W. A. BISHOP.

METHOD FOR THE CONSTRUCTION OF BUILDINGS

APPLICATION FILED DEC. 17, 1908.

980,480. Patented Jan. 3, 1911.

4 SHEETS—SHEET 1.

Fig. 1.

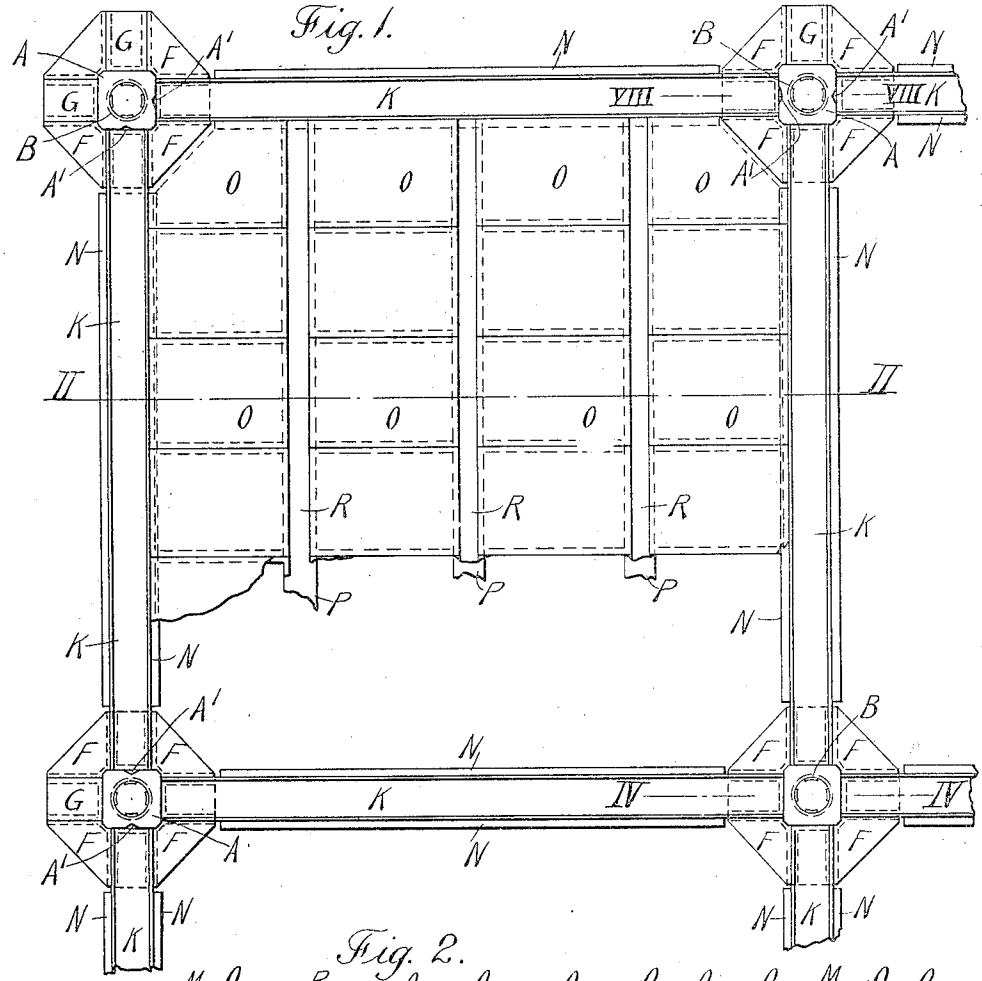

Fig. 2.

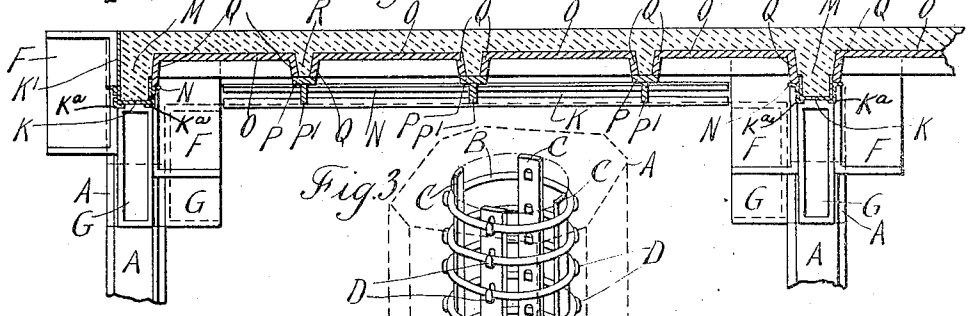

Fig. 3.

Witnesses

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4 SHEETS—SHEET 2.

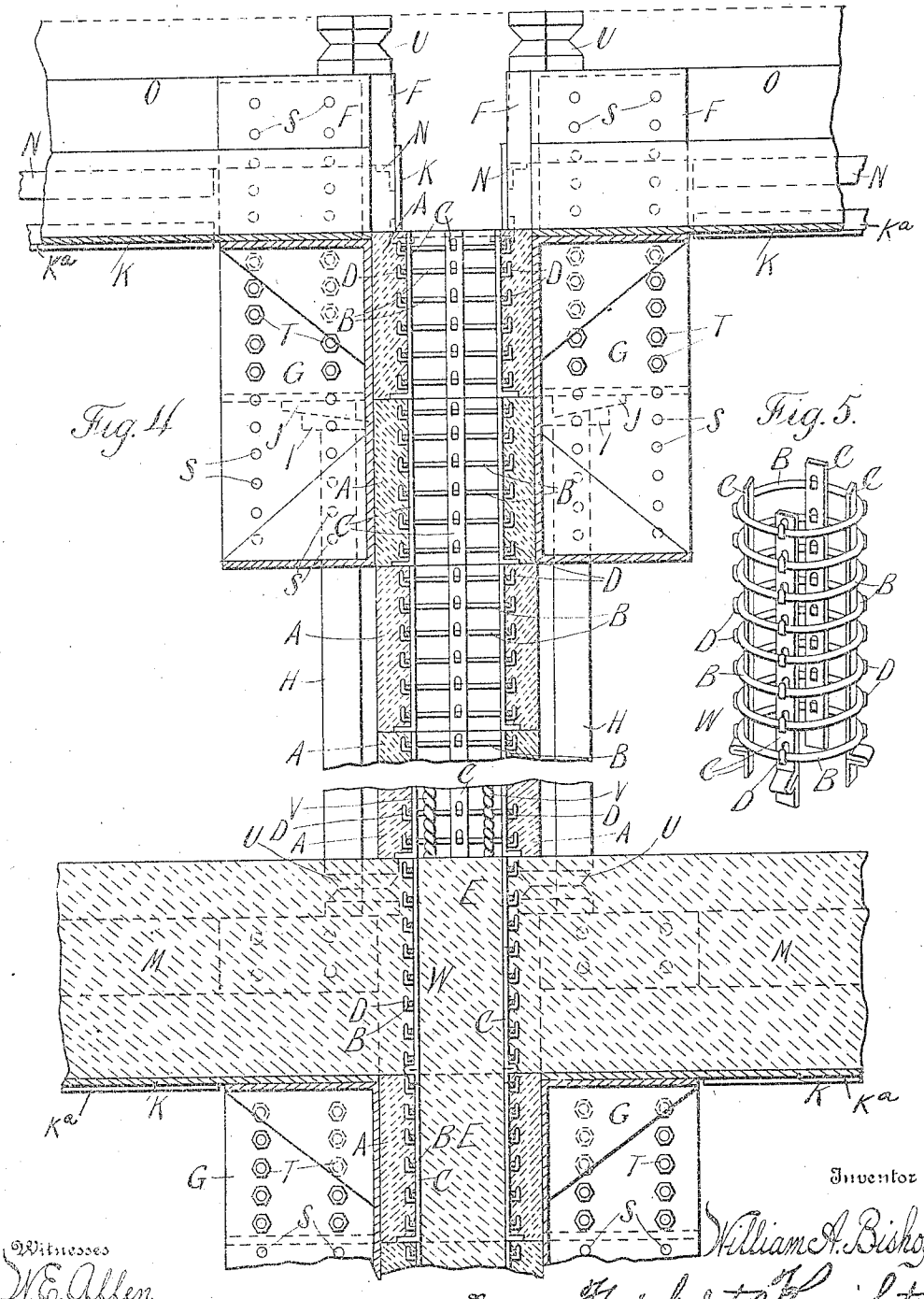

Fig. 4

Fig. 5.

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4 SHEETS—SHEET 3.

Fig. 6.

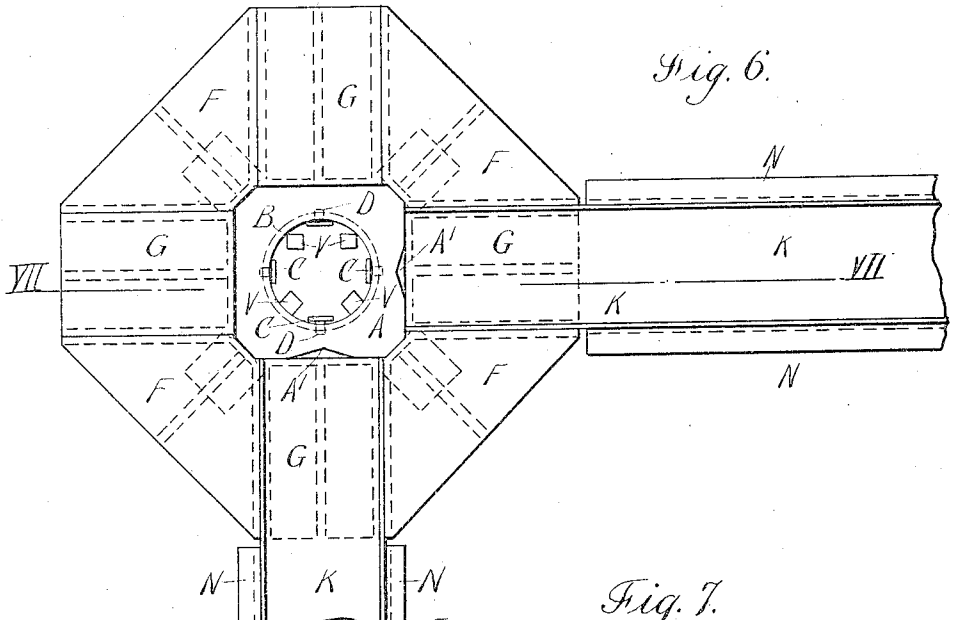
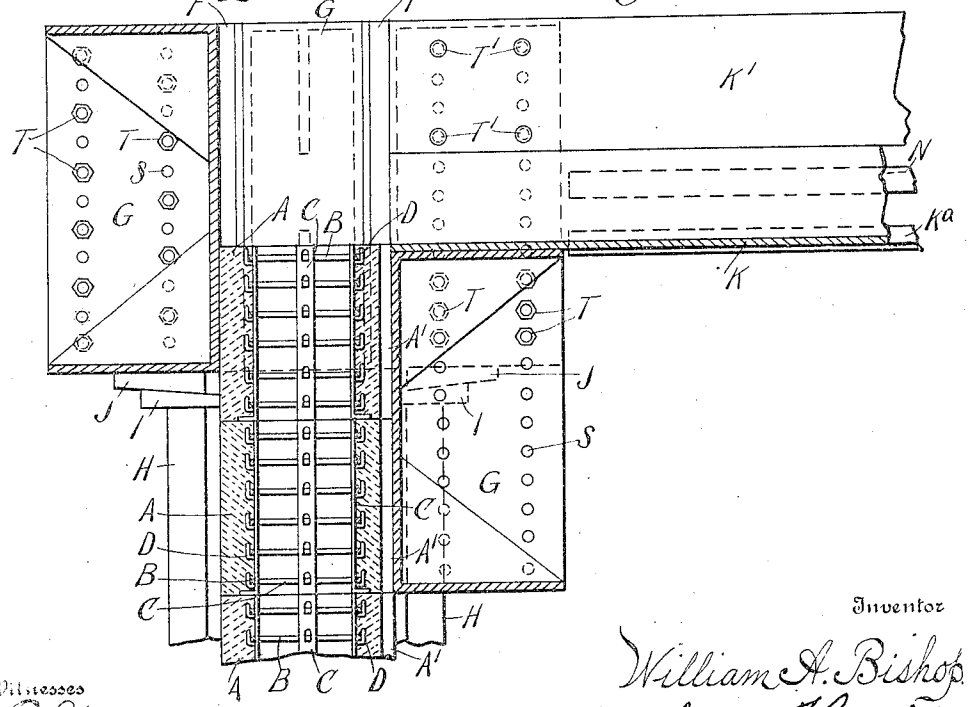


Fig. 7.



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4 SHEETS—SHEET 4.

Fig. 8.

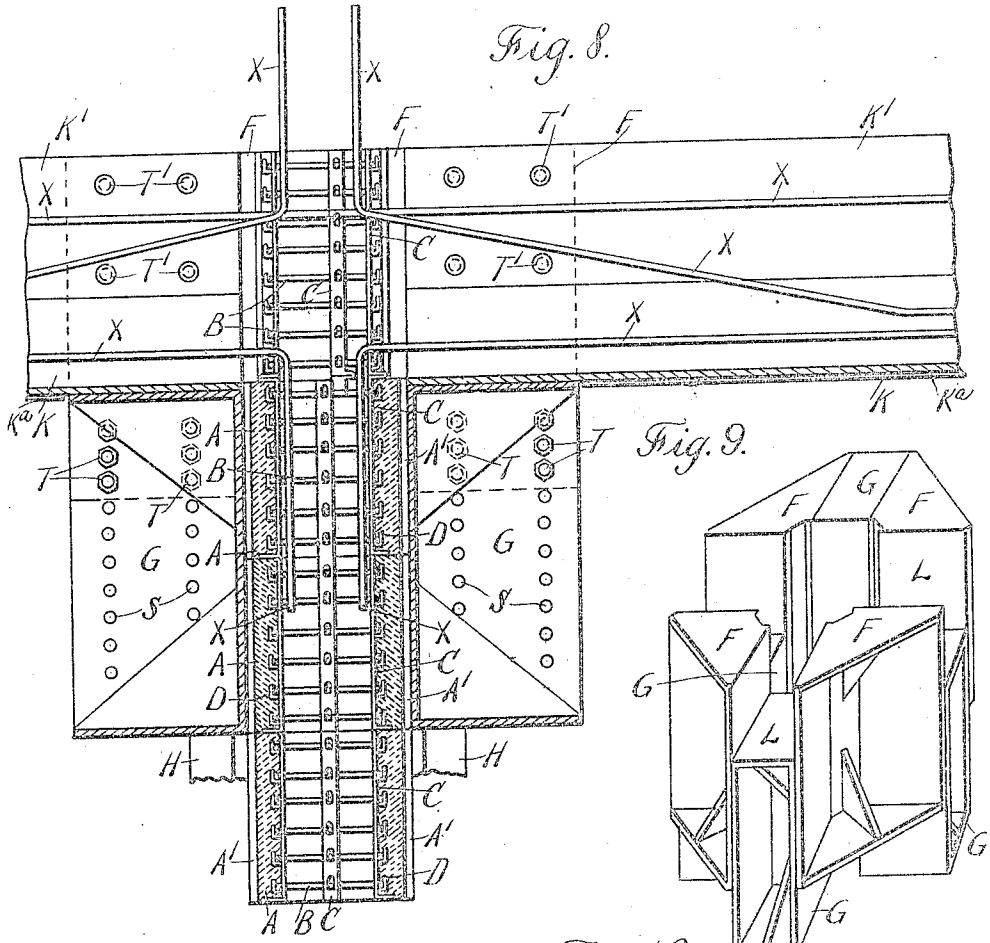


Fig. 9.

Fig. 10.

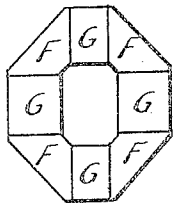


Fig. 11.

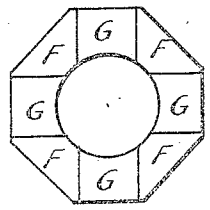
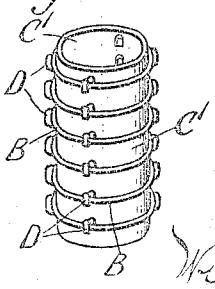


Fig. 12.



Witnesses

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UNITED STATES PATENT OFFICE.

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METHOD FOR THE CONSTRUCTION OF BUILDINGS.

980,480. Specification of Letters Patent. Patented Jan. 3, 1911.

Application filed December 17, 1908. Serial No. 467,981.

To all whom it may concern:

Be it known that I, WILLIAM A. BISHOP, a citizen of the United States of America, residing at the city of Newark, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in Methods for the Construction of Buildings, of which the following is a specification.

My improved method of building construction contemplates the employment of standardizing features resulting in greater economy by reason of the continuous reëmployment of standard forms and also involves the use of standardized elements which act as forms.

In carrying my invention into effect, I employ as part of my system, forms which are arranged to be clamped together approximately at the floor line and around the supporting pillar and which by their means of adjustment afford spaces for setting longitudinal molds or troughs in which I cast the concrete girders; as a part of my system also the floor is similarly formed, as well as the floor beams. Secondly I have evolved a method of forming supporting pillars which consists essentially of an exterior part made of component blocks or sections, constructed of high class fireproofing concrete and provided with a central opening around which is located metallic reinforce pieces, preferably formed in the shape of rings, which blocks, or sections, when placed one above the other, will provide a continuous central opening in which I mold or cast my integral concrete supporting pillars of the building, the reinforcing rings becoming exterior rings to the said supporting pillars and the blocks, or sections, forming the outside finish and fireproof envelop.

Referring to the accompanying drawings which form a part of this specification, Figure 1 is a plan view of a floor of a building, or the part of a floor of a building, made according to my invention. Fig. 2 is a cross section on the line II—II Fig. 1. Fig. 3 is a perspective view of one of my improved bricks, or sections, which I employ in carrying my invention into effect. Fig. 4 is a vertical section to a larger scale on the line IV—IV Fig. 1. Fig. 5 is a perspective view of a metallic cylindrical reinforce which I employ at the floor junction. Fig. 6 is a plan view upon the same scale as Fig. 4. Fig. 7 is a vertical section on the line VII—VII Fig. 6. Fig. 8 is a vertical section on the line VIII—VIII Fig. 1. Fig. 9 is a perspective view of the clamping parts employed by me in carrying my invention into effect. Figs. 10, 11 and 12 are detail views showing modifications.

In these drawings, A represents the exterior shell or envelop of a hollow fire proof cement block, and B metallic reinforcing rings suitably spaced and embedded in said block. Vertical spacing strips having outturned foot pieces and a vertical row of supporting hooks D struck up therefrom are provided which serve to space the rings B properly while the hollow block is in a formative state. When the rings B have been suitably placed and spaced in the spacing hooks D of the strips C, the cement is formed around same by a suitable mold, not shown, and the interior finish is formed flush with the interior faces of the strips C, the rings B being embedded in the cement shell or envelop A. These hollow fire proof cement blocks are made beforehand and are brought to the building being constructed already formed and hardened and ready for use and it is a part of my system to devise and employ a series of sizes relating both to the exterior dimensions of the blocks, which, as aforesaid, is merely a shell, or envelop, but more particularly to the interior opening which provides means for the reception of the final and integral pillar E which pillar becomes the support proper of the building, or structure, the shell, or envelop merely acting as a temporary support for the reinforcing rings and after the pillar is properly embedded and set therein constituting a fire resisting shell. In carrying my invention into effect, the exterior shell may be of any shape so far as its outside is concerned, that is to say, it may be square, eight sided, round, or in any other shape that may be desired which may tend to increase its usefulness as aforesaid, or operate to lend artistic finish to the whole; but it is to be understood that the pillar proper is the interior integrally formed piece with the metallic reinforcing rings. In Figs. 4 and 7 I show several of these hollow blocks supported one above the other. When one of these hollow columns is set in position upon a suitable foundation and properly leveled, or squared, I proceed to adjust my sectional clamping device to be placed temporarily at the top of

the column which sectional clamping device I employ for sustaining the girder forms and floor units. It will be understood that when the column formed of hollow blocks is approaching the point where another floor or story is reached, or to be reached, means must be provided for taking care of the said floor and its girders in order that a proper and satisfactory monolithic structure may be effected. I provide in this connection, molding or forming pieces which I term clamps and which are shown to good advantage in perspective in Fig. 9 of the drawings. These clamps are sectional being formed of corner pieces F and intermediate or filling pieces G; the latter may be varied in width, or shape, as occasion may require as shown in Figs. 10 and 11. As I have shown it here, there are four corner pieces F and four complementary intermediate or filling pieces G. These parts are adapted to be shifted vertically relatively to each other and to be securely locked when so shifted, as will be explained. In the utilization of this clamp, I secure it tightly around the column formed as hereinbefore described at the top thereof when said column has reached the height of the succeeding floor or ceiling. If the pillar or column is in the interior of the building and the girders are to be supported from it in four different directions, the intermediate pieces G are to be lowered sufficiently to accommodate the reception of these girders and are to be bolted to the contiguous members F of the clamp accordingly. If the column or pillar is upon the side of the building and the girders are to be supported from it in three directions, the intermediate pieces G are modified in their position accordingly, and if the column or pillar is at the corner of the building and the girders are to be supported by the said column or pillar in only two directions, the clamp is so arranged that only two of the members G are arranged in their lower position; this will also be explained. Also in carrying my invention into effect, I utilize the members F of the clamp in such a manner that they can be adjusted to provide for the floor space. That is to say, they can be lowered to an extent corresponding to the depth of the cement floor to be employed; this will also be explained; but the clamp as a whole, with its method of adjusting its members, lends itself to the depth and thickness of the girders, to the depth of the floor and also adapts itself in other ways as will be explained. In carrying my invention into effect also I employ a system of struts H which serve to support these clamps in their proper position and which are intended to be kept in place until the clamp has served its purpose and is ready for removal. Referring to Fig. 4, these struts are shown in position. They may be made of any suitable material and are intended to be used over and over again upon floors of the same height without modification of their dimensions. At the upper end of the struts H I provide beveled wedges I, J. These beveled wedges facilitate the removal of the struts upon the top of which they are mounted and provide an aid for leveling the column clamps F, G. As before stated, these column clamps F, G are to be employed when the girders and floor are to be constructed and they are placed at the top of the particular pillar or column and are extended to at least the depth of the girders as shown in Fig. 4, the clamps proper F, and the filling pieces G being adjusted and bolted securely together according to the number of girders radiating from the particular point or pillar and making allowances also for the depth of the floor as may be required and as will be explained. When the clamps are adjusted to their proper position and securely bolted, the girder forms or troughs K are placed in position thereon. These latter are formed of metal and rest in the pockets provided by the open spaces L shown in Fig. 9, and extend from one pillar or column to another and they are adapted to receive the plastic cement which is to form the girder and to retain and support the same until it is properly set and dried. Such a girder is shown as M. When the girder is properly set and dried, and at any time thereafter, and upon the removal of the column clamp, the trough K can be taken away leaving the girders proper complete and exposed. These troughs K are provided with right angle reinforcing corner plates K^a at the bottom and with right angle ledges N extending at right angles therefrom which ledges are intended to support the floor forms O. These floor forms O may be made of any suitable material and are arranged to extend from girder to girder, string pieces or form supports P being employed intermediate of the girders which extend along and at the bottom of the beam forming grooves R. These grooves or channels R traverse the floor space at proper intervals and are arranged between units or sections of the floor forms. Downwardly extending edges Q of the floor units rest upon the ledges N of the girder forms and also upon the top surface of the floor form supports, P. The downwardly extending edges or sides Q of the floor units form the sides of the beam forms or beam forming grooves R; also as shown in Figs. 2 and 4 they constitute the upper part of the girder forms. The floor form supports P may be provided with a reinforce P'.

The members F, G of the clamps are provided with a system of holes S which together with suitable bolts and nuts T provide means for securely locking the parts to any adjusted position. In order to provide

forms for the upper part of the girders of the outer walls, plates K′ are secured to corner clamping pieces F, by means of bolts T′ passing through the holes S. A cement strut foot block is shown at U. Reinforcing rods are shown at V and X. At W I show a special section of metallic reinforce which comes in skeleton form and which is employed within the clamp forms.

When the first floor is completed, the struts on the second and succeeding floors are footed on the previously made concrete block of the same thickness, as the proposed floor. This block rests on the top of the column clamp and remains in and becomes part of the floor itself. It is provided with a groove or corrugations on its sides to prevent its slipping through the finished floors after the column clamps are removed. When the forms are in place, the reinforcing rods shown may be employed or any system of reinforcing for both floors and girders may be placed in the forms in the usual manner. The special section of the block reinforcing placed in the mold formed by the column clamps may act as the anchorage for the girder reinforcing rods the latter being fastened to the reinforcing rings to keep them (the rods) in position. When the hollow block columns are filled with concrete and tamped and when the line of the bottom of the girders is reached, the concrete is continued over the entire floor, filling floor, girder and beam forms up to the top of the floor level and the entire floor is smoothed and floated as the work advances, the process being continuous from one end or side of the building to the other. When one floor or section thereof is sufficiently set to hold its own weight, the forms are removed from below by knocking out the strut wedges and removing the struts and unbolting and removing the column clamps, thus allowing the girder and floor forms to be lowered and removed. They may then be used again on the next floor or part of the same floor, or in another structure.

The column clamps are preferably made of cast iron with the joining surfaces machined or ground true. They are held together by ordinary machine bolts. The corner pieces are interchangeable and suitable for any size column in conjunction with filler or side pieces of suitable width. These filler or side pieces may be made of various widths to suit different size columns or may be in two or more unit sections bolted together side by side. They may be raised or lowered in relation to the corner pieces so as to provide for different depths of girder. The column clamps are of such dimensions as to allow the same length girder forms to be used throughout the building, allowance being made of a variation of column diameter of 20″. This is necessary owing to the fact that the column sometimes decreases in diameter as the building progresses upward.

The girder forms for short spans may be made of wood but I prefer to make them of sheet metal reinforced with angles or other suitable shapes. For long girders they may be under-trussed to prevent sagging. They may be of any depth within the range of the column clamps (and these may be made of any depth) being adjusted by means of the unit rows of bolt holes on even centers. The girder forms may be of any width up to 4″ less than the side of the square column. A narrow girder may be built with a large column by using suitable filler blocks alongside the ends of the girder forms where they rest in the clamps. The floor and floor beam forms may be of either wood or metal and of such width and length (preferably units) as to be easily handled. They may be made close fitting at the top to make an even thickness floor or beams may be formed between them if desired. The column blocks are made of dense rich fire resisting concrete and the reinforcing rings are cast in them when made, the rings being suitably spaced by means of the metal strips C carrying the spacing hooks D. The rings being endless give the greatest tensile strength for the weight of metal used. I have shown them circular in form but they may be of any section, round, square, flat or twisted. The corner column and intermediate side column blocks are made with the slight indentations A′ on the two adjacent and opposite sides respectively to form an anchorage for the curtain walls. The curtain walls may be cast as a monolithic slab in place or built up of brick, stone, terracotta or cement blocks or may be of wood or metal or stucco. They may be placed in position as the work advances or the entire skeleton frame may be completed and curtain walls erected after such completion.

In figuring the bearing capacity of the columns only the concrete which lies within the reinforcing hoops that is to say, the pillar proper, is considered, the concrete in the hollow block itself being only for fireproofing, for carrying reinforcement and for form purposes, no reliance being placed on the blocks for bearing strength (although it is obvious that they would have certain bearing capacity) except to support the forms during erection, the entire mass of bearing concrete being inclosed within reinforcing hoops; this type of column has the greatest bearing capacity per square unit of cross section.

The square column clamps as shown in plan view Fig. 6 are suitable for any column of rectangular section by using suitable filler or side pieces G, but it is obvious that the hollow blocks and the column clamps may be made of any shape section

desired, round, oval, fluted or fancy. The blocks when erected into a column form a clear open form to receive the concrete, making it easy to throughly ram or tamp the concrete in place and avoiding all chances of the concrete not filling the entire column solid. The blocks may be laid up with cement joints, or allowance may be made for shrinkage in the column by laying them up loosely and pointing up the joints after the entire concrete mass has set and shrunk. They may be made absorbent or non-absorbent as desired to suit the mixture to be placed within. They may be made on the job or in the factory and carried in stock for quick work. They may be made of any mixture desired and of any exterior finish within the range of concrete construction.

One advantage of my method herein described is speed in erection—no waiting for a floor and columns to get strong enough to carry the erecting forms for the next floor; all weight of the first and succeeding floors being carried on the columns themselves and the supporting struts. No column forms are needed. The floor forms being for the most part a collection of units and of practically indestructible material, they may be used over and over again on different jobs until worn out. The column clamps and girder forms being of iron and steel are practically everlasting and may be re-used indefinitely. No supports are needed for floor or girder forms, the whole being carried by columns and struts. The clamps and forms may be removed as soon as the concrete will bear its own weight and they may then be re-used as the work advances, the number of forms units being proportioned to the speed with which it is desired to advance the work. The column blocks are adapted to form a perfect protection for the steel reinforcement and all chance of imperfect covering is eliminated. They may be subjected to heavy pressure during process of manufacture if desired.

The difficulty of getting concrete mixtures to flow perfectly around column reinforcement when such concrete is placed in wooden forms and the difficulty of efficiently tamping same is well known and it is of common occurrence in reinforced concrete construction that when the wooden forms are removed it is found that the concrete has not entirely covered the reinforcement nor filled the forms. It is then necessary to plaster up these holes and deficiencies when finishing the columns. My reinforced concrete block columns avoid all this and present a finished surface when erected. With the block method the architect, engineer and owner are certain that the reinforcement is in its proper place, is accurately spaced and thoroughly protected, as blocks may be inspected and imperfections rejected before being laid in the columns. With the wood form method this cannot be done as after the forms are removed to reject the column would mean the tearing out of the entire work.

The endless ring type of reinforcement is superior to the spiral wound type as the greatest banding strength is obtained in a given weight of metal, and the tendency of the spiral to loosen and unwind when the outer shell is burned off, crushed or otherwise removed is well known. When this occurs with the spiral wound reinforcement it is obvious that the column reinforcement is useless.

With this block type the entire outer fire proofing shell may be removed by any method and the column would still be a banded concrete pillar with its bearing capacity as originally figured unimpaired; in fact in addition to the advantages of construction there is almost no chance for this type of column to fail due to exterior damage and its crushing strength is far beyond that of columns constructed in any other manner.

Where great compressive strength is required and the space limited the metal spacers holding the reinforcing rings may be made of a continuous or pipe like piece C′ having struck up hooks D to carry the rings or band B as shown in Fig. 12. This type is of greater strength than a concrete filled metal pipe as the endless bands or rings may be perfectly welded (which is not always possible with pipe) and the metal so distributed to get the greatest efficiency for the weight of metal used. This is not possible with pipe. A great advantage of this latter method over a solid pipe would be that in case of shrinkage of the concrete by setting or compressing under a load, the sectional reinforce pipe would remain an integral part of the whole and would compress with the concrete and still give it the same reinforcement as it had before, whereas the solid pipe would be compelled to assume the whole load with the liability to buckle. In addition to the foregoing advantages, the concrete fire resisting outer shell is firmly held in place by the reinforcing rings or bands which is another advantage over placing concrete around the bare pipe.

I have shown a broken section of column block illustrating reinforced rings in place, also form of spacer used, both skeleton and continuous or pipe. I also show details of the cast iron column clamps with reinforcing brackets, unit spaced bolt holes and one side filler or side piece.

These unit forms may be varied to suit individual taste or varying loads, different size girders, etc. The reinforcing rings in concrete blocks may be spaced any distance

on centers and may be of any section metal, they need not be round, but I show them round as that gives the greatest strength. The fire resisting concrete of which the blocks are made, may be formed of any thickness that is desired. The blocks are preferably cast in units of one foot in height but may be varied to suit the height of floors if desired. It is possible however to vary the height of the floors by raising or lowering the column clamps on the columns within a reasonable range as a section of the column is cast as a unit with the floors and girders. This method is not intended to replace or displace any special system of distorted rods, wire netting, etc., as any of the known forms of reinforcement may be applied to it and any dimension of reinforcing rods or shapes may be used with it the same as if the ordinary wooden forms were employed. Almost any method of column reinforcement composed of rods and rings may also be used by this method.

It will be seen from the foregoing that I have devised and brought into existence, a novel method of constructing concrete buildings and the novelty resides partly in the manner of performing certain functions, but it also consists in the procedure.

It is to be understood that a certain sequence of acts is necessary, or at least desirable for the best results, in carrying my invention into effect in the best possible manner. These successive acts may be briefly referred to and described as follows:—1st. Upon any suitable foundation I erect a column of my improved column blocks to the height of one story, preferably using ordinary mortar joints when securing the blocks one upon the other. 2nd. I place at the foot of the column and exterior to the same, the concrete foot blocks. 3rd. I place around the columns and upon the foot blocks, the vertical wooden struts and bind them closely around the column. 4th. I place the cast iron clamps upon the tops of the struts adjusting their position with the wedges and securely fastening them by bolts. 5th. I set in the clamps, after they have been adjusted, the girder forms or troughs. 6th. I place the floor form supports upon the ledges of the girder forms. 7th. I then place the floor form units upon the floor form supports. 8th. I then introduce the metallic reinforcing parts consisting of vertical column rods; section of the column reinforcement, or the cage; the girder and floor reinforcing rods. 9th. I then complete the structure by filling the concrete hollow columns, so as to form the permanent pillar and tamp same and at the same time fill in the girder forms, floor beams and floors up to the level of the finished floor. These nine sequential steps constitute the cycle of the operation involved in my invention and I have found by experience and extensive and practical demonstration that the successive steps as I have just explained, insures the best and most enduring results.

It will be understood that my invention is directed to the most economical means of assembling the methods which I employ and also, to an equal extent, contemplating substantial results from the standpoint of strength.

It will be seen that the completion of one floor does not depend upon the completion of a floor beneath it, but that the struts may be carried on, up, and through the building to any height. It will also be seen that immediately upon the completion of any one floor and upon its drying and setting, the struts and clamps can be removed and taken to another floor and are reëmployed. It will also be seen that my system lends itself to the standardization of building construction both as regards the strut and the clamping devices and also as to the sectional fire proof hollow blocks which can be of certain fixed sizes or standard sizes and which are brought into the building ready made. It will also be seen that after the column of hollow blocks has been erected and the clamps, girder forms, floor units and floor unit supports and the metallic reinforce parts are in place that one entire floor and its supporting pillars can be cast in one operation and that in drying and setting it will fasten itself to the concrete immediately below it and that as a consequence, the entire building when completed will be a monolithic structure. Also some of the parts employed by me, such as the reinforcing steel rods, may be omitted. In some classes of buildings they would not necessarily be a requisite. The shape also of the hollow blocks, in so far as interior cross section is concerned, may be modified and I may use a system of blocks which produce an oblong shaped pillar, or other shapes may be employed as the case may require.

In so far as the sequence of operation is concerned, I desire it to be understood that I consider the successive acts, immediately hereinbefore described by me, as the best way of carrying my invention into effect, but I do not necessarily limit myself to such succession.

Pitched roofs may be constructed by this method by a slight modification of the forms.

The finished building is a monolithic skeleton of reinforced concrete having the greatest stability and least susceptibility to vibration of any form of construction known.

A skeleton frame consisting of the column and girders only may be constructed and wooden or other type of floors used.

The block columns may be used in conjunction with steel girders, etc., by setting the column clamps and resting the ends of girders therein and casting the ends of girders into the column. The columns are no larger in section than any other form of reinforced concrete construction of the same or less bearing capacity. There is no limit to height of floors or spacing of columns within the range of reinforced concrete construction.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

The method of producing concrete pillars which consists in building up a hollow column of component blocks each constructed of fireproofing concrete and provided with a central opening around which is located metallic reinforcement and casting an integral concrete supporting pillar in the hollow column; the metallic reinforcement being exterior to the pillar and the column forming the finish and a fireproof envelop homogeneous therewith.

WILLIAM A. BISHOP.

Witnesses:
HERBERT KNIGHT,
COULIN TOMKINS.