Nov. 13, 1923. 1,474,148

R. Z. HOPKINS

BUILDING CONSTRUCTION

Filed July 29, 1920 4 Sheets-Sheet 1

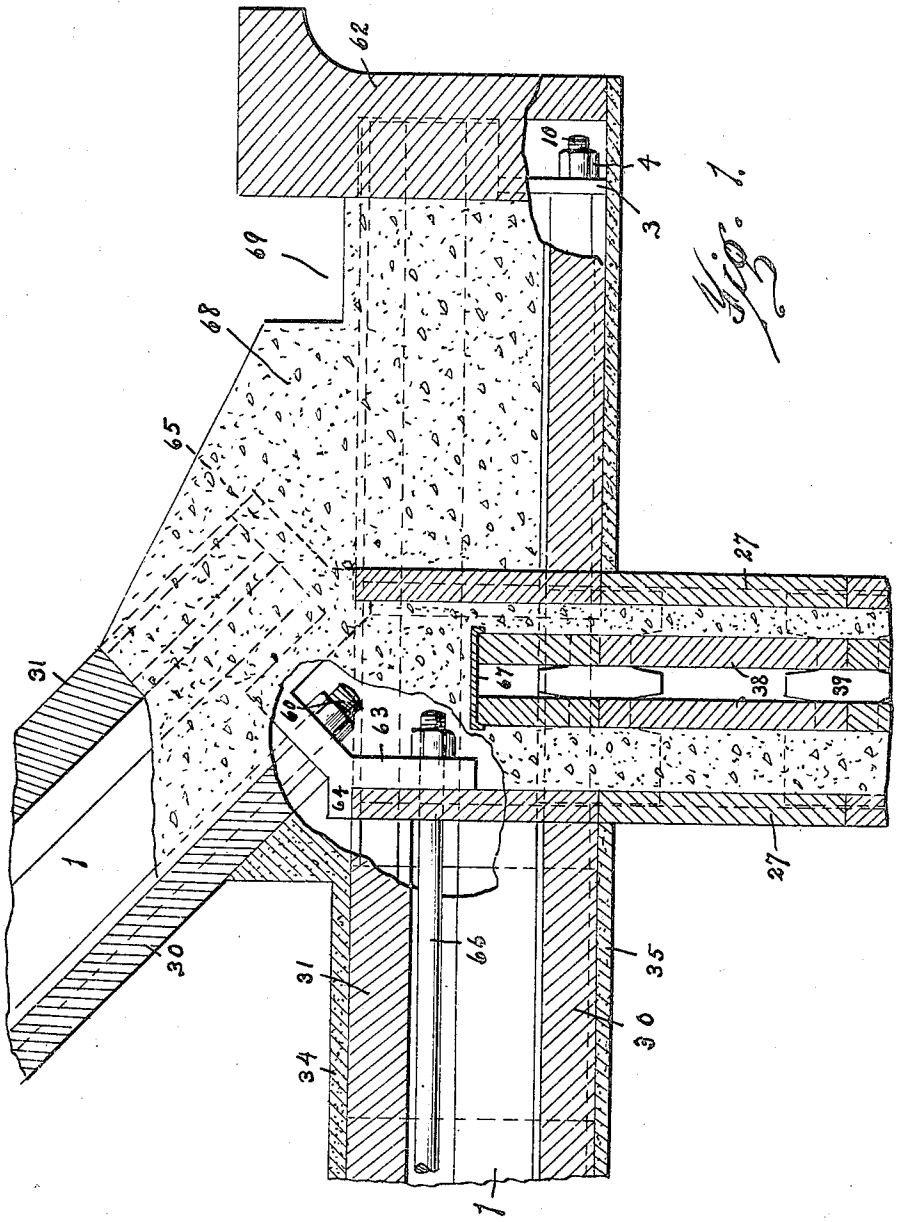


Fig. 1.

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Nov. 13, 1923. 1,474,148

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BUILDING CONSTRUCTION

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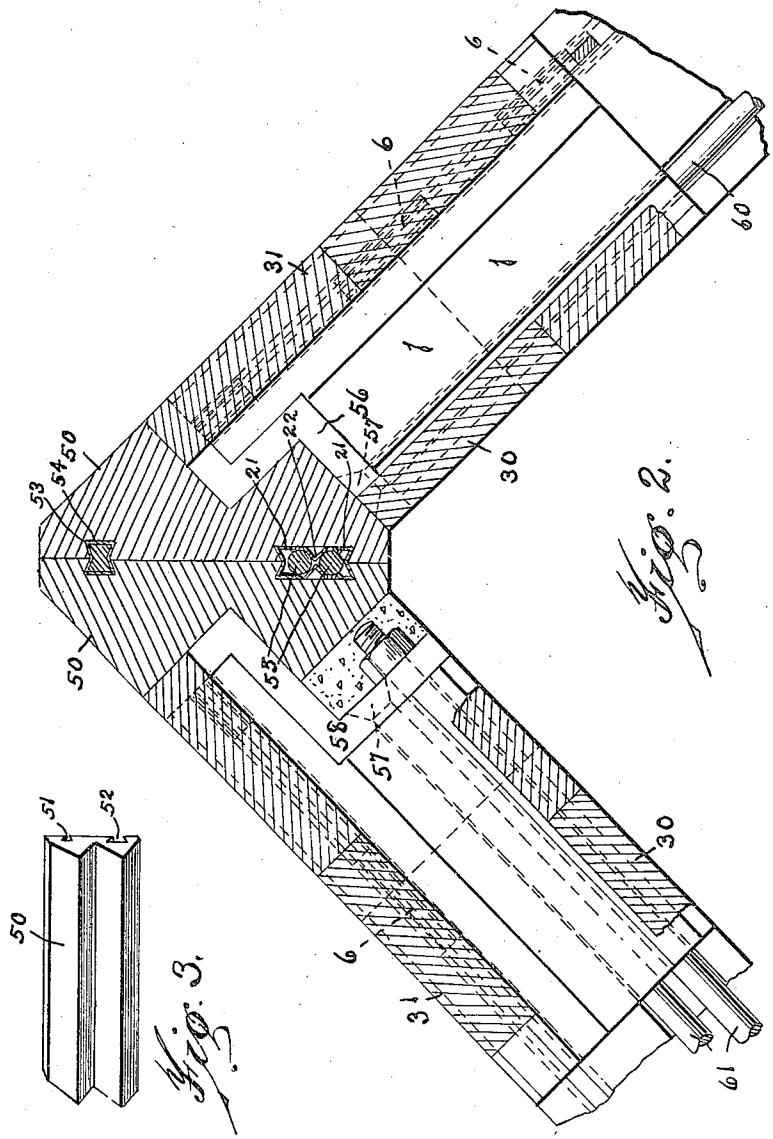


Fig. 2.

Fig. 3.

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BUILDING CONSTRUCTION

Filed July 29, 1920 4 Sheets-Sheet 3

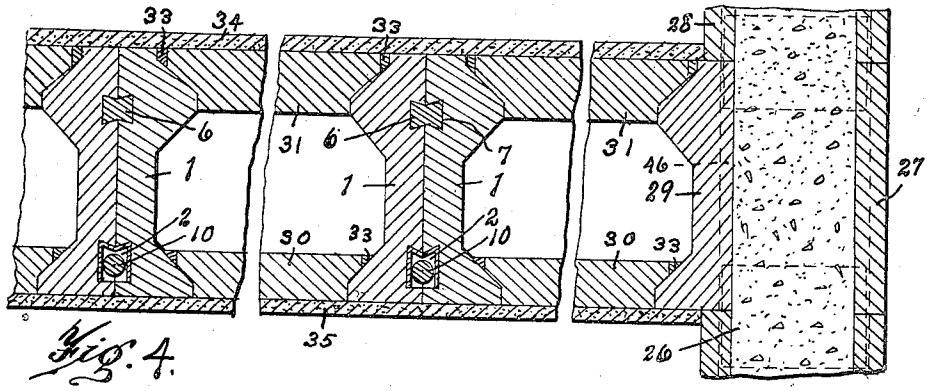


Fig. 4.

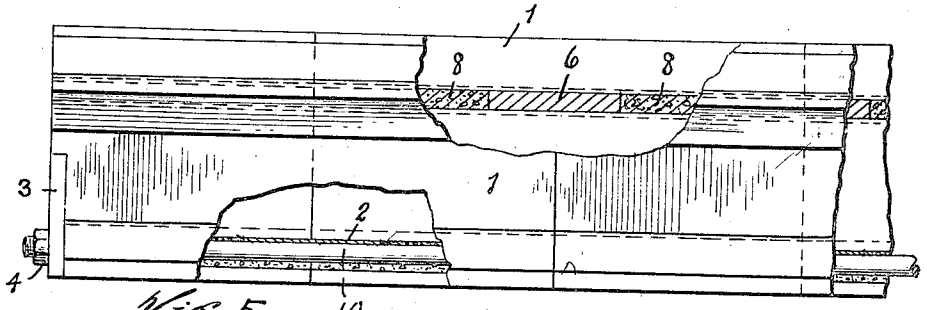


Fig. 5.

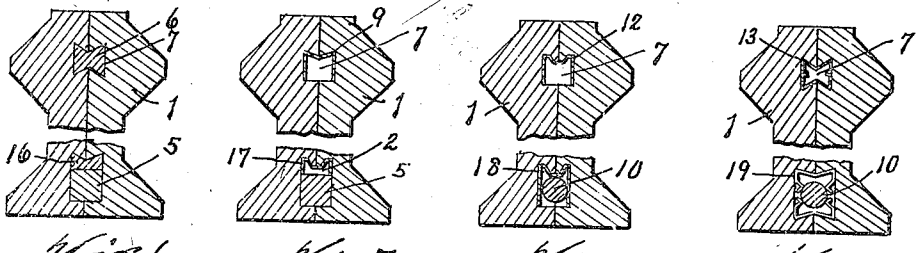


Fig. 6. Fig. 7. Fig. 8. Fig. 9.

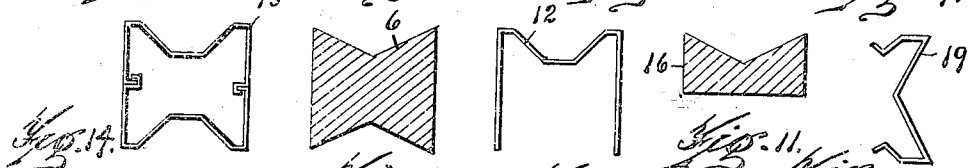


Fig. 14. Fig. 10. Fig. 12. Fig. 11. Fig. 13.

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BUILDING CONSTRUCTION

Filed July 29, 1920 4 Sheets-Sheet 4

Fig. 15.

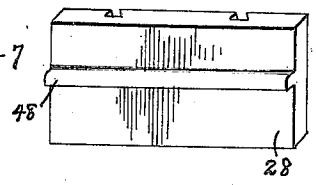


Fig. 24.

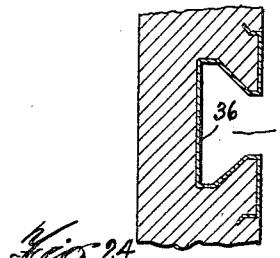


Fig. 16.

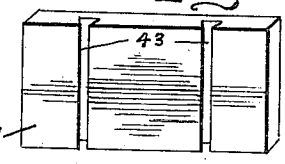


Fig. 17.

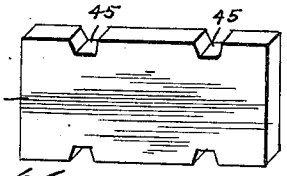


Fig. 18.



Fig. 25.

Fig. 19.

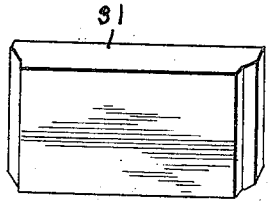


Fig. 20.

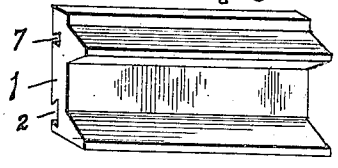
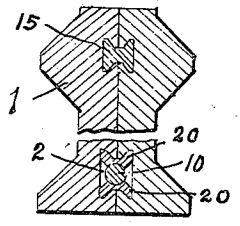


Fig. 23.



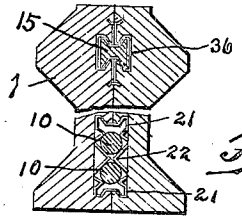


Fig. 22.

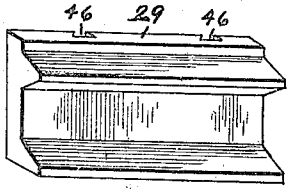


Fig. 21.

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Patented Nov. 13, 1923. 1,474,148

UNITED STATES PATENT OFFICE.

RALPH Z. HOPKINS, OF DETROIT, MICHIGAN.

BUILDING CONSTRUCTION.

Application filed July 29, 1920. Serial No. 399,661.

To all whom it may concern:

Be it known that I, RALPH Z. HOPKINS, a citizen of the United States, and residing at Detroit, in the county of Wayne and State of Michigan, have invented a new and Improved Building Construction, of which the following is a specification.

This invention relates to the construction of floors, ceilings, roofs, and other flat slab building structures, and its object is to provide a system of construction whereby a builder is enabled to erect at moderate cost and with the use of very simple falsework a substantially fireproof building by the use of proper concrete elements and metal tension bars which have been previously manufactured in what may be termed "stock sizes."

The construction of floor slabs by the use of metal tension members and terra-cotta or concrete blocks and the construction of beams or girders by the use of metal tension members and terra-cotta or concrete blocks which are strung onto these tension members have both been suggested; but the construction of a beam or girder of two longitudinal rows of blocks, the blocks of each row breaking joints with those of the other, the blocks of the two rows being formed with grooves for the metal tension members, and the blocks of the one row being locked to the blocks of the other row so as to constitute a substantially continuous beam, has not been suggested and constitutes the major idea of the present invention. The subordinate idea of the present invention is providing the beams or girders thus constructed with longitudinal shoulders and placing spacing members on these shoulders so as to constitute flat slab structures suitable for floors and roofs.

The invention consists specifically in the construction illustrated in the accompanying drawings and particularly pointed out in the claims.

In the accompanying drawings, Fig. 1 is a vertical section through an upper portion of a wall, the abutting floor and roof and the eaves and gutter of a building. Fig. 2 is a similar section through the ridge of the roof. Fig. 3 is a perspective view of a ridge unit. Fig. 4 is a vertical section through a floor taken at right angles to that of Fig. 1. Fig. 5 is a side view of a finished beam, parts being broken away to show the construction. Figs. 6 to 9 inclusive are transverse sections of girders built up of units secured together by different connectors. Figs. 10 to 14 are views showing different types of connectors. Figs. 15 to 21 inclusive are perspectives of different types of building units. Figs. 22 and 23 are transverse sections of girders built up of units secured together by different connectors. Fig. 24 is an enlarged detail of the structure shown in Fig. 22. Fig. 25 is a vertical section of a portion of wall and abutting floor.

Similar reference characters refer to like parts throughout the several views.

When reinforced concrete girders are built up of units provided with longitudinal holes to receive the tension rods, great pains must be taken to slide the units onto and along the tension rods to avoid breakage of the units. Attempts have been made to employ pairs of rows of units having grooves in their opposed faces to receive the tension rods, but the amount of transverse reinforcements of the floor necessary to hold the two rows of each beam together has been large and the falsework was necessarily as complete as for ordinary floors built complete in situ.

In the present construction, the beams are constructed of previously manufactured stock units having grooves to receive the tension rods, but in addition thereto, means are provided for locking the units of each row to the units of the other row with the tension rods between them, so that, when erected, reinforced concrete beams are produced without the necessity of sliding these units along on the tension rods.

Referring to Figs. 4 to 14 and 19 to 23 inclusive, the beams are shown to be built up of beam units 1 arranged end to end to constitute parallel rows, each unit having a groove 2 in its inner face to receive the tension rod 10. These units of the several rows break joints as indicated in Fig. 5 so that a unit of fractional lengths will occur at each end of the beam. I prefer to recess the end units to receive a metal plate 3 against which the nut 4 on that end of the rod 2 may bear. These rods may be round, as indicated in Figs. 4, 5, 8 and 9, or of any other cross section, Figs. 6 and 7 showing square tension members 5. Or they may be duplicated as shown in Fig. 22.

As stated above, these beam units are brought to the work and placed against the tension rods, the joints between two units

on one side being between the ends of adjacent units on the other side of the tension rod. When an entire unit has been positioned on one side of the tension rod for one end of a beam, and a fractional unit has been placed on the other side, connecting members are introduced to tie these units together. These connectors may be short castings, molded concrete or sheet metal properly bent. In Figs. 4, 5 and 6, I have shown short prisms 6 of iron, one of which is slipped into the end of the groove 7 in the face of the longer unit and along that groove until it extends about half way into the groove 7 in the face of the shorter unit. As these are dovetail grooves, the tie between adjacent units is rigid. The remainder of the grooves may then be filled with concrete 8, after which another unit with one-half the length of its groove 7 filled with concrete is placed against the end of the shorter unit, being slid onto the connector 6, after which another connector is slid along in the groove 7 of this new unit until it extends into the end of the groove of the last placed unit of the other row.

It will be understood that the connectors 9, 12, 13 and 15, indicated in Figs. 7, 8, 9, 12, 14, 22 and 23, may be similarly employed to tie the ends of each unit to the middle portion of the adjacent unit on the opposite side of the tension rod. The spaces in the grooves 7 not filled with these connectors may be filled with concrete. While I prefer connectors of the type shown by 6 in Fig. 6, I do not wish to be limited thereto or to any one of the connectors shown in the several views, for any other devices may be employed to unite the units of one side of the beam to the other.

It will usually be found advisable to key tension rod in position in the units, and for this purpose the parts 16 to 22 inclusive may be employed. These keys are severally introduced after a unit has been placed, being slid along the groove 2 of the last placed unit until it extends into the groove of the last placed unit of the other row, the remaining space around the tension rod being then filled with concrete. After the units have thus been positioned on the tension rod, tied together and keyed, the plates 3 and nuts 4 are secured to the ends of the rods, resulting in a light, strong and compact beam. After a beam has been thus assembled, and after the concrete in the grooves in the beam units has set, the beam may be hoisted to the place where it is to be used.

In Fig. 4, I have shown a wall consisting of a core 26 of concrete cast in situ and facing units 27 and 28 which may be of natural or artificial stone.

A band of wall units 29 are built into this wall and are preferably of the same contour as the beam units 1 (see Fig. 21). After the beams are built up and positioned, the ceiling units 30 and the floor units 31 may be positioned as indicated in Fig. 4 until the entire floor slab is completed. Luting of rich concrete may be poured into the joints between the floor and ceiling units and the beam and wall units, as indicated at 33, after which the lower side of the slab may be given a coat 35 of plaster and covering 34 of any desired character may be placed over the floor units. These ceiling and floor units keep the beams properly spaced and prevent sidewise buckling thereof.

In Figs. 22 and 24, the upper groove 8 is shown lined with sheet metal reinforcements 36 which will prevent shipping of the edges of the beam units. The keying members 21 and 22 which position the rods 10 are shown to be in separate parts. The key-members 20 in Fig. 23 may be of metal, terra-cotta or concrete.

In Fig. 25 is shown a wall provided with an air space and built up below the floor of the face blocks 27, the interior blocks 38, the tie plates 39 and the concrete 40 and 41. The face blocks 27 have vertical dovetail grooves 43 to receive the tongues 44 on the ties 39 and are thus held in position. The tie plates and the interior blocks 38 are formed with notches 45 so they may mutually position each other. As these units are built up into a wall, the spaces between them are filled with concrete 40 and 41, thus giving two solid thicknesses and an air space between them. The thickness 40 is made heavy to support the floor which extends into the wall. The units 29 are provided with similar vertical grooves 46 to receive the tongues 44 on the ends of tie plates 39, but in Fig. 4 the air space and the interior units 38 are omitted. The length of the tie plates will vary with the thickness of the wall.

In Fig. 25, the wall is reduced in thickness above the floor and the wall units 28 are formed with a ledge 48 up to which the concrete floor covering 34 is molded. The construction of the wall is otherwise as before described. It will be understood that the wall units 27 will be cut away wherever necessary to permit the floor beams to extend into the wall and rest on the concrete 40 as shown in Fig. 25, and these units 27 are preferably fitted to the beam units 1 in order to prevent the soft concrete from running out when the spaces above the floor are being filled.

The same ideas are embodied in roof shown in Figs. 1, 2 and 3. The ridge units 50 have grooves 51 and 52, the former for the connectors 53 and these grooves 51 are preferably provided with sheet metal linings 54. The sheet metal ties 21 and 22, shown in Fig. 22, may be employed to position the tension rods 55 and also to hold

the lower portions of the units 50 together.

The units 1, 30 and 31 are employed to build up the roof slabs which are practically identical with the floor slab shown in Fig. 4. Instead of the end plates 3, I prefer to use heavy stepped plates 56 which fit against the ridge units 50 and are countersunk to receive the heads 57 of the tension rods 60, or I may use the plates 58 which leave space for the nuts 59 on one of the pair of rods 61, this space being afterwards filled with concrete. The spaces between the built up beams, which now constitute rafters, are filled by the flat units 30 and 31.

In the structure shown in Fig. 1, the floor units 1 extend out into an eaves-trough member 62 across the wall, and the inclined roof beams and the top and bottom units 30—31 end at the heavy iron footing members 63 which may have flanges 64 and 65 to engage the upper wall units 27. If desired, transverse rods 66 may extend across between footing members 63 for greater safety. Cap plates 67 may be used to keep the concrete 68 from between the intermediate wall plates 38 and the concrete may be sloped up to the units 31 to form a proper gutter 69.

The modifications of the various units and the combinations between them are merely a few examples of the various forms in which my present invention may be embodied and many other modifications and changes may be designed by those skilled in the art without departing from the spirit of my invention as set forth in the following claims.

I claim:—

1. A beam comprising two rows of units placed face to face, the joints between the units of each row alternating with those of the other row, units of the two rows having registering grooves to constitute longitudinal passages, a tension member mounted in one passage, and connectors mounted in the other passage to hold the two rows of units together.

2. A beam comprising two rows of units placed face to face and having upper and lower registering grooves continuous throughout the length of the beam, a tension bar in the lower grooves, nuts on the ends of the rods to draw the units together, and connectors in the other grooves to unite the two rows.

3. A beam comprising two rows of units placed face to face and having upper and lower registering grooves continuous throughout the length of the beam, a tension bar in the lower grooves, nuts on the ends of the rods to draw the units together, and connectors in the other grooves to unite the two rows, the joints between the units of each row alternating with those of the other row and the connectors extending across said joints.

4. A beam comprising two rows of units placed face to face and each unit having two dovetail grooves registering with the grooves in the opposite unit, the joints between the units in the rows alternating, and connectors in said grooves to secure the units of one row to the units of the other row.

5. A beam comprising two rows of units placed face to face and each unit having upper and lower grooves registering with the grooves in the opposite unit, the joint between the units in the rows alternating, short connectors in said upper grooves to secure the ends of two adjacent units of one row to and intermediate the ends of a unit of the other row, a tension member extending along in the lower grooves, and bearing plates and nuts on the ends of said tension member.

6. A beam comprising two rows of units placed face to face and having upper and lower longitudinal grooves, a tension rod in one of the grooves extending longitudinally of the beam, and means in the other groove to unite the two rows of units.

7. A beam comprising two rows of units placed face to face and rigidly connected, the units of one row breaking joints with that of the other row, said beam having a groove along and within the contacting faces of said units, and a tension bar in said groove extending the length of the beam.

8. A beam comprising two rows of units placed face to face and rigidly connected, said beam having a groove along and within the contacting faces of said units, and a tension bar in said groove extending the length of the beam .

9. A beam comprising two rows of units placed face to face and leaving registering grooves adjacent the lower sides of the units, and a tension member extending longitudinally of the beam in said registering grooves.

10. A beam comprising two rows of units placed face to face and having registering grooves, connectors in said grooves to unite the units of the two rows, and reinforcements for the units within the grooves.

11. A beam comprising two rows of units placed face to face and having registering grooves, sheet metal facing in said grooves to reinforce the units, and connectors to unite the contacting blocks of the two rows.

RALPH Z. HOPKINS.