Apr. 3, 1923. 1,450,240

H. BEIERBACH

BUILDING UNIT

Filed June 24, 1922 2 sheets-sheet 1

Fig. 1.

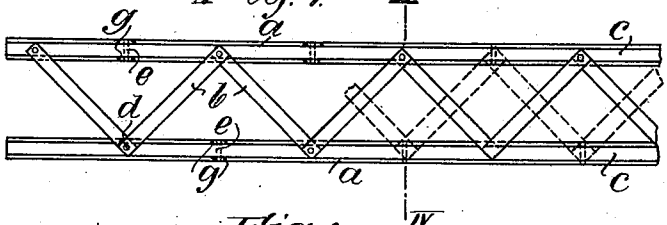


Fig. 2.

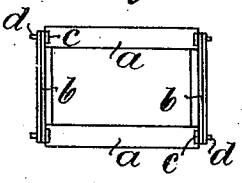


Fig. 3.

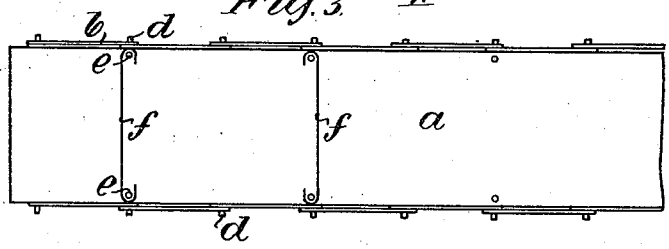


Fig. 4.

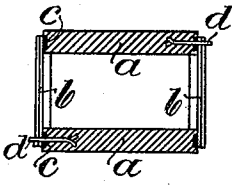


Fig. 5.

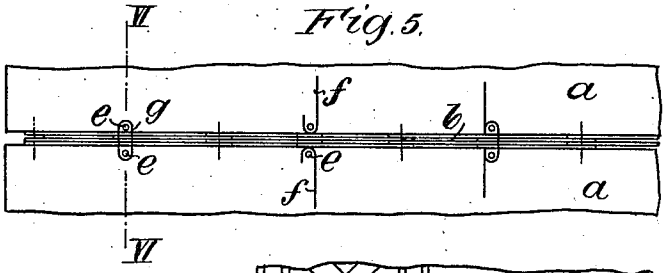


Fig. 6.

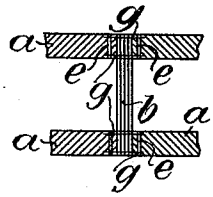
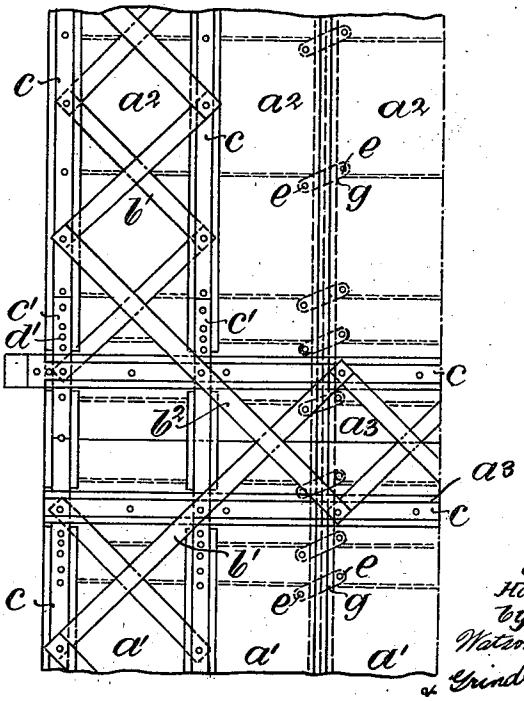


Fig. 7.



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BUILDING UNIT

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Fig. 8.

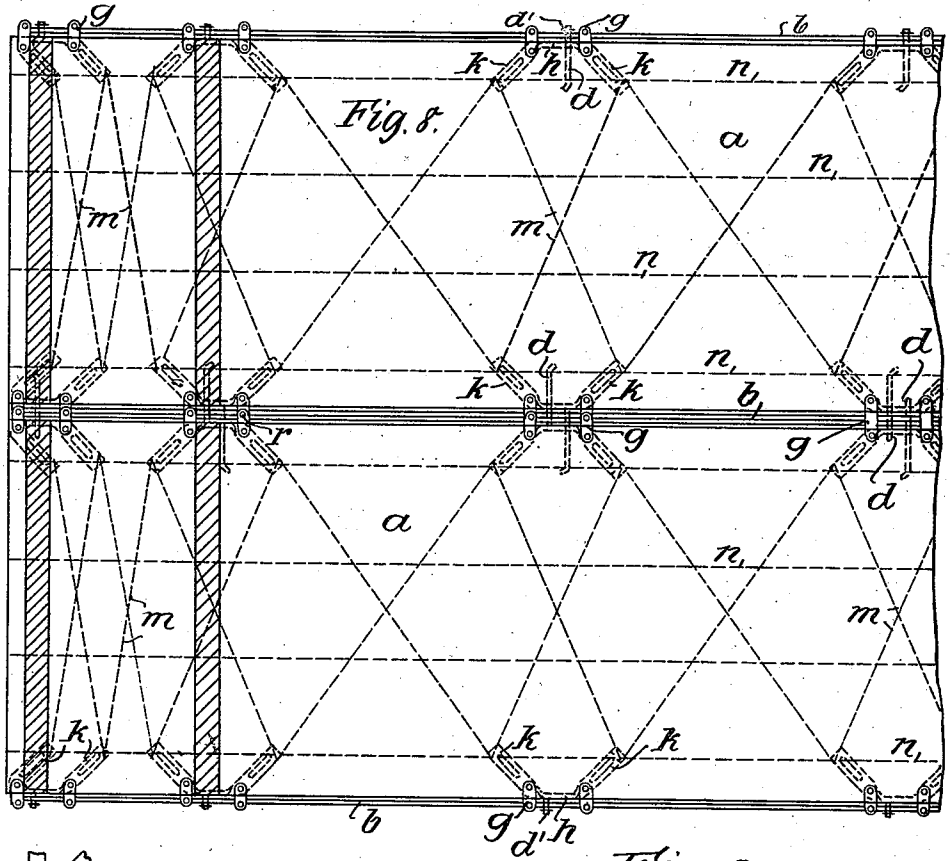


Fig. 9.

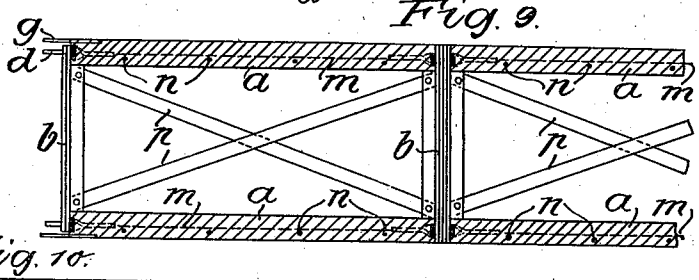


Fig. 10.

Fig. 11.

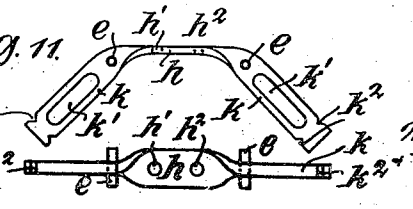


Fig. 12.

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Patented Apr. 3, 1923. 1,450,240

UNITED STATES PATENT OFFICE.

HANS BEIERBACH, OF MANNHEIM, GERMANY.

BUILDING UNIT.

Application filed June 24, 1922. Serial No. 570,699.

To all whom it may concern:

Be it known that I, HANS BEIERBACH, a citizen of Germany, and a resident of Mannheim, Germany, have invented certain new and useful Improvements in Building Units, of which the following is a specification.

This invention relates to a structural girder unit particularly intended for use in building construction for the formation of walls, floors and the like by assembling the units as required.

Structural girder units of reinforced concrete have already been proposed, but such have hitherto consisted of concrete reinforced throughout and not only on the two outer faces, and were consequently expensive, heavy and inconvenient to produce.

The improved building unit consists of two metallic reinforced blocks or slabs of concrete or other suitable plastic composition (hereinafter comprised by the term "concrete") interconnected by separate metal members which form the filling for the building unit having outer reinforced concrete slab faces. Pins or bolts are let into the longitudinal edges of the slabs at such distances apart as to support the perforated ends of struts consisting preferably of angle-iron one web of which is in a plane at right angles to the slabs. The struts maintain the slabs at the desired distance apart and form therewith a complete girder structure. In order to securely hold the bolts in the slabs and to maintain the bolts at the required distance apart when manufacturing the slabs, flat metal strips are let in the longitudinal edges of the slabs and have holes engaging the bolts. Auxiliary bolts provided in the slabs near the side edges thereof and at right angles to the aforementioned bolts serve to connect adjacent building units, the auxiliary bolts of adjacent units being connected in pairs by metal fish plates. The auxiliary bolts may be secured by the metallic reinforcement of the slabs which in turn may be anchored in the slabs in such manner that the slabs are capable of withstanding greater strain.

In order that the invention may be more clearly understood, reference is hereinafter made to the accompanying explanatory drawings whereon:—

Fig. 1 is a side fragmentary view of one form of building unit. Fig. 2 is an end view and Fig. 3 a plan view thereof. Fig. 4 is a section on the line IV—IV of Fig. 1.

Fig. 5 illustrates part of two adjacent units in plan and Fig. 6 is a section thereof on the line VI—VI.

Fig. 7 shows one example of building construction.

Fig. 8 illustrates a modified construction partly in plan and Fig. 9 is a cross-section thereof.

Fig. 10 is a section through a wall and upper floor.

Figs. 11 and 12 are side and plan views of a detail hereinafter mentioned.

The building unit consists of two slabs *a* of concrete or the like connected together at the required distance apart by struts *b*, which preferably consist of angle-iron one web of which is inwardly directed whilst the other web is flat in relation to the side of the building unit.

Metal strips *c* are let into the longitudinal edges of the slabs *a* and have holes for the reception of bolts *d* which are also embedded in the slabs *a*. The struts *b* have holes whereby they are threaded on the bolts *d*. The struts *b* may be secured in position on the bolts *d* by split pins or the like.

Preferably the struts *b* at the two sides of the girder are staggered as indicated in Fig. 1 so that adjacent units can be brought close up to each other. The girders may be of any desired length and are shown broken short in Figs. 1 and 3. The struts *b* may be replaced by other suitable connections such as a metal cover plate.

In order to connect adjacent assembled units, the slabs are provided at suitable intervals with auxiliary bolts *e* which may be more securely held in place by the metallic reinforcement as indicated by way of example at *f* in Fig. 3. When the units are assembled the bolts *e* are arranged opposite each other in pairs as in Fig. 5 and are joined together by fish plates *g* fitted over both ends of the bolts as in Figs. 1 and 6. Additional reinforcement may be provided in the slabs for binding the bolts *d* and / or the metal strips *c*. Fig. 7 shows the construction of the corner of a building with an intermediate floor, in which the supporting walls consist of vertically assembled and adjacent building units whilst the intermediate floor consists of horizontally assembled units. On the drawing the lower

floor units are designated a', the upper floor units a^2 and the intermediate floor a^3, for the sake of convenience. It will be seen that the adjacent units are connected by fish plates g which connect each pair of bolts e. The end section of the wall shows the struts b and it will be seen that the floor beams a^3 are fitted between the upper and lower units a' and a^2. In order to further support the transverse floor, the end struts b' and b^2 may be extended as shown so as to connect the girders a' and a^3 and a^2 and a^3 respectively. At the point of intersection, the metal strips c may also be continuous or fitted with auxiliary fish plates such as c' which may, for example, be more securely connected to the adjacent units by the provision of a plurality of additional bolts d'.

In order to increase the total rigidity of the structure, the bolts d may project to such an extent from the slabs a as not only to receive the struts b but also project into corresponding apertures in the adjacent slabs (see Fig. 4). The fish plates g may be let into recesses in the slabs or they may be laid flat upon the slabs, the latter arrangement being preferable if the slabs are to have an outer coating. The structural girder units may also be provided with a suitable coating on one or both faces under cover and delivered in such condition to the site for the erection. During or after assembly of the units, the joints may be pointed or otherwise filled up so that the metal parts in the finished building are completely covered or enclosed.

The struts b of the girder structure need not necessarily be provided at the edges of the slabs as, for example, in the construction of projecting gutters for roofs. In such case the two slabs to be connected together may be of different dimensions, the struts being connected to the outer face of the smaller slab and to any point on the face of the larger slab. In such case the struts will of course be preferably connected to the bolts d during casting stamping or otherwise producing the slabs. It will of course be understood that for further strength and in special cases the interior of the building element may also be provided with one or more series of struts or continuous metal sheets.

In the construction according to Figs. 8 to 12, the metal strips at the side edges of the slabs are dispensed with by the provision of an anchoring reinforcement in the slabs. The anchoring device consists of a metal strip having a flat middle portion h and lugs k turned through ninety degrees and inclined to the middle portion. The portion h is provided with apertures h' and h^2 for the reception of the bolts carrying the struts. The lugs k are fitted with cross-pins e over which the fish plates are fitted. The lugs k are also provided with slots k' which when embedded in the slabs are filled with concrete and thus anchored therein. The lugs k may also have notches k^2 or projections in lieu thereof which serve for the ready attachment of the slab reinforcement which is illustrated by way of example as consisting of iron wire.

In Fig. 8 it will be seen that the anchors h are fitted in the slabs a at the required distances apart and that these distances may vary. At the left hand side of Fig. 8 the distance is smaller than in the middle of the building unit in order to strengthen it at its point of support where it constitutes a floor as in Fig. 10. The form of the anchor may also vary slightly from the construction shown in Figs. 11 and 12, as shown at the left of Fig. 8.

As shown in Fig. 8 the lugs k of the anchors are connected together by the wire reinforcement m whilst the slabs are also provided with the usual longitudinal reinforcement n. The fitting of the anchors and reinforcement m may be readily carried out during manufacture of the slabs by the aid of a jig or frame. The frame may have a flat bed upon which the slab is formed with vertical struts at the sides on which the anchors h are temporarily fastened in any convenient manner. Thereupon the wire reinforcement m is stretched in position and the longitudinal reinforcement n (with or without other reinforcement) is laid on the network so formed. The formation or casting of the slab can then be effected. When using such a frame, a plurality of slabs may be formed upon one another by fitting a partition upon each finished slab after the latter has set and then laying the next set of anchors and reinforcement thereon for the casting of the next slab. The wire reinforcement m as shown in Fig. 8 is preferably wound in zig-zag formation over the notches k^2 of the anchor lugs k. In order to strengthen individual parts, the wire m may be duplicated or wound round adjacent parts. Similarly additional reinforcement n may be provided in known manner at parts subjected to greater stresses.

When embedding the anchors it will be understood that one bolt d is already in the anchor so that it is embedded therewith.

After setting each pair of slabs are connected (as already described) by the struts b fitted upon the bolts d and secured as indicated in Fig. 8 by split pins d'. Additional diagonal struts p may be provided, as in Fig. 9 for the purpose of transversely stiffening the interior of the girder structure. The struts p may be connected to the struts b by screws or the like; they may be either temporarily fitted until erection of the building unit or they may be permanently employed.

The bolts *d* may be of such a length that they not only support the struts *b* but also pass through the opposite anchor *h*, as indicated at the right hand end of the joint in Fig. 8. The bolts *d* may also penetrate into the adjoining slab *a* so as to further increase the rigidity of the connection. During erection the fish plates *g* on one or both sides of the anchors, are then connected together either in pairs by means of extra bolts, screws or the like *r* or the fish plates *g* may be of such a length, as shown on the right of Fig. 8, as to unite adjacent anchors.

In order to increase the strength of corners or the like, as in Fig. 10, intermediate metal strips *s* are preferably employed, the function of which will be readily apparent from the drawing.

In Fig. 8 at the junction of the two building units, short fish plates *g* are indicated which are connected by pins or rivets *r* in addition to longer fish plates which extend between opposite anchors. The short fish plates are indicated as pivoted at their point of attachment to the anchors. Such pivoted fish plates may however be dispensed with and replaced by projections rigidly attached to the anchors *k* by a plurality of rivets, the projections being connected together by rivets or bolts *r*. Such arrangement is preferable if the building units are liable to longitudinal stresses which would then subject the connecting bolts *r* to a shearing stress. The connecting bolts must consequently be of requisite strength to resist this shearing stress. If desired the parts indicated as fish plates in Fig. 3 may also be integral with the anchors *k*.

Claims:

1. A building unit comprising a pair of concrete slabs spaced apart, metal strips let in the side edges of said slabs and having apertures therein, projections from the side edges of said slabs extending through said apertures and struts having apertures at each end for engaging said projections, said struts connecting the slabs together.

2. A building unit as specified in claim 1 in which the slabs are provided with pins passing through the slabs close to the side edges thereof, said pins being adapted to receive fish plates for connecting adjacent building units together.

3. A building unit comprising a pair of concrete slabs, metal strips embedded in the side edges of said slabs, projections extending outwardly from said metal strips, diagonal struts connecting the projections on the slabs, fish plates for connecting adjacent building units together and means for securing said fish plates in position.

4. A building unit comprising two slabs spaced apart, anchors embedded in said slabs at intervals, pins embedded in said slabs and passing through apertures in said anchors, said pins extending outwardly from the side edges of said slabs, pins carried by said anchors projecting through the two faces of said slabs and fish plates for connecting said last mentioned pins of one building unit to the corresponding pins of the adjacent unit.

5. A building unit as specified in claim 1 having anchors embedded in said slabs at intervals and wires stretched between said slabs across the space between them.

6. A building unit according to claim 4 in which the anchors are provided with diagonally extending lugs forming attachments for cross bracing between said anchors.

In testimony whereof I hereunto affix my signature.

HANS BEIERBACH. [L. S.]

Witnesses:

OTTO WAGNER, [L. S.]

VIKTOR BENLOR.