June 22, 1937. A. MacMILLAN 2,084,649

STEEL FLOOR AND COLUMN CONSTRUCTION

Filed Oct. 19, 1936

Fig. 1

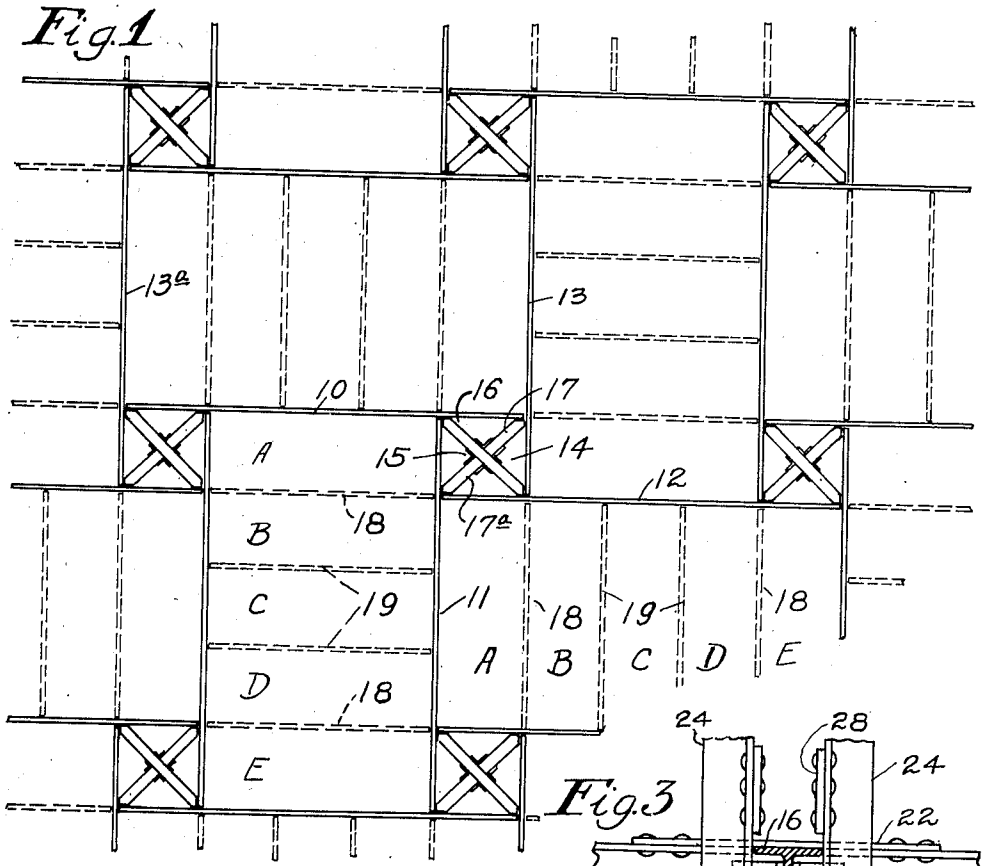


Fig. 2

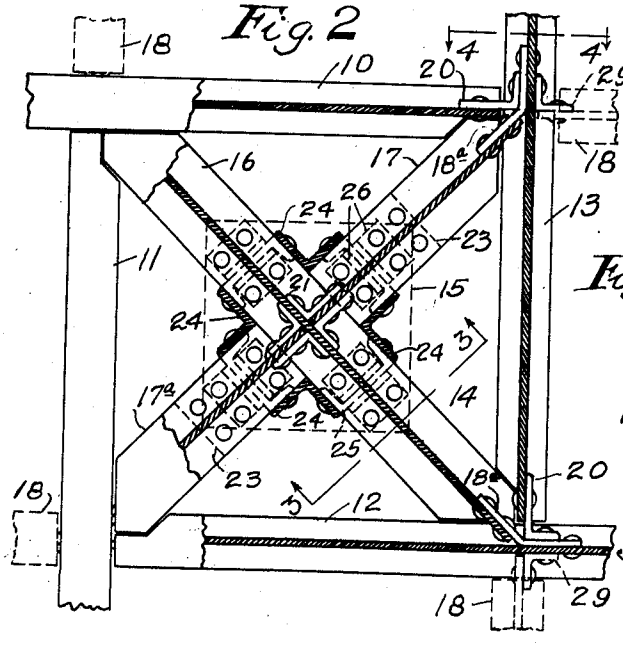


Fig. 3

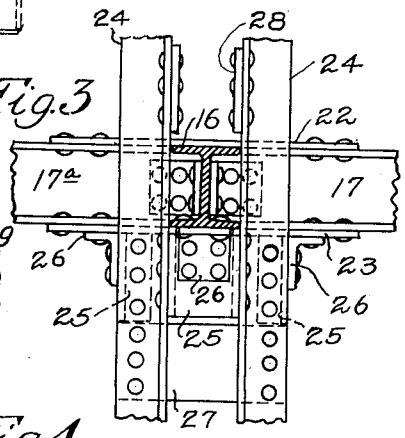
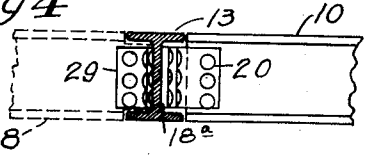


Fig 4



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STEEL FLOOR AND COLUMN CONSTRUCTION

Abram MacMillan, Chicago, Ill.

Application October 19, 1936, Serial No. 106,339

14 Claims. (Cl. 189—34)

An object of this invention is to provide an improved form of steel floor construction wherein the steel floor members are disposed so as to utilize their strength to the best advantage, and particularly one wherein the floor members are all economically chosen of the same depth throughout.

Another object is to provide an improved form of column and bracket for supporting a floor whether made up of girders secured together as in a steel frame construction or of a concrete slab.

These and other objects, as will hereinafter appear, are accomplished by this invention which is fully described in the following specification and shown in the accompanying drawing, in which—

Figure 1 is a partial floor plan showing the general arrangement of members, columns and supporting brackets;

Fig. 2 is a partial enlarged plan partly in section showing a detail of the column and bracket and the manner of supporting the floor members thereon; and

Figs. 3 and 4 are partial vertical sections on the line 3—3 and 4—4 respectively of Fig. 2.

This is an improvement on my application Serial No. 717,179, filed March 24, 1934.

The invention comprises main load-carrying girders as 10, 11, 12 and 13 arranged in end-abutting relation to form a parallelogram 14 within which is located a column 15 attached to the girders by means of cross-arms or brackets 16, 17, 17a which preferably extend diagonally across the parallelogram so as to be secured to the girders at their points of anchorage to each other. Cross beams 18, 19 are placed across the large parallelograms formed by the main girders, the latter being shown in full lines in order to make the main framing stand out clearly while the cross-beams which support only the weight of their own area are shown dotted.

The cross-beams 18 are preferably in line with the main girders and the intermediate cross-beams 19 are spaced so as to form panels A, B, C, D & E, preferably of substantially the same size and shape.

Each of the main girders is anchored in the same way so that a description of any one of the girders as 10 will suffice for the others. The girder 10 abuts at its end the girder 13 to which it is attached by means of an angle 20 (Figs. 2 and 4). The end of the girder 11 is attached to the girder 10 in the same way; the end of the girder 12 is similarly attached to the girder 11, and the girder 13 to the girder 12. Likewise the opposite end of each girder is attached to a girder which it abuts. Thus the girder 10 is attached to the girder 13a. Each girder of the main frame is attached at four points, i. e. at its two ends to other girders which it abuts and at two points intermediate its ends where other girders abut it. Thus each girder is rigidly fixed at both ends and can be calculated as such rather than as a beam merely supported at the two ends as in the case of girders attached at their ends to columns. Girders fixed at their ends are capable of supporting with safety much greater loads with less deflection than are girders merely supported at their ends.

This simple arrangement provides for the equivalent of continuous beam action since the ends of the beams are rigidly fixed which results in the use of much lighter steel to support a given load on a given span.

It will be observed that the four girders thus appear to form whorls or fans about each column, the whorl about one column being the reverse of that about the next adjacent column either vertically or horizontally of the sheet.

This method of fabricating the beams in the floor structure is still further augmented by the method of supporting this girder structure on the columns. This is done by using a diagonal cross carried by each column which is attached to the four girders forming the sides of the parallelogram 14 at points where these girders abut. Thus the unsupported length of each girder is the same length as the cross beams 18, 19, i. e. the column spacing less the length of one side of the parallelogram 14. In this way the stresses in the girder for a given span and loading are greatly reduced. Each cross arm has a bent plate 18a for attachment to the girder.

The method of attaching the girders to the column will now be described. The cross-arm 16 is continuous while the cross-arms 17, 17a are in two pieces secured to the cross-arm 16 by four angles 21 and by top and bottom splice plates 22, 23 so that these cross-arms have the strength and rigidity of a single integral member. A column is composed of four vertical angles 24 which lie in the four crotches formed by the cross-arms and which are secured together by four channels 25 and angles 26, the latter being riveted to the cross-arms so as to make a strong, rigid connection. The column angles are then connected by suitable lacing bars or plates 27, 28.

The column and its cross-arms can be used also for other forms of steel construction and for concrete buildings, particularly of the well-

known flat-slab type. When so used a perfectly flat ceiling results as the cross-arms take the place of the usual drop head commonly used therein at each column to take the heavy shear which is always present at the columns.

This makes a very light but strong column and one that adapts itself very well for architectural purposes. Spaces are thus provided for placing pipes, conduits and the like in the column which is completed by encasing the column angles in cement, tile, plaster or other fireproof material. The column encasing may be square as indicated or it may be round, octagonal or the like. The beams, cross-arms and girders may all economically be chosen of the same depth so that a flat ceiling is obtained. The beams are attached at their ends to the girders by means of angles 29 in a well-known manner.

Due to the shortened unsupported lengths of the beams and girders and to the fact that the girders have "fixed ends" there is a saving of over one fourth of the total weight of steel in a given floor over the conventional framing, in addition to the fact that the girders are no deeper than the beams.

This system of framing is designed to carry any suitable floor deck (not shown) such as tiles or concrete. It is also well adapted to carry a floor made up of 2" x 4" wood pieces laid on a 45° angle across the building and spiked to each other so as to form a 4" deep floor. This girder and beam distribution would provide a substantially uniform spacing for such a floor. Or, if desired, a deck made of steel plates of a size and shape to cover the panels A, B, etc. may be used.

I claim:

1. In a building construction, four girders arranged to form a parallelogram, an end of each girder being firmly anchored to another of the four girders intermediate its ends and itself having, at a point intermediate its ends, an anchorage to the next adjacent girder of the four, a column within the parallelogram, and cross supports carried by the column and secured to the four girders at their points of anchorage to each other.

2. In a building construction, four girders arranged to form a parallelogram, an end of each girder being firmly anchored to another of the four girders intermediate its ends and itself having, at a point intermediate its ends, an anchorage to the next adjacent girder of the four, a column within the parallelogram, and cross supports carried by the column and secured to the four girders at their points of anchorage to each other, the opposite ends of certain of the girders being similarly anchored and supported on columns.

3. In a building construction, four girders arranged to form a parallelogram, an end of each girder being firmly anchored to another of the four girders intermediate its ends and itself having, at a point intermediate its ends, an anchorage to the next adjacent girder of the four, a column within the parallelogram and supporting arms secured to the column and lying at an angle to each other and extending diagonally of the parallelogram and having their ends attached to the girders at the corners of the parallelogram.

4. In a building construction, four girders arranged to form a parallelogram, an end of each girder being firmly anchored to another of the four girders intermediate its ends and itself having, at a point intermediate its ends, an anchorage to the next adjacent girder of the four, a column within the parallelogram and supporting arms secured to the column and lying at an angle to each other and extending diagonally of the parallelogram and having their ends attached to the girders at the corners of the parallelogram, the column having four vertical angle irons secured to the cross supports in the angles formed thereby to form column supports.

5. A floor construction supported on columns arranged in rows longitudinally and transversely and comprising a group of four girders spaced from a supporting column and arranged about the same to form a parallelogram, one end of each girder terminating at a point intermediate another girder of the group and secured thereto, the opposite ends of certain of these girders being similarly attached to other girders and forming one side of a similar parallelogram, and means for supporting said girders on the column within each of said parallelograms.

6. A steel floor construction supported on columns arranged in rows longitudinally and transversely and comprising a group of four girders spaced from a supporting column and arranged about the same to form a parallelogram, one end of each girder terminating at a point intermediate another girder of the group and secured thereto, the opposite ends of certain of these girders being similarly attached to other girders and forming one side of a similar parallelogram, column brackets having four arms extending diagonally across each of said parallelograms, and secured to said girders at their points of intersection, and a column secured to the column brackets.

7. A steel floor construction supported on columns arranged in rows longitudinally and transversely and comprising a group of four girders spaced from a supporting column and arranged about the same to form a parallelogram, one end of each girder terminating at a point intermediate another girder of the group and secured thereto, the opposite ends of certain of these girders being similarly attached to other girders and forming one side of a similar parallelogram, intersecting column brackets extending diagonally across each of said parallelograms, and secured to said girders at their points of intersection, and a column secured to the column brackets, said column comprising four angle irons secured in the four crotches formed by the column brackets.

8. A steel floor construction supported on columns arranged in rows longitudinally and transversely and comprising a group of four girders spaced from a supporting column and arranged about the same to form a parallelogram, one end of each girder terminating at a point intermediate another girder of the group and secured thereto, intersecting column brackets extending diagonally across said parallelogram and secured to said girders at their points of intersection of the girders, and a column secured to the column brackets, said column comprising four angle irons secured in the four crotches formed by the intersecting column brackets.

9. In a building construction, a column bracket comprising intersecting members, one of said members being composed of two sections extending on opposite sides of the other member and secured together with top and bottom splice plates so as to carry the full strength of said

sections across the other member, vertical angles lying in the crotches formed by the intersecting members, and means for securing the angles to the intersecting members and to each other to form a column and column bracket.

10. In a building construction, a column bracket comprising intersecting I-beam members, one of said members being composed of two sections extending on opposite sides of the other member and secured together with top and bottom splice plates so as to carry the full strength of said sections across the other member, vertical angles lying in the crotches formed by the intersecting members, and means for securing the angles to the intersecting members and to each other to form a column and column bracket.

11. In a floor construction, a row of columns, a main load-carrying girder passing two columns in a row and spaced therefrom, a cross girder secured at each end of the main girder transversely to the main girder at a point intermediate the length of the cross girders, a second main load-carrying girder similarly secured to the cross girders near their other ends to form a parallelogram, means for supporting all said girders on four columns forming another parallelogram, and cross beams carried by the main girders.

12. In a floor construction, a row of columns, a main load-carrying girder passing two columns in a row and spaced therefrom, a cross girder secured at each end of the main girder transversely to the main girder at a point intermediate the length of the cross girders, a second main load-carrying girder similarly secured to the cross girders near their other ends to form a parallelogram having a length longer than the column spacing and a width less than the column spacing, and means for supporting all said girders on four columns.

13. In a building construction, a main girder, parallel rows of columns, each column having a bracket in the form of a cross, means for attaching and supporting the girder at its ends and at two intermediate points to said column brackets leaving an unsupported portion between said intermediate points of a length less than the column spacing, and cross beams each secured to the girder at the intermediate points and at two equally spaced points therebetween.

14. In a building construction, spaced columns arranged in rows, each column having a column bracket extending from the column and having two spaced arms on each side of the row, an integral girder extending parallel to a row of columns and spaced therefrom and secured to two arms of each of two adjacent columns in a row, a second integral girder similarly secured to spaced arms on opposing columns of the next adjacent row, said second girder facing the first girder, and spaced cross beams secured at intervals to the girders.

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