F. B. GILBRETH.

FLOOR CONSTRUCTION FOR BUILDINGS.

APPLICATION FILED FEB. 25, 1903.

1,047,930.

Patented Dec. 24, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

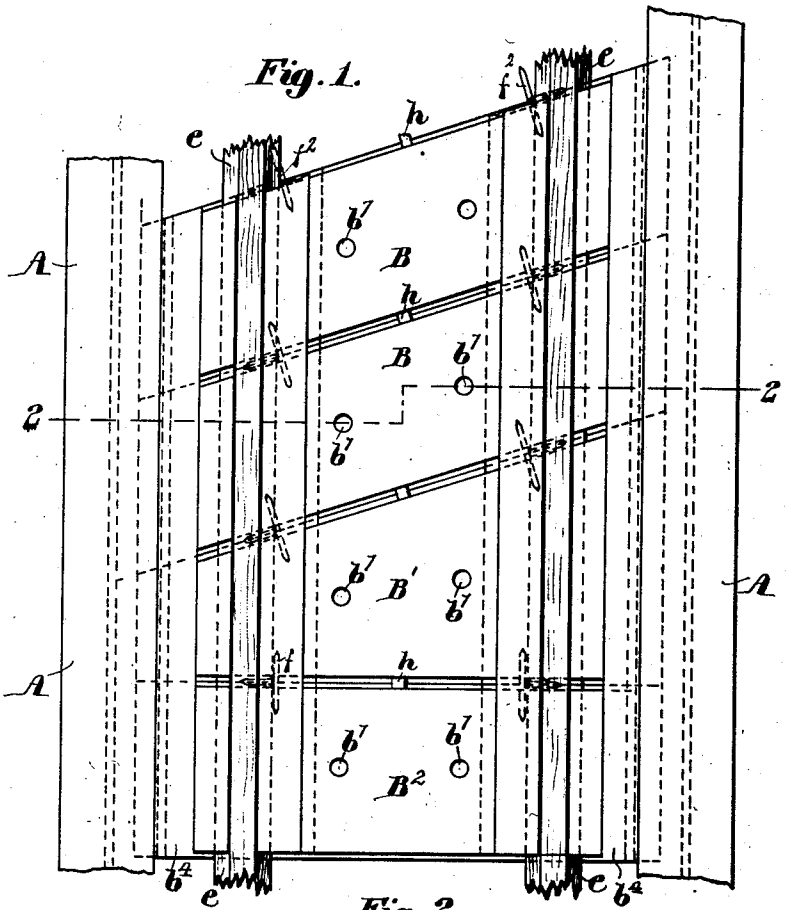
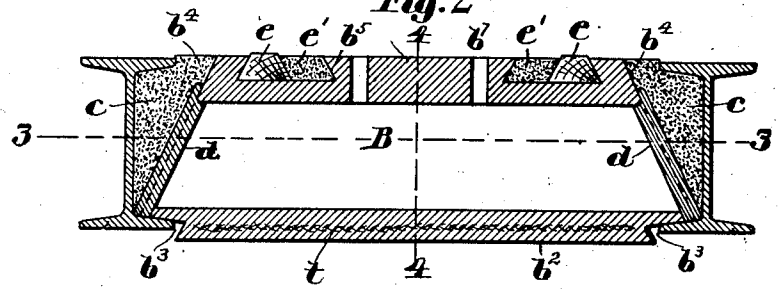


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 4

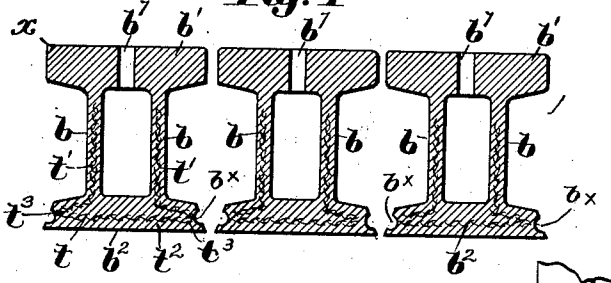


Fig. 3.

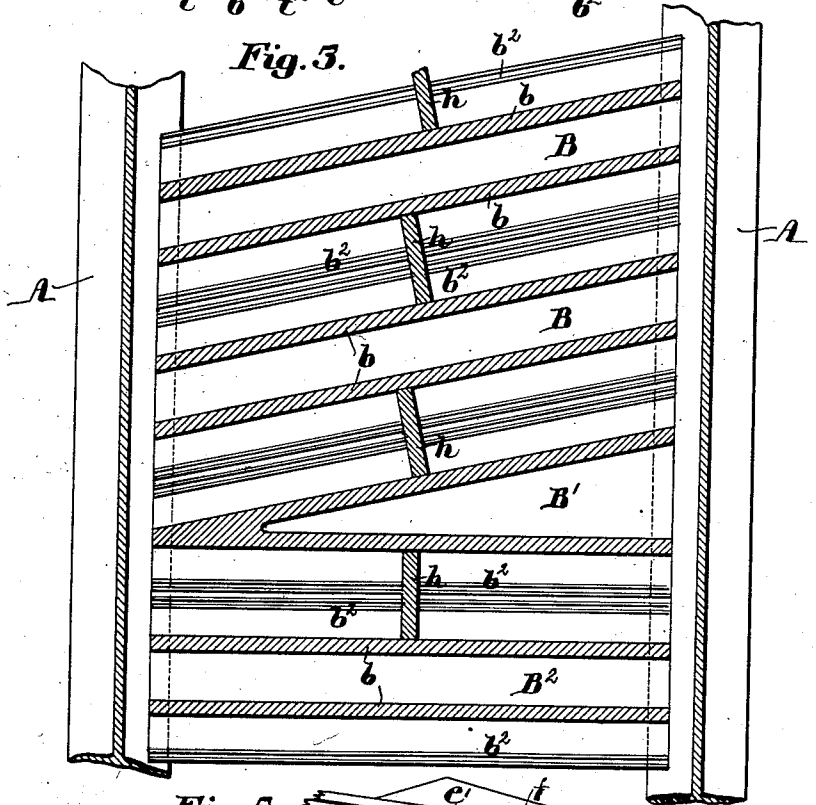


Fig. 5.

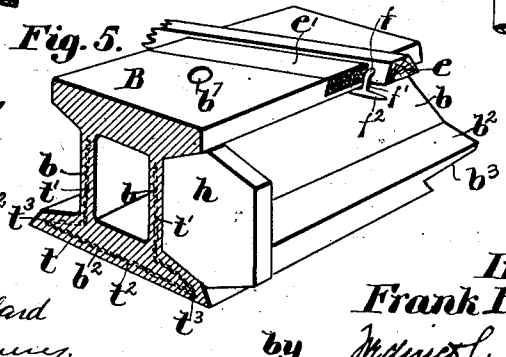
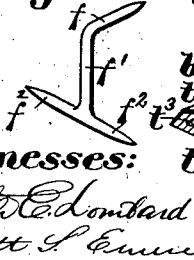


Fig. 6.



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UNITED STATES PATENT OFFICE.

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FLOOR CONSTRUCTION FOR BUILDINGS.

1,047,930. Specification of Letters Patent. Patented Dec. 24, 1912.

Application filed February 25, 1903. Serial No. 144,986.

To all whom it may concern:

Be it known that I, FRANK B. GILBRETH, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Floor Construction for Buildings, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention aims to improve building construction by the use of building blocks made from concrete or equivalent material, of novel construction and applied in a novel manner.

The various features of my invention will best be understood from a description of one embodiment thereof in connection with the accompanying drawings, referring to which, Figure 1 in plan view shows portions of two floor beams between which are arranged a plurality of building blocks illustrating one embodiment of my invention. Fig. 2 is a cross-section on the dotted line 2—2, Fig. 1. Fig. 3 is a horizontal section on the dotted line 3—3, Fig. 2. Fig. 4 is a vertical section on the dotted line 4—4, Fig. 2. Fig. 5 is a perspective detail, to be referred to; and Fig. 6 shows a novel screed-holding dog.

In the particular embodiment of my invention selected for illustration herein and shown in the drawing, referring first to Figs. 1 and 4, A, A represent portions of usual I-section beams such as commonly used in floor or roof construction. In lieu of I-section beams, any equivalent form of beams may be used, such as ordinary channel, L or T beams. Between adjacent beams A and supported thereby are arranged the building blocks B B made and arranged in accordance with my invention. As here shown, the blocks B are severally made from concrete or equivalent, preferably molded material, and preferably of a general flanged box-girder shape in cross-section, as best shown in Fig. 4; that is, comprising vertical webs or members b b connected by the top and bottom flanges or members b' b^2. These blocks B, see Fig. 2, have their bottom flanges b^2 notched at their under sides and at their ends as at b^3, to receive the projecting bottom flanges of the supporting beams A upon which the said blocks rest. This notching at b^3 is preferably of a dovetailed nature and such that the bottom of the block B depends somewhat below the bottom of the supporting beams A leaving between adjacent ends of the blocks at opposite sides of any beam A a longitudinal recess under the beam, into which a mortar or other filling may be placed to bring the surface below the beam down flush with the bottoms of the blocks B preparatory to furnishing a uniformly smooth surface, either for final finish or preparatory to plastering. The dovetailed end walls of the notches b^3 furnish adequate support for the mortar filling referred to, which latter may also constitute a fireproof protection for the supporting beam at its under side. For economical construction and the saving of time the blocks B are molded or cast in advance, and preferably each with one or more metal reinforcing tension members t which may conveniently be strips of wire netting of suitable gage and mesh. As shown in Fig. 4, each tension member is given a general U-shape with vertically extended portions t', a horizontally-arranged portion t^2 and the outwardly-flanged or folded portions t^3. This cross-sectional shape of metal tension member affords conveniently, suitable reinforcement for all necessary portions of the blocks. In making these blocks before their use, it is difficult to make them such that they would fit accurately between the supporting beams A if laid straight across from one to another of said beams, that is, at right angles thereto. This difficulty would arise not only from a, perhaps unnecessarily, slight variation in the lengths of the molded blocks, but also from the almost universal lack of uniformity in spacing of the supporting beams themselves. Inasmuch as any considerable inaccuracy or fit between the blocks B at their ends and their respective supporting beams would be detrimental to the construction as a whole and should be avoided, I make the blocks of the construction shown, such that they may be arranged diagonally from one to another of the supporting beams. Thus, any inequality in spacing of the beams or in lengths of the blocks B is easily compensated for and taken up or adjusted by a relatively slight variation in the angular positions or diagonal directions of the several blocks, enabling the latter always to be positioned with their ends firmly seated against and upon their respective beams.

In constructions of the molded block type as heretofore attempted, it has been the uni-

form custom, so far as I am aware, to swing the blocks horizontally into position, which is open to more or less inconvenience and difficulty. My invention, on the contrary, comprehends blocks which are chamfered off at their ends from their tops downwardly and outwardly, or made "battering" as it is commonly called, as best shown at b^4, whereby the blocks may be positioned by first resting them at one of their ends upon the bottom flange of one of the supporting beams A and thereafter dropping or swinging the opposite ends of the blocks until they rest upon the bottom flanges of the adjacent supporting beams. By this means the several blocks present the same supporting areas at their ends as if the latter were vertical, and have therefore sufficient supporting strength. At the same time they may be inserted and removed by vertically swinging movements which are much more convenient than horizontal movements as heretofore employed. This battering of the ends of the several blocks not only permits of the insertion of the blocks in the manner described, where desired, but also permits of the insertion of a body of filling material, such as cinder concrete *c* between the ends of the blocks and the adjacent portions of their respective supporting beams, thereby affording fire and rust protection for the said beams and at the same time steadying or holding the beams and interposed blocks against play or movement with the obvious result that both the beams and the blocks may be made lighter with corresponding strength. To economize in this interposed filling *c* and at the same time to insure a tight filling free from objectionable openings or apertures I may, before inserting the said filling, close the ends of the box-girder-like blocks by end pieces *d*, best shown in Fig. 2, which may rest at their lower edges upon the supporting beam flanges as shown, or upon the projecting bottom flanges b^2 of the blocks, should the latter project sufficiently toward the supporting beam webs, the said end pieces at their upper edges being preferably notched as shown, to fit under the top flanges b' of the blocks, thereby to furnish support for the latter and also a means for retaining the said end pieces in position. By the use of these end pieces *d*, a compact filling is insured between the ends of the blocks and the supporting beams, with a minimum of material used. Obviously, it is desirable to use as little filling material as possible, not only because of the reduction in dead load and corresponding cost, but also because it reduces the amount of material which must be mixed, handled and dried out on the job.

Referring now to Figs. 1, 2 and 5, the blocks B for the best results should be such that their top faces when laid will be substantially flush with the top faces of the supporting beams, possibly slightly below the level of the supporting beams. To facilitate the accurate and proper laying of the floors however it is desirable that screeds, so-called, be used, which will project slightly above the top faces of the blocks and beams. These screeds are ordinarily long strips of wood, generally of dovetail shape in cross-section, and to receive such screeds my invention contemplates molding or otherwise forming in the top faces of the blocks B transverse dovetailed recesses b^5, Fig. 2, wider however than the width of the screeds *e* to be placed therein. The screeds are first placed in position as shown in Fig. 2, with one of their edges locked under the adjacent beveled or inclined wall of the dovetailed recesses b^5 and a concrete or other suitable filling *e'* is then placed in the said recesses between the said screed and the opposite inclined wall of said recess, thereby securely to lock the screed in position. The screed receiving recesses b^5 are made of considerably greater width than the screeds themselves, to facilitate entrance of the latter into the said recesses and to give free access for leveling up the screeds preparatory to laying of the floor. Should it be required to run the screeds transversely of the supporting beams, A, the dovetailed recesses b^5 may be used as wire receiving conduits or recesses, or for other purposes, as may be found convenient. Before running in the filling, the screeds may be secured by dogs, engaged under one or another of the top flanges b' of the blocks and driven laterally into the screeds *c c* between adjacent blocks.

My invention contemplates a novel form of dog, as best shown in Fig. 6, the same comprising a screed holding prong or point *f* bent over from or forming a part of the shank *f'*, the latter at its opposite end being provided with oppositely extended locking legs f^2. This dog is inserted by turning it so that the oppositely extended legs f^2 may be dropped down between adjacent top flanges b' of the blocks and thereafter given a quarter turn to carry the oppositely extended legs under the said adjacent flanges, the dog then being driven sidewise to enter its prong into the side of the screed, thus securing the latter to adjacent blocks instead of to one block only as heretofore. The blocks therefore are separated slightly at their upper flanges to permit entrance of the dogs *f'* described, and they are also preferably separated at their bottom flanges to permit the plastering when applied to be pressed upwardly between the bottom flanges and to clench over and above the same. Preferably also the edges of the bottom flanges have groove-like or other shaped pockets or recesses b^x, into which the plastering when filled in between adjacent

flanges may lock, thereby to form a more secure adherence of the plastering to the blocks.

In constructions of this general nature it is important to support the various blocks as firmly as possible against transverse rocking or tipping movements, such for instance, as might be caused by resting a heavy weight upon the edge of one of the top flanges, for instance at the point marked *x*, Fig. 4, which would tend to roll or transversely tip the block. This is most effectually guarded against in the construction shown by the peculiar cross-sectional or box-girder shape of the block, together with the full width support of the latter upon the flange of the supporting beam. To further guard against such rolling or transverse tipping movement my invention comprehends placing between adjacent blocks one or more transfer plates *h*, Fig. 5, shaped to have sufficient bearing upon and between the flanges of adjacent blocks, whereby any weight upon the top flange of one block is transmitted by and through said interposed plate to or upon the bottom flange of the next adjacent block as well as directly downward to and upon the bottom flange of the same block. By this means, weights are transferred from one block to another, whereby the entire construction is strengthened and the necessary dead weight correspondingly reduced. By giving to the several blocks full width supports upon their respective supporting beams, and when necessary, providing separate transfer plates or devices for supporting one block by or from the next adjacent block, I am enabled to position the said blocks separated slightly one from another as here shown, not only to permit of the clenching of the plastering applied to the under surfaces thereof, and the insertion of the screed holding dogs between the upper flanges thereof, but also to permit of the introduction through the separating spaces at the tops of the blocks of such filling material or materials as may be desired to form a practically solid construction, both at the top and bottom flanges of the several blocks; and where desired, the entire intervening space between adjacent blocks may in the same manner be filled. If desired also the box-girder-like blocks B may have their top flanges or members *b'* perforated as at *b*^{7}, to permit of filling material being run into the interiors of the blocks at any time to further add strength thereto, either during original installation, or construction, or subsequently, for repair work.

While the diagonal arrangement of the blocks is desirable for reasons stated, yet at the ends of the bays formed by the end walls and the supporting beams A the construction must be filled out square, and to accomplish this my invention contemplates the use preferably at or adjacent the ends of such bays, of triangular or otherwise irregularly or suitably shaped blocks B', if desired, and these triangular blocks may constitute the end blocks of the series; or rectangular filling blocks B^2 may be laid straight across from one beam A to the next, constituting the end blocks, as may be found most convenient. These triangular or rectangular end or filling blocks may be of the same general box-girder-like construction as the others.

While I have for convenience illustrated my invention in connection with one specific embodiment thereof, particularly adapted for floor construction, my invention nevertheless is not limited to such use, nor is it limited in other respects to the particular embodiment shown, for it may be varied as desired, within the spirit and scope of the invention.

Having described one embodiment of my invention, and without limiting myself to details, what I claim and desire to secure by Letters Patent is,—

1. The combination with a series of flanged building blocks having alined screed-holding recesses, of a screed narrower than said recesses, dogs driven into the screed and engaging the flanges of adjacent blocks for holding the screed in its proper place at one side of the recesses, and filling material deposited in the recesses at the opposite side of the screed.

2. In a building construction, the combination with flanged building blocks and screeds carried thereby, of screed-holding dogs having each a prong driven into a screed and each having a plurality of oppositely extending locking legs for engagement with the flanges of said blocks.

3. In building construction, the combination of suitable supporting beams, interposed flanged blocks supported thereby and adapted to carry screeds extending lengthwise of the supporting beams and transversely of said blocks, and screed-holding dogs located at the joints between the adjacent blocks bridged by said screeds and each having a prong driven into a screed and laterally projecting legs engaging the flanges of the blocks.

4. In building construction, the combination of suitable supporting beams, interposed hollow blocks supported directly thereon, and closures for both ends of said blocks, said closures fitted under the upper wall of said blocks and resting at their lower ends against said beams.

5. In building construction, the combination of suitable supporting beams having lateral flanges along the lower edges, interposed hollow blocks or lintels having downwardly sloping ends supported on said flanges, a closure for the ends of said blocks

fitted under the upper walls thereof and braced against said flanges between the ends of the lintels and the webs of the beams.

6. The combination with suitable supporting means, of blocks laterally flanged at top and bottom and supported by their ends upon said beams, and transverse plates interposed between said blocks to hold the flanges thereof sufficiently apart to permit the space between to be filled with cement and engaging the top and bottom flanges of the blocks, for the purpose set forth.

7. In building construction, the combination of suitable supporting beams, laterally flanged blocks arranged between them and supported thereby, and plates vertically arranged between the sides of said blocks and engaging the flanges thereof.

8. The combination with supporting beams, of flanged blocks arranged between the same and supported thereby, and interposed transfer devices for transferring loads from the top flange of one block to the bottom flange of an adjacent block.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

FRANK B. GILBRETH.

Witnesses:

FREDERICK L. EMERY,

SUSAN E. HAYNES.