Oct. 3, 1933. J. G. L. SKAR 1,928,797

CONTINUOUS FLOORING FOR BOOKSTACKS

Filed Sept. 18, 1931 3 Sheets-Sheet 1

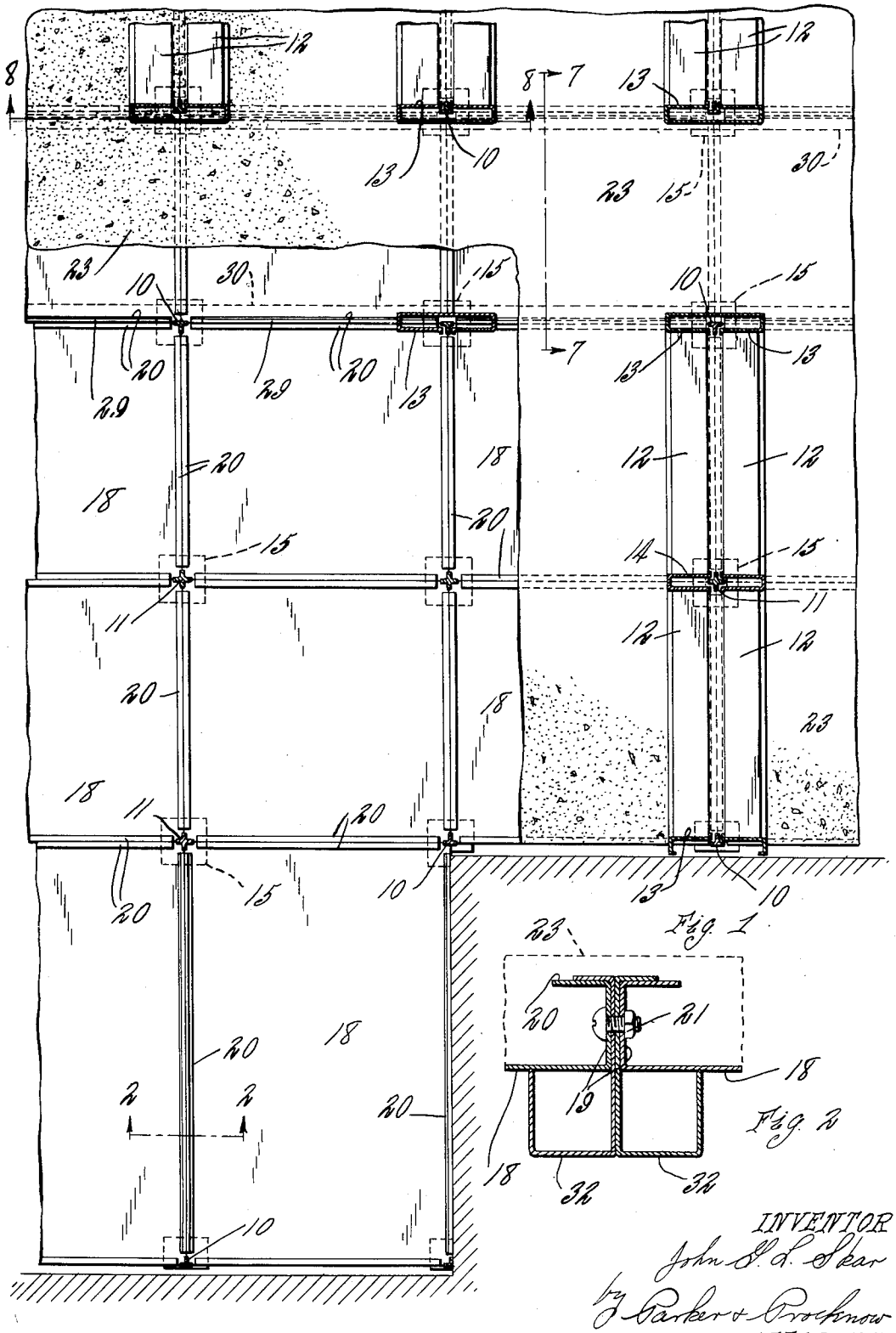


Fig. 1

Fig. 2

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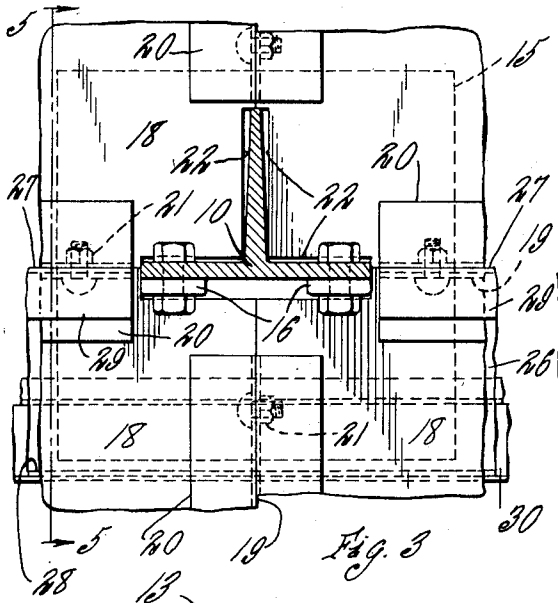


Fig. 3

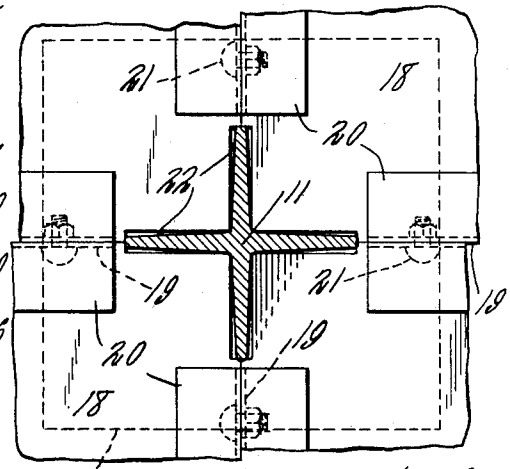


Fig. 4

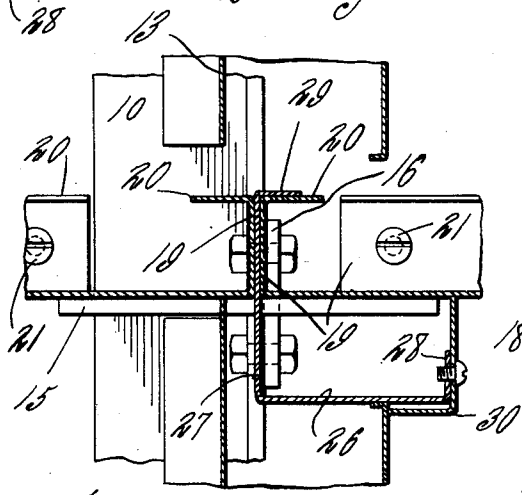


Fig. 5

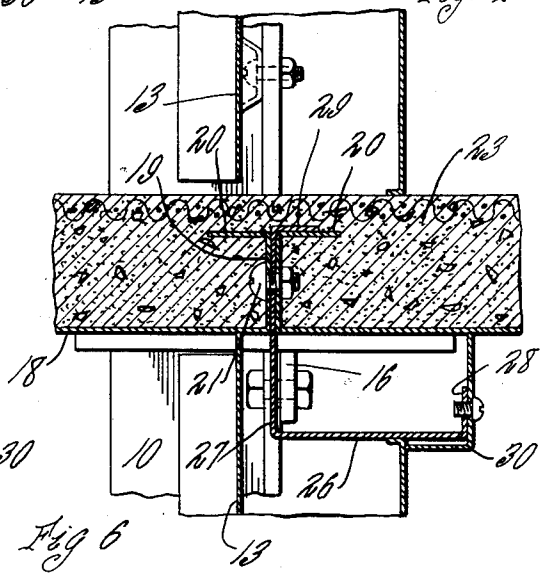


Fig 6

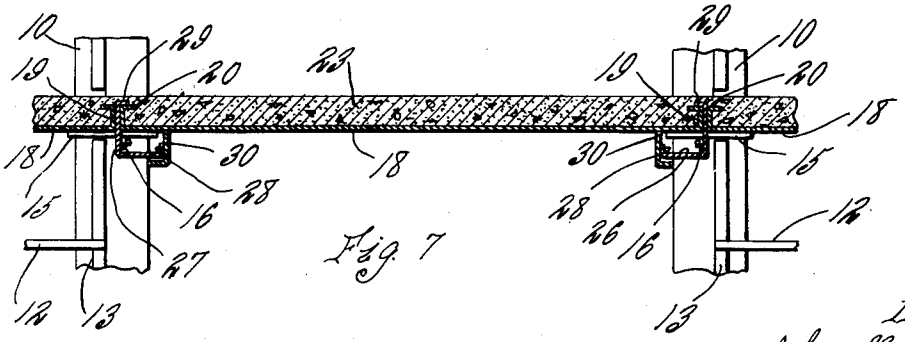


Fig. 7

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CONTINUOUS FLOORING FOR BOOKSTACKS

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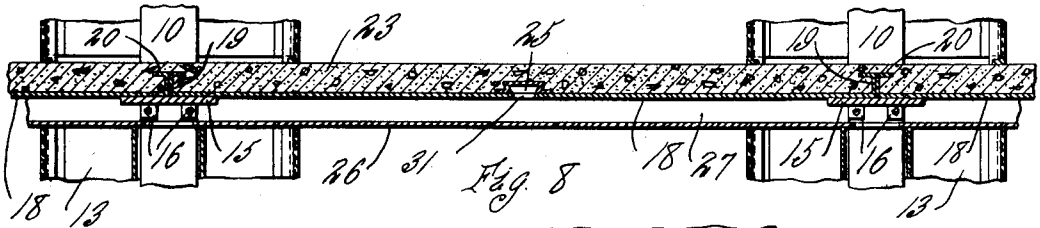


Fig. 8

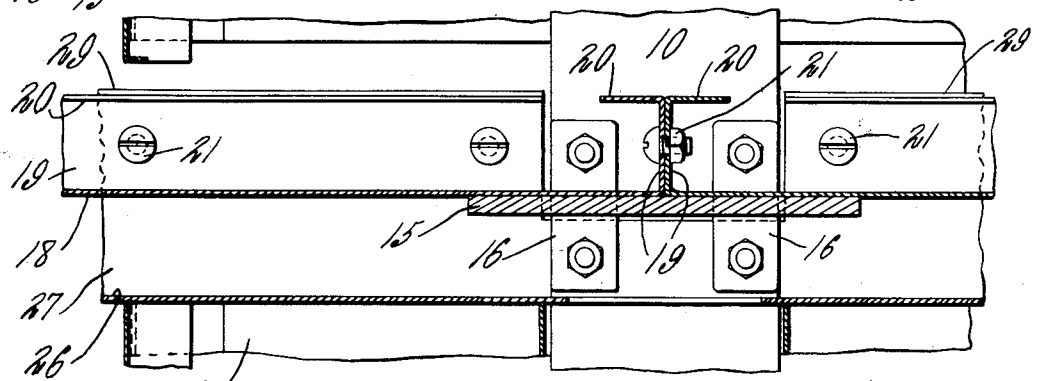


Fig. 9

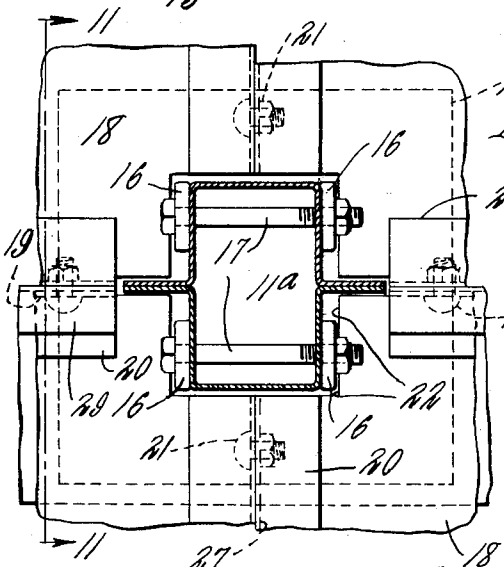


Fig. 10

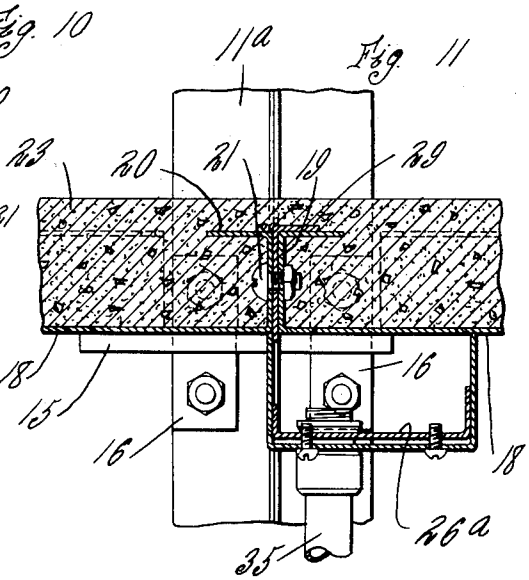


Fig. 11

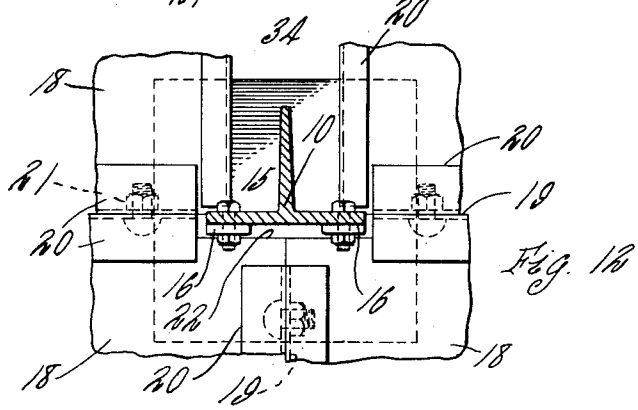


Fig. 12

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UNITED STATES PATENT OFFICE

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CONTINUOUS FLOORING FOR BOOKSTACKS

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Application September 18, 1931
Serial No. 563,521

9 Claims. (Cl. 72—70)

This invention relates more particularly to improvements in floor constructions for library stacks or analogous structures.

Library stacks commonly comprise ranges of book racks or shelving and a skeleton supporting frame or structure therefor including upright columns or main supporting members and longitudinal and transverse horizontal beams or structural members which interconnect and laterally support the upright members and also support the floors or galleries which extend along the main aisles and the branch or lateral aisles between the book racks or shelving. The book racks or shelving are ordinarily arranged in tiers several stories or several tiers high, the floors being located at appropriate levels to afford suitable access to the shelving of the different stories or tiers.

One object of this invention is to provide a practical and desirable improved floor construction for library stacks or structures of the sort mentioned which will simplify and reduce the cost of the structure.

Other objects of the invention are to provide a floor construction in stacks or structures of the sort mentioned which can be built with the minimum labor and at the minimum cost but which will be strong and durable; which while being of light weight and the minimum depth, will be strong and rigid; which eliminates the usual horizontal floor beams or supporting members used in such structures; which provides a combined concrete and metal floor that is of light weight but strong and rigid and has a flat, metal under-surface or ceiling; which comprises light metal forms and concrete or plastic flooring material which is molded in and incorporated with the metal forms; which comprises shallow light metal forms which are permanently secured in and supported by the skeleton frame structure, and a concrete or analogous material which is poured or molded in said metal forms and together therewith forms the flooring; which provides a continuous, integral floor comprising shallow, flat metal forms which span the spaces between the upright supporting members of the structure, and a layer of concrete or analogous material which is adapted to be poured or molded in the metal floor forms and extends across and covers the joints between the forms thereby connecting or tying together the forms and forming a continuous, unbroken floor surface; and also to improve library stacks and analogous structures in the other respects hereinafter described and set forth in the claims.

In the accompanying drawings:

Fig. 1 is a sectional plan view of a library stack structure embodying my invention, a portion of the concrete of the flooring being broken away to show the metal floor forms.

Fig. 2 is a transverse, sectional view thereof enlarged on line 2—2, Fig. 1.

Fig. 3 is an enlarged sectional plan view showing one of the upright columns used at the ends of the racks and the adjacent portions of the floor forms supported thereby.

Fig. 4 is a similar view showing one of the intermediate columns and adjacent floor forms.

Fig. 5 is a sectional elevation on line 5—5, Fig. 3.

Fig. 6 is a view similar to Fig. 5 but showing the concrete flooring in place.

Fig. 7 is a sectional elevation enlarged, across the main aisle, on line 7—7, Fig. 1.

Fig. 8 is a similar sectional elevation lengthwise of the main aisle on line 8—8, Fig. 1.

Fig. 9 is a fragmentary sectional elevation similar to Fig. 8, but on a larger scale, and omitting the concrete.

Fig. 10 is a sectional plan view similar to Fig. 3 but showing a structure having hollow sheet metal columns.

Fig. 11 is a sectional elevation on line 11—11, Fig. 10 but showing the concrete in place.

Fig. 12 is a sectional plan view showing a slightly modified construction of the metal floor forms, to provide ventilating openings beneath the shelves of the stacks.

Fig. 1 illustrates a usual library stack arrangement in which a number of book racks are arranged in parallel rows or ranges with the book racks of each row spaced apart by lateral or branch aisles between them and with a main aisle extending between two rows of racks and connecting with the lateral or branch aisles. The stack, as shown, comprises upright supporting columns or members 10 and 11 which are respectively arranged at the ends and intermediate portions of the several racks and form the main supports for the shelves, which are shown at 12 and extend between end and intermediate, hollow sheet metal casings 13 and 14 which encase and are secured to the columns 10 and 11 respectively. This invention is not concerned with the particular construction of the individual book racks or manner of supporting the shelves of the same, and the shelves can be supported from the upright columns by any usual or suitable constructions. It will be understood that the book racks are similarly arranged in different tiers or stories with the racks in one story directly over the racks in another story.

The upright column—sections or supporting members 10 and 11 of the different tiers or stories are arranged vertically one above another and are connected together to form columns extending the full height of the stack. Preferably, a flat, horizontal bearing plate 15 is arranged on the upper end of each column section of one tier

and the column section directly thereover in the next tier rests at its lower end upon the bearing plate 15, that is, the column section of one tier is arranged directly over the column section of the next lower tier and is supported thereby through the medium of the bearing plate 15 which extends between the adjacent ends of the column sections of the two tiers. The adjacent ends of the column sections are, as shown, rigidly connected and held in position by splice plates 16 which extend vertically through slots in the bearing plate 15 and are bolted to the vertical sides of the column sections. In the case of the T-shaped and cross-shaped columns shown in Figs. 1, 3, 4 and 12, the splice plates are arranged against the sides of the opposite flanges of the column sections and bolted thereto, whereas in the case of the hollow sheet metal column 11^a shown in Fig. 10, the splice plates are arranged at opposite sides of the hollow column and secured thereto by bolts 17 passing through the column sections and through the splice plates.

The bearing plates project laterally from the columns and provide bearings or supports for sheet metal floor forms or sections 18. These floor forms or sections extend horizontally between the upright columns or supports, with the columns disposed at the four corners of each form or section and each floor form or section 18 bearing at its corners upon and being supported by the bearing plates 15 of four columns. Thus, as shown in Fig. 1, each column supports the adjacent corner or corners of one or more of the metal floor forms or sections 18, depending upon the location of the column in the structure, each column in the intermediate portions of the structure partially supporting four sections whereas the columns along the sides of the structure may each partially support one or more sections.

Each metal floor form or section 18 preferably consists of a flat sheet metal plate having upstanding marginal flanges 19 on its four sides provided with inturned upper edges 20. The flanges 19 of the floor forms are cut away at the corners of the forms to leave space between the flanges of adjacent forms for the passage of the upright columns 10 or 11 but between the columns the flanges 19 of adjacent sections are adapted to abut against each other and be secured together by bolts 21 or other suitable fastening means (see Fig. 9) passing through the flanges 19 at suitable points. The corner portions of the bottom plates of the floor forms or sections 18 may be also notched as indicated at 22, Figs. 3 and 4, to fit around the flanges or wall portions of the upright columns and provide an opening for the passage of the splice plates. The metal floor forms or sections are thus supported at their corners by the columns, and being secured together and fitting around the columns, they serve to tie together and laterally support the columns and unite the columns and forms in a unitary structure.

After this metal structure consisting of the upright columns or supports and the horizontal floor forms or sections 18 has been erected, the floor is completed by pouring or molding the concrete or other plastic flooring material 23 in the metal forms 18 and leveling and finishing it to form a desirable floor surface. This molded layer 23 fills the forms and preferably is made deep enough to extend above and cover the inturned edges 20 of the side flanges of the forms. As shown in the drawings, with the exception of Fig. 12, the layer of concrete extends continuously over the joints between the adjacent metal forms or sections 18 and, being preferably reinforced, as by embedded wire netting forms, a strong, continuous, unbroken concrete floor surface. This continuous layer of composition in which the edge flanges of the metal floor forms or sections are embedded, when set, ties together or constitutes a strong bond between the several metal floor sections or forms, and the metal forms or sections having their flanged edges embedded and anchored in the concrete, greatly increases the tensile strength of the composition layer. A composite metal and concrete or plastic composition floor is thus produced which has great strength and rigidity, although it may be of comparatively little depth and of relatively light weight.

As shown in Fig. 8, the metal floor forms or sections 18 may be provided between their opposite side edges with a channel shaped strip 25 welded or otherwise secured to the top face of the bottom plate of the form and adapted to be embedded in the composite layer. This strip stiffens and strengthens the metal form or section between its edges and also provides a channel or conduit through which electric conductors or the like may extend to furnish current for the lamps employed for lighting the stack.

The flooring constructed as described and illustrated has a flat smooth sheet metal bottom surface which forms a flat metal ceiling. The undersurface of this ceiling plate may be painted or otherwise finished to provide an attractive ceiling.

It is usual in library stacks or structures of this type to provide conduits for housing and hiding electric conductors, and in cases where the book racks are disposed in ranges or rows at opposite sides of a main aisle, it is desirable to provide main conduits for the conductors extending along this main aisle adjacent the ends of the book racks at opposite sides of the aisle. Conduits for this purpose are conveniently formed in the structure herein described by bent sheet metal members 26 (see Figs. 5, 6 and 7) which have upright side flanges 27 and 28 connected by a bottom horizontal web portion. The flanges 27, which are deep, extend up between and are clamped between the edge flanges 19 of the adjacent metal floor forms and preferably have inturned top edges 29 overlying the top edges of the form flanges. Each of these conduit members 26 extends outwardly from the columns along one side of the main aisle and forms a conduit or space beneath the ceiling which may be closed by a removable cover plate 30 extending along the outer edge of the member 26 and *xx* secured by screws to the upturned outer flange 28 of the member 26. These cover plates 30, as shown, are of angle shape in cross section having vertical flanges which extend upwardly to the ceiling plate and horizontal bottom flanges which extend inwardly under the conduit members 26. The conduits can be readily opened along their sides to insert or remove conductors by removing the cover plates. The conduits thus formed extend laterally only slightly beyond the upright end casings or members 13 of the racks and are inconspicuous. The conduit members 26 formed and arranged as herein described, in addition to forming the conduits or housings for conductors or the like, also serve as stiffening and strengthening *xxx* members for the floor. The wire conduits formed by the channel strips 25 preferably extend lengthwise over the lateral aisles between the book racks

and communicate with the conduits formed by the members 26 by means of holes 31, Fig. 8, through the ceiling plates of the floor forms at points where the conduits intersect, thereby enabling conductors to be passed from the conduits along the main aisle into the conduits for the lateral aisles.

In cases where the span between columns is excessive, the floor may be strengthened by members similar to the conduit members 26 secured between the edges of the floor forms or sections extending between such widely spaced columns. Such a construction is shown in Fig. 2 in which two such strengthening members 32 are secured between adjacent edges of two floor forms or sections 18. These members 32 in this construction consist of bent sheet metal plates having vertical walls which extend up and are secured between the flanges 19 of adjacent floor sections, the portions of the members 32 beneath the floor sections being bent horizontally outward and then upwardly to meet the under face of the bottom plates of the floor forms or sections.

If desired, the floors may be constructed so as to provide ventilation openings therethrough. This may be readily accomplished in a composite metal and concrete floor such as hereinbefore described by making the metal floor forms 18 that extend along the lateral aisles of less width so that they will not meet beneath the book racks, but will leave a gap or opening 34 between their adjacent flanged edges beneath the racks as shown in Fig. 12. The concrete or composition layer on these floor forms or sections of course does not bridge this opening but terminates at the spaced edges of the floor forms. Such ventilation openings may be provided in sufficient number and wherever necessary, preferably beneath the book racks, to afford this required ventilation.

In the modified construction shown in Fig. 11 the conductor conduit is constructed substantially as before explained except that its removable cover is of channel section and encloses the conduit member 26^a and is secured by screws to the bottom thereof. In this construction, the conductors are led into the conduit through an upright pipe 35 connecting with the bottom of the conduit.

I claim:

1. The combination with upright supports, of metal floor sections supported by and bridging the spaces between said supports, a conduit arranged below said sections and having a wall extending up and secured between edges of adjacent sections, and floor surface material supported on said floor sections.

2. The combination of metal floor sections arranged horizontally edge to edge and each comprising a bottom plate and upstanding edge flanges, and a metal conduit arranged beneath said floor sections and having a wall which extends up and is secured between the edge flanges of adjacent floor sections.

3. The combination of metal floor sections arranged horizontally edge to edge and each comprising a bottom plate and upstanding edge flanges, and a metal conduit arranged beneath said floor sections and having a wall which extends up and is secured between the edge flanges of adjacent floor sections and having a removable wall closing one side of said conduit.

4. The combination of metal floor sections arranged horizontally edge to edge, and a metal member having a bottom plate spaced below the bottoms of said sections and having walls extending upwardly from opposite edges of said bottom plate, one of said upwardly projecting walls extending up and being secured between the edges of adjacent floor sections.

5. The combination with spaced upright supports, of metal floor forms supported by and bridging the spaces between said supports, certain of said forms having bottom plates reinforced between their edges by a conduit-forming channel member secured on said bottom plates, and set plastic composition supported by and incorporated with said floor forms.

6. The combination with spaced supports, of a floor structure comprising metal forms arranged horizontally edge to edge and supported by and bridging the space between said supports, said forms having bottom plates and upstanding side and end flanges, and a body of set plastic composition filling and supported by said metal forms and extending continuously over said side and end flanges thereof and across the joints between the side and end edges of said forms, the bottom plates of said forms providing a metal ceiling beneath said composition.

7. The combination with spaced upright supports, of a floor structure comprising metal forms each having a bottom and upstanding longitudinal and transverse marginal flanges and arranged horizontally edge to edge longitudinally and transversely of the floor and extending from one to another of said upright supports and supported at their corners thereby and connected to each other at their sides and ends between said supports, and a body of set plastic composition filling and supported by said metal forms and extending continuously over said flanges and across the longitudinal and transverse joints between the forms.

8. The combination with spaced supports, of a composite floor structure bridging the spaces between said supports and comprising light sheet metal forms supported by said supports and each having a bottom plate and upstanding edge flanges at their sides and ends, the side and end flanges of adjacent forms abutting, and a set plastic composition filling said forms and extending continuously over said flanges and across the longitudinal and transverse joints between said forms and rigidly uniting the forms and composition in an integral mass.

9. The combination with spaced upright supports, of a composite floor bridging the spaces between said supports and comprising separate horizontally arranged metal form plates provided with upwardly projecting parts and each supported at its corners by a plurality of said supports, said form plates being connected to each other at their adjacent edges extending both longitudinally and transversely of the floor, and a set plastic composition supported on said form plates and in which said upwardly projecting parts are embedded, said composition extending continuously over and covering the form plates and the longitudinal and transverse joints between them and uniting the several form plates and composition in an integral mass.

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