in Fig. 13, hereinafter to be described. Said rods are arranged in vertical pairs, each pair consisting of an upper rod 30 and a lower rod 31. A pair of said rods is located at each side of each column (Figs. 1 and 2) and when the columns are arranged as shown four pairs of rods 30, 31 extend directly from each column to two adjacent columns, the rods associated with four columns inclosing a rectangular space, at the corners of which are located the columns. Two other pairs of rods 30, 31 extend diagonally across the said space between the corner posts. The latter pairs of rods extend between the angle bars of the cores but do not pass through the openings of said bars and are supported on the rods that extend through said openings. The rods 31 of each pair are inclined upwardly just outside the column bars while the rods 30 are inclined downwardly, and said rods 30, 31 cross each other some distance from the columns and above the vertical center of the floor structure (Fig. 4). The upper rods 30 of each pair are continued beyond the points of crossing of the rods and extend to and are supported upon other columns. Said latter rods are bowed downwardly at their central portions to lie near the lower layer of the floor structure and thus constitute the tension or cradle rods of the floor slabs. The lower rods 31 constitute strut members which are arranged to take shearing and compression stresses of the floor loads. In order that the rods may be held in proper relation to each other before the concrete has been poured they may be tied together at their points of crossing or may be locked together by short horizontal key rods 32. Said rods 30, 31 constitute trussed heads which directly support the parts of the floor structure adjacent to said columns. The crossing points of the rods 30, 31 define the limits of what is herein termed the trussed heads. Supported on the frame work thus formed by the cradle and strut rods are light film rods 35 arranged in criss-cross relation with respect to each other and the strut and cradle rods. These rods may be of any length desired and may be laid upon the tension and strut rods with or without fastening the same thereto. As herein shown, said rods are so arranged that each rod terminates at one pair of horizontally adjacent cradle rods, and each rod is passed at its end over one of said cradle rods and under the other cradle rod and is secured to the latter rod by a hook 36 (Figs. 2 and 3) formed on the end of said film rod. When thus arranged the film rods may be made of a length to extend from the cradle or tension rods of one column to those of an adjacent column or may extend over one or more pairs of cradle rods and be attached to the cradle rod of a farther pair.

From an inspection of Fig. 1, it will be seen that the film rods are arranged in sets each of a horizontal width substantially equal to the width of the spreading column heads and that certain of said sets extend directly between columns in the shortest directions and others extend diagonally between columns, and further that loads on the floor are transmitted directly to the columns without the intervention of beams or girders. Said sets of film rods cross each other over the column heads, and at points over the columns the floor slab is reinforced both by the film rods and by the rods of the column heads. It will also be observed by reference to Fig. 1 that the film rods are laid at such distances apart as to produce a metallic net work of reinforcement of substantially uniform mesh extending throughout the floor. In lieu of the film rods described, I may employ any approved form of fabric supported upon and suitably secured to the strut and cradle rods.

It will be noted by an inspection of Figs. 1 and 2 that what has herein been termed the "trussed column heads" extend some distance radially from the columns in all directions and directly support the flat floor

slabs immediately adjacent to the columns against shearing and compression stresses, while the cradle or tension rods and film rods support the floor slabs between said heads. It will be observed by reference to Fig. 1 that the parts of the floor which have been designated as floor slabs and are supported by said cradle and film rods, as distinguished from the parts of the floor supported directly by the truss column heads, are of relatively short spans. For convenience of designation said floor slabs are indicated by the reference letters A, B, C, D, E. It will thus be seen that the floor construction is adapted to bear heavy loads with an economic use of reinforcing material, and that for lighter loads the columns may be spaced at considerable distances apart without impairing the strength of the floor structure. It will be furthermore observed that the floor between the columns is flat on its lower side and is without projections such as occur in floors that are supported by beams and girders. Therefore there is a material saving of vertical thickness of floor structure as compared to a beam and girder construction.

The manner of anchoring the metal reinforcing floor structure to the vertical wall 22 of the building is shown in Figs. 8 and 9. It consists in providing a horizontal anchor rod 40 which extends parallel with the side face of the wall and is connected with said vertical wall by means of anchor ties 41 attached at their outer ends to said rods 40 and at their inner ends to suitable anchors 42 embedded in the wall. The cradle or tension rods of the reinforcing structure are fastened in any suitable manner to said rods 40 and the film rods may likewise be attached to said anchor rods. As a further improvement in this feature of the construction, the inner face of the vertical wall is provided with a horizontal inwardly opening recess and below said recess with a bracket or corbel 44 extending inwardly beyond the inner face of said wall. The floor structure extends into said recess and is supported on said corbel. An advantage of this construction is that the vertical wall 22 may be erected from top to bottom before the floors are formed, the said recesses and corbels being built in the walls at the different floor levels as the erection of the wall progresses. The anchors 42 and anchor ties 41 are embedded in said wall at the levels of said recesses as the work on the wall progresses. Thereafter the anchor rods are fixed to the anchor ties and the reinforcing floor rods are attached to the anchor rods after which the concrete is poured over said reinforcing rods and into the recesses 43. It will be understood that any suitable form molds will be used to give proper form to the plastic concrete during the molding operation. The recesses 43 are made of a depth greater than the thickness of the floor, whereby the floor may be given a suitable finish at its junction with the wall, as shown in Fig. 9. This arrangement is an advantage inasmuch as it renders the construction of the vertical wall independent of the floor structure and avoids necessity of the workmen who are erecting the wall waiting until a floor has been completed before proceeding with the erection of the wall above said floor.

In Figs. 5 and 7 I have shown means for centering the core bars of an upper column upon a completed lower column and also means for supporting or bracing the core bars after they have been set in place and before the concrete has been molded around the same, thus preventing wind pressure on the upwardly projecting core bars from swaying the said bars in a manner to injuriously effect the molded and set concrete below. The centering means herein shown comprises a plate 50 having on its upper and lower faces circular flanges 51, 52, respectively. The lower circular flange 52 is made of a diameter to fit closely within the space surrounded by upper ends of the core bars of the lower column and the upper flange 51 bears a like relation to the core bars of the superjacent column. If the upper column be made smaller than the lower column, as shown in Fig. 5, the upper circular flange 51 will be made of smaller diameter than the lower flange. It will thus be seen that the upper and lower columns are accurately alined by the presence of the centering plates. The said centering plates may be provided with side extensions 53, 53 to constitute brackets which support the molding forms in which the concrete body of the column is molded.

The core of each column is braced and supported from a lower column by means of brace rods or wires 55, 55 which are attached at their upper and lower ends to the spacing sleeves 26 extending between the core bars and extend obliquely from one side of the core to the other. A number of said brace rods may be employed to brace the upper column core from swinging in all directions. The said brace wires or rods are attached to the lower column core before the concrete is poured about the core thereof and extend therefrom at their upper ends for attachment to the core of the next upper column when said core is placed in position. Said brace rods or wires 55 serve, not only to support the upwardly projecting reinforcing cores from wind pressure during the erection of the building, but also constitute permanent brace connections between the columns which add considerable to the strength of the structure. It will be understood that the core of a given column may

extend for a greater distance than from floor to floor as, for instance, they may extend through one or more floors, depending on the distance apart of the floors.

In Fig. 6 I have shown another form of bracket 60 for supporting the molding forms in which the concrete body of the column is cast. This bracket plate 60 may comprise an elongated channel bar that fits between the two lateral pairs of core bars and are attached thereto by bolts 61. Said bars are preferably perforated in order that the plastic concrete may pass therethrough and more thoroughly embed the same in the concrete body. In Figs. 11, 12 and 13 I have shown a construction of a reinforced concrete beam 64 supported from a column by the use of a column head construction of the same general character as that found in the floor slab construction heretofore described. As shown in said Figs. 11 and 12, 65, 66 designate upper and lower rods which extend through the opening 25 in the flanges of the core bars. In this instance both rods 65 and 66 are adapted to extend continuously between adjacent posts or like supports. The lower rods extend horizontally through the openings in the column core bars and from one column to the other and lie within the lower part of the beam. The upper rods extend through said core bars at a point above the lower rods and are inclined downwardly to and slightly below the level of the bars 66, and from the points at which they cross said rods 66 are designed to extend for a distance parallel with the latter rods toward the posts to which they are adapted to be attached. Said bars are adapted to be locked in the trussed form given thereto at points where they cross each other by means of short key rods 67. The beam may be further reinforced by other rods 68 located between the rods 66. It will thus be observed that the rods 65, 66 at the column constitute a truss-like formation which gives great strength to the reinforcing rods to resist shearing and tension stresses, and that the parallel parts of said rods serve as tension members to support and reinforce the central part of the beam.

In Fig. 13 is shown the same construction indicating the manner in which the ends of said rods 65, 66 are attached to the core bars of the columns. As herein shown, said rods extend through openings 25 in the flanges at one side of the column and through lower openings in the opposite core bars and are upset or headed at their ends as shown at 69. The rods 30, 31 of the floor construction may be in a like manner attached to the core bars of the columns.

In Figs. 14 to 18, inclusive, I have shown a socket sleeve adapted to be embedded in the floor construction and to open downwardly from the lower side of the floor structure, which constitutes the ceiling of the room below, to receive a shaft bearing supporting rod or stud. As therein shown, 75 designates a sleeve that is open at its lower end and closed at its upper end. Said sleeve is provided at its upper end with a radial irregularly shaped flange 76 and its lower end with a circular flange 77 and is provided between the said lower flange and the body of the sleeve with short radial wings 78. It is also provided between its ends with annular ribs or beads 79, 79. The said sleeve is provided at its upper end with openings 80, 81 through which are adapted to extend anchor rods 82, 82, said holes being arranged so that the rods extend therethrough at right angles as herein shown. The said sleeve is embedded in the concrete body of the floor structure with its base flange flush with the lower face or ceiling surface of the floor structure. The purpose of the rods 82 is to provide an anchoring for the sleeve and also to provide means for maintaining the sleeve stable and in position during the time the concrete is being poured. Thus in a reinforced structure, such as herein shown, the anchor rods 82 are adapted to be laid on the metallic reinforcing parts and may be tied thereto by the ties indicated at 83 in Fig. 18. When thus secured in place, the said anchor rods avoid tendency of the sleeve to be twisted out of alinement to the vertical during the pouring operation. The said wings 78 also serve to prevent the socket sleeve from turning or rotating in the concrete body of the floor and the exterior ribs and the upper flanges aid to prevent the sleeve from being pulled out of the floor structure. The sleeve may be interiorly screw-threaded to provide means for attaching shaft hanger suspending studs therefrom.

The word concrete as herein employed is used in both a specific and generic sense to denote any cementitious composition having the properties of commercial concrete as now sold on the market.

I claim as my invention:—

1. In a reinforced concrete building construction, the combination of a column and a floor made of suitably molded concrete, said column embracing a core comprising a plurality of rigidly connected bars provided with vertically separated apertures, reinforcing rods supported on said column, certain of which extend continuously through the apertures of the bars and radially from said column into the concrete floor structure, and film rods supported on the main reinforcing rods in criss-cross relation to each other and the main reinforcing rods.

2. In a reinforced concrete building construction, the combination of a column and a floor formed of a body of concrete, suit-

ably molded to form, the column embracing a core comprising a plurality of rigidly connected angle bars having their apices directed toward a common center, the flanges of said bars being provided with a plurality of vertically separated openings, and reinforcing rods supported on said column, certain of which extend continuously through the openings of said bars and radially from the column into the floor structure, and certain of said bars extending through said floor structure and constituting tension bars for the floor structure.

3. In a reinforced concrete building construction, the combination of a column and a floor made of suitably molded concrete, said column embracing a core comprising a plurality of rigidly connected bars provided with vertically separated openings, and reinforcing rods extending through said openings and into the floor, said rods being arranged in vertical pairs and crossing each other radially outside of the column, one of the rods of each pair being inclined upwardly from the column core bars and constituting a strut rod, and the other rod of each pair being inclined downwardly from the core bars toward the bottom of the floor structure and crossing the upwardly inclined rod to constitute a tension or cradle rod.

4. In a reinforced concrete building construction, the combination of a column and a floor made of suitably molded concrete, said column embracing a core comprising a plurality of rigidly connected bars provided with vertically separated openings, reinforcing rods extending through said openings and into the floor, said rods being arranged in vertical pairs and crossing each other radially outside of the column, one of the rods of each pair being inclined upwardly from the column core bars and constituting a strut rod, and the other rod of each pair being inclined downwardly from the core bars toward the bottom of the floor structure and crossing the upwardly inclined rod to constitute a tension or cradle rod, and means for locking said rods of each pair together at the points of their crossing.

5. In a reinforced concrete building construction, a concrete floor a column comprising a molded mass of concrete and a core comprising a plurality of rigidly connected bars embedded in said concrete mass, and a column head comprising a plurality of rods extending through the column and into the floor and supported directly on the core bars and arranged in upper and lower sets, the rods of said upper and lower sets being arranged to cross each other a distance radially from the column to constitute a trussed column head.

6. In a reinforced concrete building construction a concrete floor a column comprising a molded mass of concrete and a core comprising a plurality of rigidly connected bars embedded in said concrete mass, and a column head comprising a plurality of rods extending transversely through the column and into the floor and supported directly on the core bars, said rods being arranged in upper and lower pairs, the lower rod of each pair being inclined upwardly toward the upper rod of the pair to constitute a strut or compression member and the upper rod crossing the lower rod a distance radially from the column.

7. In a reinforced concrete building construction, a concrete floor a column composed of a mass of concrete molded to form, and embracing a metal core composed of a plurality of angle bars arranged with their apices directed toward a common center, the flanges of said bars being provided with a plurality of vertically separated apertures, and a column head comprising a plurality of rods extending transversely of the column through said apertures and into the floor and supported on said bars and arranged in trussed relation with respect to each other.

In testimony, that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 21 day of June A. D. 1907.

FRANCIS M. BARTON.

Witnesses:
W. L. HALL,
D. E. MARMON.