April 20, 1937. F. AURYANSEN 2,078,117

WALL OR FLOOR STRUCTURE AND BEAMS THEREFOR

Filed Jan. 7, 1933 3 Sheets-Sheet 1

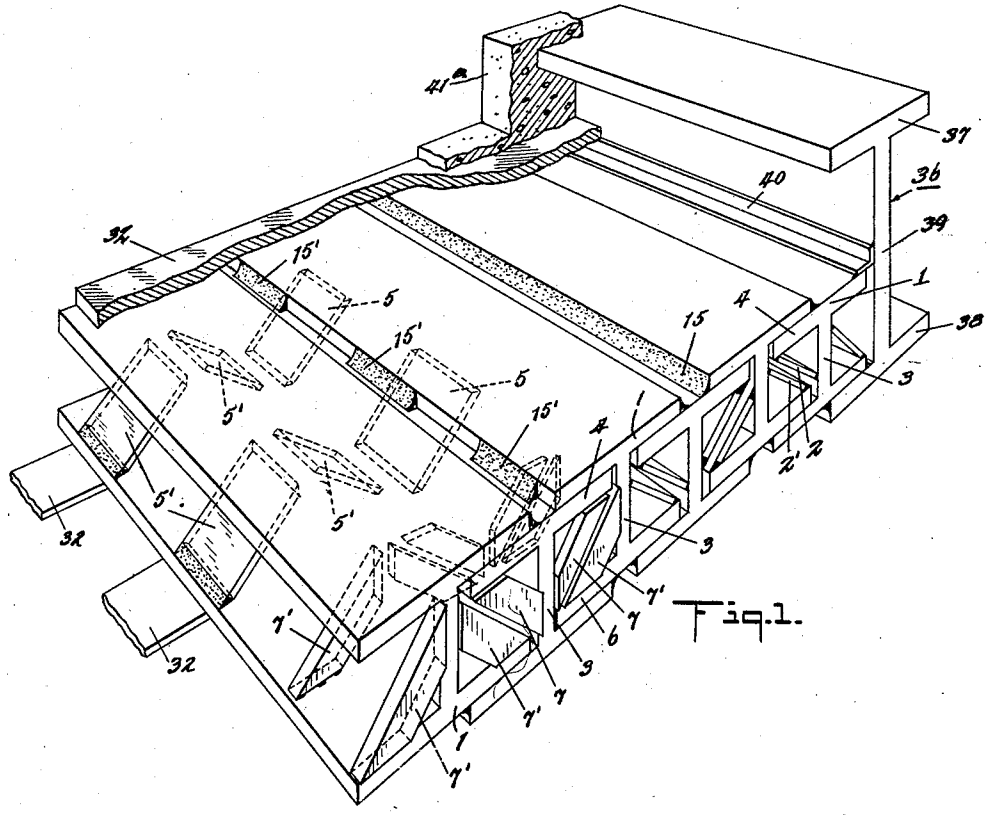

Fig. 1.

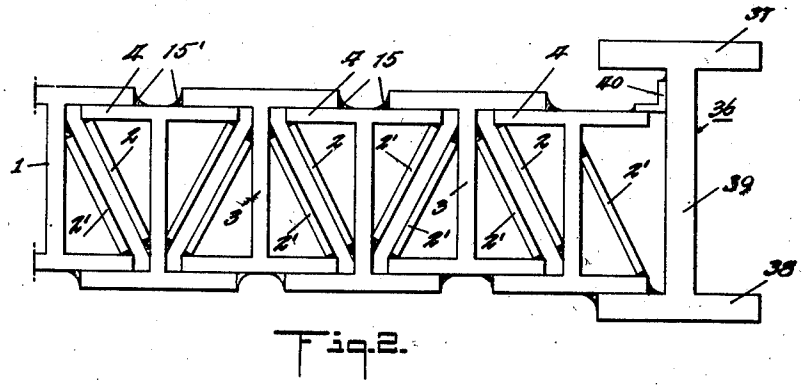

Fig. 2.

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Filed Jan. 7, 1933 3 Sheets-Sheet 2

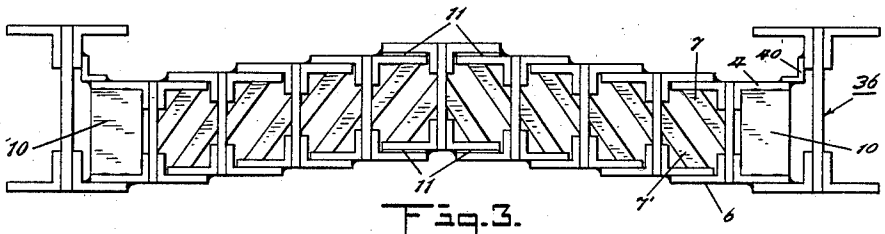

Fig. 3.

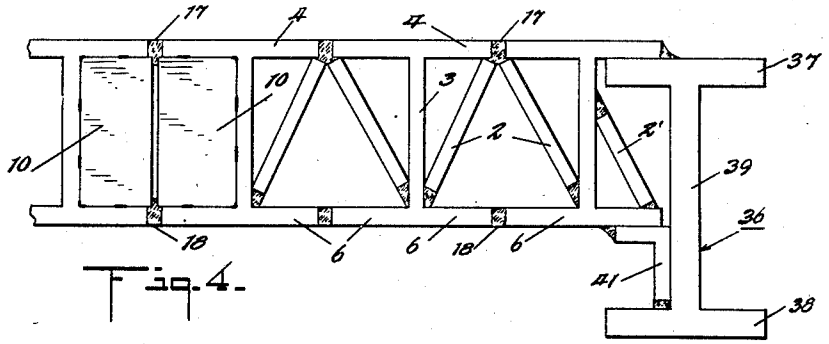

Fig. 4.

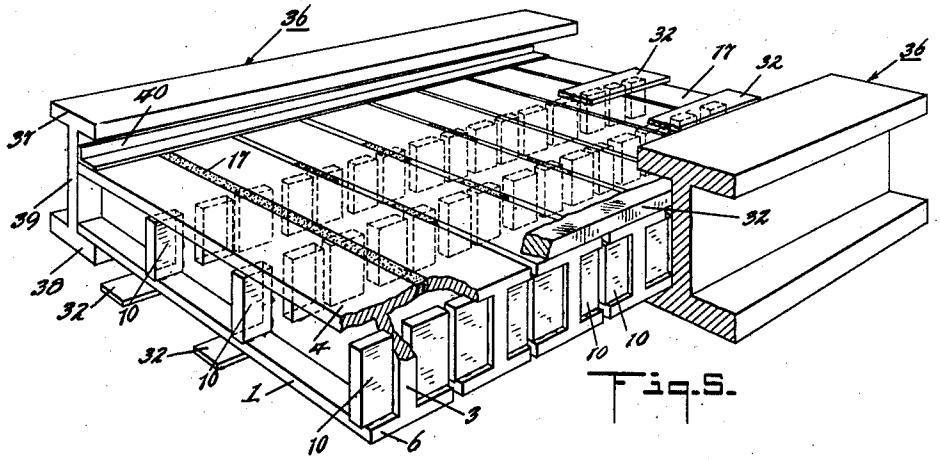

Fig. 5.

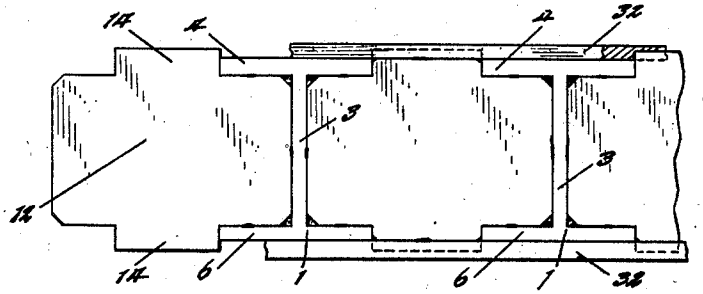

Fig. 6.

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WALL OR FLOOR STRUCTURE AND BEAMS THEREFOR

Filed Jan. 7, 1933 3 Sheets-Sheet 3

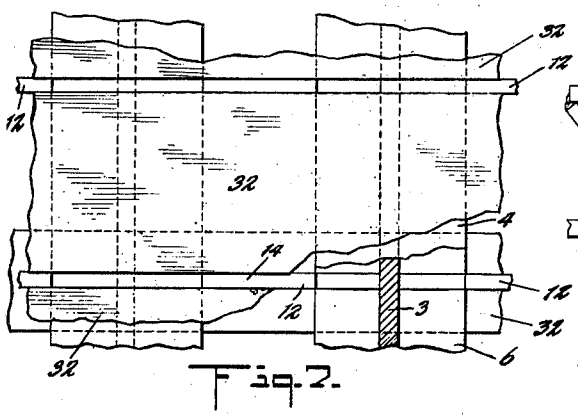

Fig. 2.

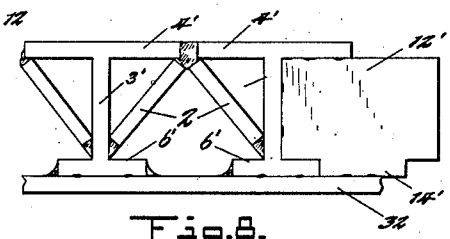

Fig. 8.

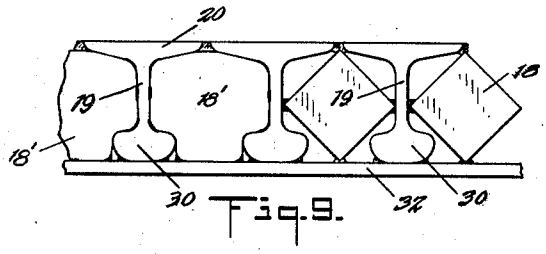

Fig. 9.

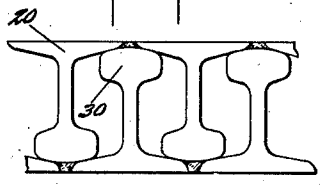

Fig. 10.

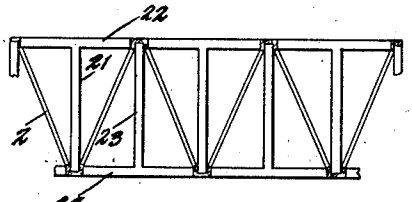

Fig. 11.

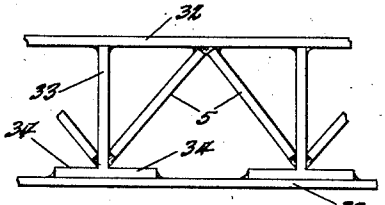

Fig. 12.

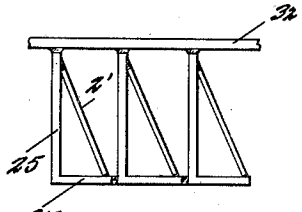

Fig. 13.

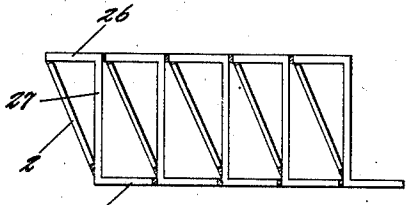

Fig. 14.

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Patented Apr. 20, 1937

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UNITED STATES PATENT OFFICE

2,078,117

WALL OR FLOOR STRUCTURE AND BEAMS THEREFOR

Frederick Auryansen, Forest Hills, N. Y.

Application January 7, 1933, Serial No. 650,710

5 Claims. (Cl. 189—34)

This invention relates to metallic wall or floor construction and to the beams for use in such constructions and it is an object of this invention to provide a floor construction of the class described which is particularly adapted for shallow floor constructions, which secures a transverse distribution of the load and which is so arranged that the members comprising the floor construction act as a unit in resisting both longitudinal and transverse stresses. It is also an object of this invention to provide an improved reinforced beam construction for use in floor constructions of the class described.

In the drawings—

Figure 1 is a perspective view of a portion of a floor construction in accordance with this invention;

Figure 2 is an end elevation illustrating a construction shown in part of Figure 1;

Figure 3 is an end elevation of a modified construction used where a "crowned" surface is desired;

Figure 4 is an end elevation illustrating a further modification;

Figure 5 is a perspective view illustrating a further modification, parts being broken away to show other parts more clearly;

Figure 6 is a fragmentary view in elevation of a further modification, parts being broken away in order to show other parts more clearly;

Figure 7 is a fragmentary plan view of the parts shown in Figure 6, parts being broken away to show other parts more clearly; and

Figures 8 to 14 are fragmentary end views of further modifications.

As shown in the drawings a floor construction in accordance with this invention can be formed of flanged beams of various types reinforced by bracing members; thus in Figure 1 the floor construction comprises I-beam members 1, the flanges 4 and 6 of which are reinforced by suitable bracing members. These bracing members can be continuous members 2, 2' of substantially the same length as the beams which extend between the webs 3 of the beams and the outer portions of the upper flanges 4 and the lower flanges 6 respectively. The continuous members 2, 2' serve also as longitudinal reinforcing members. Where the load to be carried by the structure does not make such heavy reinforcing necessary the bracing members need not be continuous but can be positioned as are the bracing members 2, 2' and comprise a series of short bracing members 5, 5' as also shown in Figure 1. It is also possible to use bracing members such as 7, 7' which lie in a plane perpendicular to the flanges and extend, as in the case of bracing members 7, between the web 3 and the upper flange 4 of one beam and as in the case of the bracing member 7' between the web 3 and the lower flange 6 of an adjacent beam. The bracing members are secured to the webs and flanges in any suitable or desired manner but preferably by welding as shown in the drawings. The bracing members, however, need not be as shown in Figure 1 but can be formed as rectangular members fitting between the upper and lower flanges 4 and 6 respectively of the beams and secured as by welding to the flanges 4 and 6 and the web 3 of the beam as are the bracing members 10, shown in Figures 4 and 5. It is also possible where the load is such that the beams may be separated to use bracing members as shown at 12 in Figure 6, which extend between adjacent beams 1 and are secured to the webs 3 and the lower and upper flanges 6 and 4, respectively. In this arrangement the bracing members 12 can have portions 14 which project between the flanges of the beams and engage transverse flange plates 32.

A complete floor structure comprises a number of the reinforced beams grouped together. The beams can be grouped as shown in Figure 1 where the beams are placed with their flanges overlapping, the beams being staggered so that the flanges are positioned alternately above and below the flanges of adjacent beams. The overlapping flanges are secured together as by welding and the weld may extend continuously from end to end of the flanges as at 15 or it may be interrupted as at 15' in Figure 1. The beams need not, of course, be placed with their flanges overlapping in the manner shown in Figure 1 but may be placed with their flanges overlapping as shown in Figure 3, wherein the beams are placed with their flanges overlapping so as to give a "crowned" or arched effect to the surfaces formed by the upper and lower flanges. This effect can be increased by the insertion of filler or spacing plates 11 between the overlapping or contacting flanges so as to increase the distance that each flange is raised above the flange next below it. The overlapping beams may be parallel as shown in Fig. 1 or may converge.

It is also possible to provide a floor construction in which the flanges do not overlap but abut or lie closely adjacent as shown in Figure 4. In this construction the flanges 4 and 6 are welded along their abutting edges, as at 17 and 18 respectively and in the construction shown the

reinforcing plates 2 are secured to the upper flanges 4 of the beams by the same welds that secure the abutting edges of the beams together. In this construction the "crowning" effect obtained in Figure 3 can be obtained to some degree by making welds 17 joining the top flanges 4 of the beams of greater width than the welds 18 joining the bottom flanges 6 of the beams. The arrangement of the beams with their flanges abutting as shown in Figure 4 is not limited to use in connection with the reinforcing members arranged as are the members 2, 2' shown in that figure, but vertical reinforcing members extending transversely of the beams as shown at 10 in Figures 4 and 5 can also be used. The reinforcing members 10 are shown as spot welded along their edges to the upper and lower flanges 4 and 6 respectively and to the webs 3 of the beams but these welds can be continuous if desired. The welds 17 and 18 secure the adjacent beam flanges together and also serve to unite the edges of adjacent reinforcing members 10.

The transversely extending reinforcing members can also be used where the beams are spaced apart, as shown in Figures 6 and 7, and in this arrangement it is desirable to use the transverse bracing members 12 which extend between adjacent beams and are secured to the webs 3 and to the upper and lower flanges 4 and 6 respectively of the beams and have projecting portions 14 extending between the flanges of the beams and secured to transverse flange plates 32 which are also welded to the beam flanges 4 and 6.

In each of the illustrations given above the beam used has been I or H shaped, but it is to be understood that the invention is not limited to beams of that shape as beams of any of the usual designs can be used. For example, in the arrangement shown in Figure 8 the wide upper flanges 4' can be reinforced by the longitudinally extending bracing members 2 as in Figure 4, or by transversely extending bracing members 12'. The bracing members 12' as shown extend between adjacent beams and are secured to the upper and lower flanges 4' and 6' respectively and to the webs 3' and are provided with projecting portions 14' which extend between the narrower lower flanges 6' of the beams and are attached to transverse flange plates 32 but lack projecting upper portions inasmuch as the beams are arranged with their upper flanges closely adjacent, as in Figure 4. Where bracing members 2 are incorporated in the construction their purpose is three-fold: (1) To add a diagonal system to the horizontal (flange) and vertical (web) members and thus obtain a transverse truss to constrain the main beams to act as a unit; (2) to support and stiffen the loaded flanges; and (3) to act as longitudinal reinforcement of the main beams where the members 2, 2' are continuous.

Beams such as the rails shown in Figure 9, the T-members shown in Figures 11 and 12, the angles shown in Figure 13 and the Z-members shown in Figure 14, can also be used if desired. In the case of the rail members shown in Figure 9, transversely arranged bracing members 18 or 18' can be used, being welded to the webs 19 and flanges 20 of the rails, the welds which secure the bracing members 18 to the flanges 20 serving also to secure the flanges 20 of adjacent rails together. Flange plates 32 complete the transverse distributing system, being welded to the rail heads 30 and to the transverse bracing members 18 or 18'.

In the case of the T-members shown in Figure 11, alternate T-members are placed with their flanges oppositely located and reinforcing members 2 extending between the webs 21 and the edges of the flanges 22 brace the flanges of those T-members having their flanges at the upper portions thereof. In this arrangement it will be noted that the welds which secure adjacent flanges together also secure thereto the webs 23 of the intermediate oppositely disposed T-members and the bracing members 2. In the arrangement shown in Figure 13 angles are used having horizontal flanges 24 and vertically extending flanges 25 and bracing members 2' serve to reinforce the flanges 24 and flanges 25. Welds secure the horizontal flanges together and to the bracing members 2' and the vertical flanges to the transverse plates 32 and bracing members 2'. In the arrangement of the Z-members shown in Figure 14, the reinforcing members 2 brace the upper flanges 26 from the webs 27 and welds secure adjacent upper and lower flanges 26 and 28, respectively together. In Figures 11, 13 and 14, members 2 act as diagonal web members of a transverse truss system.

In the arrangements so far described reinforcing members which brace flanges of the beams have been used but it is possible to place some beams so that reinforcing members are not necessary. Thus, as shown in Figure 10, the rails are placed so that the flanges 20 are braced by the heads 30 of intermediate rails to which the flanges 20 are secured by welds. In each of the constructions previously described as well as in the arrangement shown in Figure 10, it is to be understood that the welds uniting adjacent flanges can be continuous throughout the length of the beams or can be interrupted or spot welded.

Where a number of beams are grouped together to form the floor structure the flanges of the beams besides being welded together may also be joined by transversely extending bars or plates as 32, shown in Figure 1. The bar or plate can be only of sufficient width to act as a tie, in which case a number of bars or relatively narrow plates spaced along the length of the beams 1 are used. In cases where a flat floor is desired cover plates extending substantially throughout the whole area of the floor can be used. The plate or bar 32 is secured to the beam flanges by welding or in any other suitable manner. In the case of the constructions in which the transversely arranged reinforcing members, as 10 and 12 of Figures 5 and 6 respectively are used, the plates 32 can be placed along the line of the reinforcing members, being directly over or under the reinforcing members 10 as in Figure 5 or adjacent to the reinforcing members 12 as in Figure 7 so that the projecting portions 14 of the reinforcing members 12 may be welded or otherwise secured to the transversely extending plates 32. In both of these constructions transversely extending bars 32 may be secured to both the upper and the lower flanges of the beams. Transversely extending plates can also be used in connection with the structure shown in Figure 8, being secured to the lower flanges thereof and where the transversely extending bracing members 12' are used the plates 32 are secured to the bottom edges of the bracing members 12'. As shown in Figure 9 a transversely extending bracing member 32 can be used to join the heads 30 of the rails which, in this construction, are placed at the bottom of the beams

and the transversely extending bracing members 18 or 18' secured to the transversely extending plates 32. In the construction shown in Figure 12 transversely extending plates 32, preferably forming a continuous surface, can be secured to the upper ends of the webs 33 of the spaced T-members and the members 32 can be braced from the webs by longitudinally extending bracing members 5 which may be continuous if desired. As desired, transversely extending plates 32 can be used to connect the flanges 34 of the T-members. In the construction shown in Figure 13 transversely extending plates 32 preferably forming a continuous surface, can be used to join the upper edges of the vertically extending flanges 25. In each of the constructions illustrated, as in Figure 1, the transversely extending member or plate can be of any desired width or a plurality of cover plates extending over the full area of the floor construction can be used.

In constructions where greater strength is desired beams of greater depth can be associated with a floor construction in accordance with this invention as shown in Figures 1 to 5. In Figures 1, 2, 3 and 4 the beams 36 of greater depth are associated with the floor construction in different ways, the beams 36 extending parallel with the beams 1 of the floor construction while in the arrangement shown in Figure 5 the beams 36 extend transversely of the beams 1. As shown in these figures the beams 1 may rest directly upon the flanges 37, 38 of the beams 36 and be secured to the webs 39 thereof by angles 40 or the beams 1 may rest upon angles 41 secured to the webs 39 of beams 36.

In each of the arrangements shown it will be noted that where a number of the reinforced beams are grouped together for use in a floor construction the beams are secured together either by having their adjacent flanges welded or by transverse bracing members and transverse bars or plates so that the beams act as a unit in resisting stresses longitudinally and transversely and there is an increased strength provided transversely and in some of the types longitudinally as well of the floor. The arrangements illustrated also provide for lateral distribution of the loads to a number of the beams permitting of the use of much lighter or shallower beams.

In a construction such as is shown in Figure 6 the transverse bracing members 12 and the tie-bars 32 secured to the top and bottom flanges act as a transversely extending beam which provides for a lateral distribution of the load throughout the floor structure. This is also the case in the construction shown in Figure 8 in which portions of the upper flanges 4' cooperate with transverse bracing members 12' and the tie members 32 to form transverse beams or trusses. It will also be noted that there is a lateral distribution of the load through these bracing members acting in shear. In constructions where inclined bracing members as 2, 2', 5, 5', or 7, 7' of Figure 1 are used the bracing members cooperate with the webs and flanges of the beams to act as transversely arranged trusses and effect a lateral distribution of the loads. The lateral strengthening of the floor structure present in each of the constructions illustrated serves to brace the framing by which it is carried and permits of lessened lateral bracing of the structure.

Where desired, openings can be made in the upper flanges in constructions such as are shown in Figures 1 to 5 inclusive and the space between the beam flanges filled with concrete and the openings in the flanges thereafter closed. Constructions such as are shown in Figures 6, 8 and 12 are open at the bottom and these structures can be lined with cement by use of a cement gum or may be painted in the usual manner. Cover plates, when used, or the abutting flanges, permit of water-proofing the structure and provide suitable bases for a pavement or other surface thereon as at 41a in Fig. 1. When desired, sections of the floor up to the limit of convenient handling can be assembled for installation as units and be ready to sustain a load immediately after erection.

I claim:—

1. A metallic floor structure comprising a plurality of I-beams arranged with their flanges overlapping, girders of greater depth at opposite sides of said shallower beams and extending parallel thereto, means bracing the webs and flanges of said I-beams and top and bottom plates cooperating with said bracing means to form transverse beams extending to said girders.

2. A metallic floor structure comprising a plurality of I-beams arranged with their flanges overlapping and forming two continuous and parallel surfaces, plate girders of greater depth extending parallel thereto at opposite sides of said I-beams and means between said surfaces bracing the web and flanges of said beams and forming therewith transverse beams extending to said plate girders.

3. A metallic floor structure comprising a plurality of I-beams arranged with their flanges overlapping and forming two continuous and parallel surfaces, means between said surfaces bracing the webs and flanges of said I-beams, and top and bottom plates cooperating with said bracing means to form transverse beams.

4. A metallic floor structure comprising a plurality of rolled, undistorted I-beams arranged with their flanges overlapping and forming two continuous and parallel surfaces, and means between said surfaces bracing the webs and flanges of said I-beams.

5. A metallic floor structure comprising a plurality of I-beams arranged with their flanges overlapping so as to form an arched surface and providing two continuous and parallel surfaces, and means between said surfaces bracing the webs and flanges of said I-beams.

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