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FLOOR CONSTRUCTION

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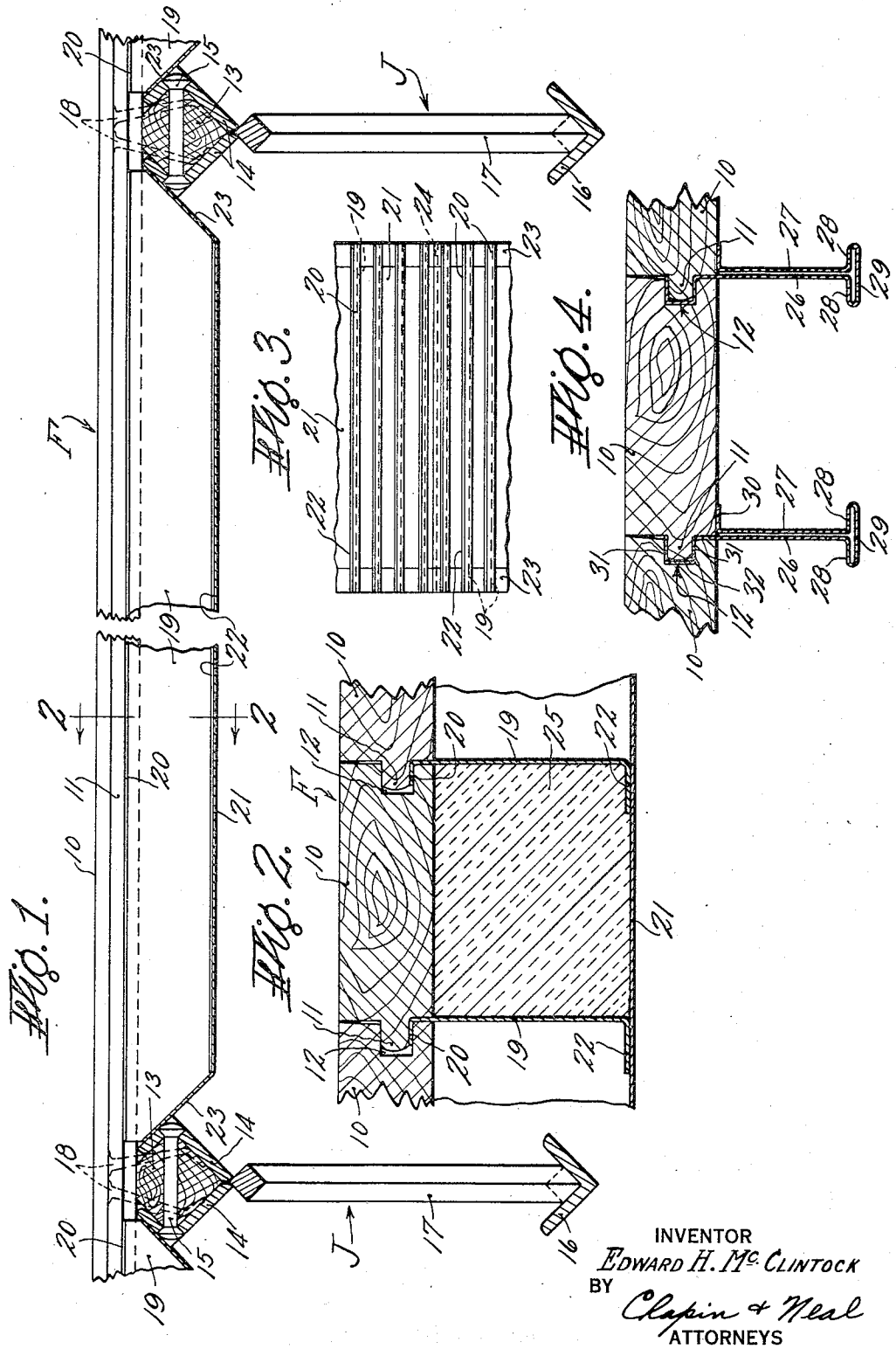


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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FLOOR CONSTRUCTION

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This invention relates to improvements in floor constructions.

The invention has for its general objects the provision of an improved floor construction, which has the advantages of being relatively light in weight per unit of area; of being strong and rigid enough to withstand, without deflections of substantial degree, relatively heavy loads; and of enabling substantial savings to be effected in the cost of materials and labor.

The invention has for a particular object to combine with the floor boards, underlying members of sheet metal rigidly attached thereto in such a fashion as to produce, in effect, a series of composite beams of box or other shape, to stiffen the floor and prevent it from undue deflection under substantial loads even though the span between adjacent joists, or other floor supports, is increased far beyond the limits heretofore permissible.

The invention, in its preferred form, includes a series of vertical members of sheet metal, preferably one for each floor board, and an underlying horizontal member of sheet metal to which the vertical members are attached in spaced and upstanding relation. The vertical members are rigidly attached to the floor boards, preferably by clamping each member along its upper edge between the matching of a pair of adjoining floor boards. The horizontal member is preferably, although not necessarily in all cases, supported at its ends from the floor joists or other supports.

These and other objects will more particularly appear as the detailed description proceeds and will be pointed out in the appended claims.

The invention will be disclosed with reference to the accompanying drawing, in which:

Fig. 1 is a sectional elevational view showing a preferred form of floor construction embodying the invention;

Fig. 2 is a fragmentary cross sectional view thereof, taken on the line 2—2 of Fig. 1;

Fig. 3 is a small-scale, fragmentary top plan view of the sheet metal unit shown in Fig. 1; and

Fig. 4 is a view taken similarly to Fig. 2 and showing a modification of the invention.

Referring to this drawing; two floor joists J, which may be of any suitable type or construction, are shown as supporting a flooring F, made up of a plurality of matched boards 10, the tongues and grooves of which are marked 11 and 12, respectively. These joists, in the particular form shown, include a nailing strip 13 held compressed between a pair of angle irons 14 by a suitable fastening means such as the rivet 15. The angle irons 14, which form the top chord of the joist, are interconnected with the angle iron bottom chord 16 of the joist by a latticed web member, comprising a rod 17 which is bent back and forth to engage first with one chord and then with the other chord of the joist,—being welded thereto at the areas of contact. The particular joist construction, however, is not essential to the invention and is given merely as an illustrative example of one type of joist which has been found suitable. Also, the supports for the flooring need not necessarily be joists because under certain conditions hereinafter described, the walls only may be used to support the flooring without any intervening joists.

The joists J, of whatever construction, or other supports are set far apart on centers,—say for example 36 inches or more as distinguished from the usual maximum permissible limit of 18 inches. The boards 10 are nailed to the nailing strips 13 of the joists, as indicated at 18. With the joists, thus spaced, a serious deflection in the floor F would occur under ordinary loads.

To avoid any deflections of substantial degree under ordinary loads, I provide a series of sheet metal members 19, one for each floor board 10, and secure each member 19 to the flooring by tightly inserting its upper portion in the matching between adjacent boards 10, whereby when the boards are driven up the members 19 become clamped thereto. For example, each member 19 is flanged at its upper end preferably, but not necessarily, by bending such end at right angles to form a flange 20 which is continuous and coextensive in length with its member 19. But the flange 20 need not necessarily be continuous although that is the most desirable form. Flange 20 is engaged between the lower face of a tongue 11 and the lower face of the groove 12, as clearly shown in Fig. 2. The upper vertical portion of the member 19 is also clamped between the lower vertical faces of the two adjoining boards. The lower edges of all the members 19 are secured to a member 21 of sheet metal. As shown, each member 19 has its lower portion turned at right angles to form a flange 22, which is suitably secured, as for example by spot welding at frequent intervals to the member 21. The construction affords the equivalent of a series of box girders, each of composite construction and consisting of the sheet metal webs 19, the sheet metal bottom flange 21 and a top flange comprising the board 10 and the flanges 20. These box girders materially stiffen the flooring and avoid undue deflection of the boards 10 which otherwise would

occur under ordinary loads with the abnormally wide spacing of the floor joists J.

It is preferable and usually desirable, but not necessarily always essential, to support the sheet metal members from the floor joists J or other supports, and the ends of members 21 may be supported from the joists in any suitable manner. When joists of the particular type disclosed are used, the ends of each member 21 may be supported therefrom in a very simple and inexpensive way. Opposite ends 23 of each member 21 are bent into upwardly diverging relation, like the ends of a pan, with a slope corresponding to that of the upper legs of the angle irons 14. The member 21 is then dropped in place between an angle iron 14 of one joist and the adjacent angle iron 14 of the adjacent joist, with its ends resting on the upper legs of these two angle irons. It is not necessarily essential that the ends of member 21 be secured to the angle irons 14 although this can be done, as by welding or otherwise, if deemed necessary or desirable. The ends of members 19 will be cut to conform to the ends 23 of member 21 but the ends of members 19 are preferably not secured to the ends 23 because it is desired to allow for the lateral movement of members 19, necessary as will later appear during the operation of laying the floor.

For convenience, the sheet metal members are made up in a series of units, each of a size convenient to handle. Thus, each unit comprises a member 21 of convenient width,—say for example three feet wide,—and the necessary number (depending on the width of boards 10) of the members 19 affixed thereto. The members 21 of adjacent units preferably overlap, as shown at 24 in Fig. 3. Each unit is of relatively light weight because the members 19 and 21 are made of relatively thin sheet steel. For example, in the particular construction illustrated, the members 19 and 21 are made of 26 gauge and 24 gauge metal.

These overlapping sheet metal units serve also as a protective fireproofing. All parts of the floor boards, as well as the wooden nailing strips 13 are protected from below by an unbroken metallic covering made up of the members 21 and angle irons 14. If desired to insulate the floor, the space between each pair of members 19 may be filled with rock wool or other suitable insulating material.

An alternative construction is shown in Fig. 4. Here each reenforcing member is made of thin sheet steel, as before, but the metal is doubled over to provide a web of double thickness, comprising the parts 26 and 27, and a bottom flange, much like that of an I-beam, also of double thickness and made up of the parts 28 and 29. The web member 27 is shorter than its mate 26 and has its upper end bent at right angles to form a flange 30 which engages the lower side of a floor board 10. The other web member 26 has a part of its upper portion engaged between the vertical faces of a pair of adjoining boards 10 and has a U-shaped part, with horizontal legs 31 and a cross bar 32, to encompass all three sides of a tongue 11 and be engaged and held between the tongue 11 and its groove 12. This construction affords the equivalent of a series of T-beams, each having a composite top flange comprising the board 10 and the metal flanges 30 and 31. The lower edges of these members are not connected one to the other as are the members 19, above described, although obviously they may be if desired, in the same manner as shown in Fig. 2. The ends of these reenforcing members may be connected to the joists J in any suitable way or they may be used with some advantage, if not thus connected.

In laying the floor, the sheet metal units are laid in place between each pair of joists J with their ends 23 resting on the adjacent angle irons 14 of the joists. This is work which can readily be done by the carpenter who lays the floor, and the carpenter's work is not greatly different than before. He lays the boards 10 successively in place and nails them to the nailing strips 13 of the joists. The difference is that he engages the groove 12 of one board 10 with a flange 20 of one member 19 and then tilts the board downwardly until its tongue 11 engages the flange 20 of the next adjacent member 19. These members 19 are spaced apart by a distance equal to the width of boards 10 and it is necessary to drive them down forcibly because one member 19 must be deflected somewhat in order to allow the lower vertical face (beneath the tongue 11) of board 10 to move into place. But the member 19 springs back so that one of its vertical faces is pressed tightly against the aforesaid vertical face of the board, which thus becomes tightly held and gripped between a pair of members 19. Succeeding boards are applied in the same manner and, as each is forced into place, it locks a flange 20 between the lower wall of its groove 12 and the lower wall of the tongue 11 of the preceding board. The grip on the members 19 is still further increased when the boards are driven together tightly, as they usually are, to compress their upper vertical faces one against the other. Thus, the boards become tightly locked to the sheet metal members and the assembly affords the equivalent of a series of box girders, placed side by side, each having as the major portion of its top flange a floor board 10.

In the example shown, no lining floor is used, being deemed unnecessary, but obviously a lining floor can be used if desired and laid in the manner above described, after which another floor can be superposed thereon in the usual or any suitable manner. A lining floor is usually used to enable the floor boards to be satisfactorily jointed at abutting ends. This usually requires nailing of the boards at the end joints and the lining floor provides a medium into which the nails can be driven. Here, however, the flanges 20 serve to hold the ends of two abutting boards in perfect alignment and no nailing of the boards at their ends is necessary. At each side of the end-abutting boards is a straight metal flange 20, each of which extends along one board across the joint to the other board and thence along the other board. These two flanges hold the ends accurately aligned without the use of other fastening means. The flanges 20 also prevent the floor from warping and hold the constituent boards thereof in uniformly flat form.

By the use of the invention, substantial savings in cost may be effected. Thus, in the example shown two joists J, spaced 36 inches on centers, are used in place of the usual three, spaced 18 inches on centers and the sheet metal units are used to render the third joist unnecessary. Thus, there is a saving in cost of material equal to the difference between the cost of the one joist omitted and the cost of the sheet metal units used. As one illustrative example, the cost of joists in one case was 15 cents per square foot of floor while the cost of the sheet metal units was less than seven cents per square

foot of floor. The labor expense is substantially less. Then there is an additional saving in both labor and material where, as here, the lining floor is dispensed with.

It should be noted that the invention, in its broader aspects, is not dependent on the use of matched boards although the use of the latter is deemed preferable, more practical and satisfactory and much simpler. Still, it is possible to insert the webs 19 between adjacent boards and fasten them thereto in ways other than those herein shown. The main requirement is to have the floor boards rigidly secured to the sheet metal units.

It should be noted that the invention is not restricted in all its features to the use of joists. It is readily possible by increasing the depth of the webs 19 and the thickness thereof as well as the thickness of member 21, to materially increase the span between the supports, even to the point where the side walls alone will suffice without any intervening joists or supports. For example, a 20 foot span is possible if the webs be made, say 8 inches in depth as against the depth shown in Fig. 2, which is approximately two inches. The webs would be made say of 20 gauge metal and members 21 of 18 gauge metal. The depth of the webs would then be equal to that of the joists shown, wherefore the increase in depth of webs 19, necessary to secure the aforesaid long span, does not result in any additional vertical space over that necessary for joists J. In the case described, the ends of members 21 would not be bent upwardly as described and would rest directly on the walls or on ledges formed thereon.

Aside from the savings in costs of labor and materials, the invention provides a better and stronger floor than one which is constructed with the additional joists, necessary to secure the standard spacing, and without the stiffening and reenforcement provided by the sheet metal units. In effect, these units combine with the floor boards to form a series of composite box beams or girders having the bottom flange and both webs constructed of sheet metal and a top flange composed of wood and steel but largely of the wooden floor board. The result is a very light, strong and rigid deck, which will withstand heavy loads without deflections of substantial degree. Because the deflections are slight, no squeaking of the floor boards will occur.

For example, in the case of the construction illustrated, a weight of 225 pounds concentrated at the center of the span on two boards 10, each 2¼ inches in width, resulted in no deflection perceptible to the eye. Actual measurement showed a deflection less than $\frac{1}{16}$ of an inch. The aforesaid concentrated load is equivalent to a load of 450 pounds uniformly distributed along the length of the floor boards. This is for a width of 4½ inches of floor. For a 12 inch width the uniformly distributed load would be 1200 pounds. This is for a three foot span. Dividing this load by three, the load per square foot is obtained, namely 400 pounds. The same load imposed on the same boards having the same span between supports, but having no sheet metal or other stiffening means, resulted in a deflection so large as to be not only readily perceptible to the eye but actually dangerous, approaching closely to the point where the boards would break. This load is many times greater than is required for house construction and is several times greater than that required for offices, school houses and public auditoriums. The figures given are to be taken as purely illustrative and not as establishing limits. As above set forth, the same construction with changes in the depth of webs 19 and in the thickness thereof and of members 21, can be used to withstand other and greater loads and to enable the use of wider spans between supports.

Thus, the invention provides an improved floor construction, wherein sheet metal is combined with the wooden floor boards to secure a very strong and rigid yet light weight and resilient deck, and by the use of which substantial savings in costs of labor and material may be effected.

What I claim is:

1. A floor construction, comprising, spaced supports, a plurality of floor boards laid side by side in abutting relation, a sheet metal member underlying said boards and spanning the space between said supports and supported from the latter, and a plurality of webs of sheet metal fixed to said member and upstanding therefrom, each said web secured along its upper edge to a floor board.

2. A floor construction, comprising, spaced supports, a plurality of floor boards laid side by side in abutting relation, a sheet metal member underlying said boards and spanning the space between said supports and supported from the latter, and a plurality of webs of sheet metal fixed to said member and upstanding therefrom, each said web having its upper edge rigidly held between a pair of adjoining floor boards.

3. A floor construction, comprising, spaced supports, a plurality of matched floor boards laid side by side in abutting relation, a sheet metal member underlying said boards and spanning the space between said supports and supported from the latter, and a plurality of webs of sheet metal fixed to said member and upstanding therefrom, each said web having its upper edge engaged in the matching between adjoining floor boards and rigidly clamped therebetween.

4. A floor construction, comprising, spaced supports, a plurality of floor boards laid side by side in abutting relation on said supports and fastened thereto, and a plurality of sheet metal webs each held along its upper edge between a pair of adjoining floor boards and depending therefrom, a sheet metal member underlying said boards and spanning the space between said supports and supported from the latter, and a plurality of webs of sheet metal fixed to said member and upstanding therefrom, each said web secured along its upper edge to a floor board.

5. A floor construction, comprising, spaced supports, a plurality of floor boards laid side by side in abutting relation on said supports and fastened thereto, each board having a tongue and groove engagement with the adjoining boards, a plurality of sheet metal webs, each having the upper edge portion thereof held between the tongue and groove of adjoining boards and depending from such boards, and a sheet metal member supported at its ends from said supports and spanning the space therebetween, said member underlying and supporting a plurality of said webs.

6. In a floor construction, having a plurality of wooden floor boards laid side by side in abutting relation, a plurality of sheet metal webs, one for each said board and fixed to and depending therefrom, and a sheet metal member interconnecting the lower ends of said webs, the assembly providing a plurality of box beams the bottom flanges thereof being formed by said member,

the top flanges thereof by said boards and the webs thereof by the aforesaid webs.

7. In combination with the wooden board of a floor, a pair of sheet metal webs one on each side thereof and secured thereto and depending therefrom, and a sheet metal member uniting the lower ends of said webs, whereby said member, webs and board are connected to function as a box beam.

8. A sheet metal unit for reenforcing the boards of a wooden floor, comprising a sheet metal member extending lengthwise of said boards and underlying in spaced relation a plurality of said boards; a plurality of sheet metal webs, one for each overlying board, fixed to and upstanding from said member in spaced parallel relation and each underlying a joint between the side edges of a pair of adjoining boards, the spacing between said webs being equal to the width of said boards, said webs having right-angularly turned flanges along their upper edges to be fixed to one of the adjacent boards.

9. A sheet metal unit for reenforcing the matched boards of a wooden floor, comprising a sheet metal member extending lengthwise of said boards and underlying in spaced relation a plurality of said boards; a plurality of sheet metal webs, one for each overlying board, fixed to and upstanding from said member in spaced parallel relation and each underlying a joint between the side edges of a pair of adjoining boards, the spacing between said webs being equal to the width of said boards, said webs having right-angularly turned flanges along their upper edges to be fixed in the matching between adjoining boards.

10. The combination in a floor, of sheet metal webs one for each floor board and substantially coextensive in length therewith, each pair of abutting floor boards receiving between them the upper edge of one only of said webs, each web having a part turned at right angles to said edge to be engaged in the matching between said pair of abutting boards, each web extending downwardly from its board a substantial distance below the bottom thereof, and a sheet metal member underlying a series of said boards and interconnecting the lower edges of the webs which depend from such boards.

11. A floor construction, comprising, spaced supports, a plurality of floor boards laid side by side in abutting relation on said supports and fastened thereto, a sheet metal member underlying said boards in spaced relation and suspended from said supports, and a plurality of webs of sheet metal fixed along their lower edges to said member and extending upwardly to the floor boards and having their upper edges clamped one between each pair of abutting floor boards.

12. A floor construction, comprising, spaced supports, a plurality of floor boards laid side by side in abutting relation on said supports and fastened thereto, a sheet metal member supported from said supports independently of the floor boards and underlying said boards in spaced relation, and a plurality of webs of sheet metal fixed along their lower edges to said member and extending upwardly to the floor boards and having their upper edges clamped one between each pair of abutting floor boards.

13. The combination with the boards of a floor, of sheet metal webs one for each of said boards, each pair of abutting boards receiving between them and clamping the upper edge of one only of said webs, said webs extending downwardly a substantial distance below the boards, and a sheet metal member underlying said webs and fixed thereto.

14. The combination in a floor made up of matched boards, each having a tongue and groove engagement with the adjoining boards, of sheet metal webs one for each such board and having flanges right angularly turned from their upper edges, each pair of abutting boards receiving between them and clamping the upper edge of one only of said webs, the flanges of the clamped webs entering and being held between the tongues and grooves of abutting boards, said webs extending downwardly a substantial distance below said boards, and a sheet metal member underlying said webs and to which the lower edges of said webs are secured.

15. A floor construction, comprising, spaced supports, a plurality of floor boards laid on said supports in abutting relation and nailed thereto so as to draw one board tightly up against another, a sheet metal member underlying said boards in spaced relation, a plurality of sheet metal webs, one for each overlying board, fixed to said member along their lower edges and upstanding therefrom with their upper edges received one between each pair of abutting floor boards and clamped therebetween as said boards are drawn up by nailing into abutting relation, the aforesaid upper edges being free of interconnection except for the interconnection by said boards, and being free to be flexed laterally if and when necessary to allow said boards to be tightly drawn up and nailed.

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