June 25, 1940. J. R. O'DONNELL 2,205,859

STAIR CONSTRUCTION

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Fig. 1.

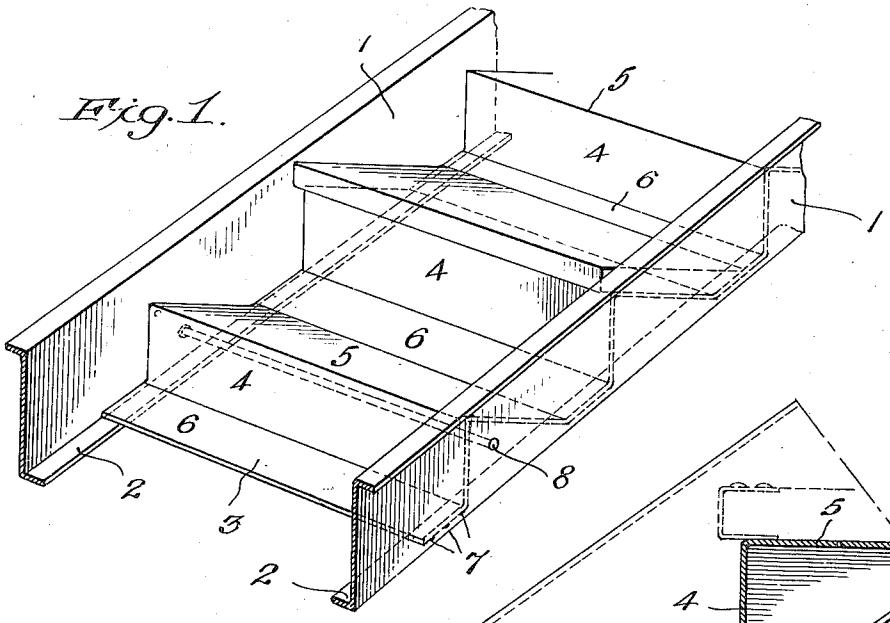


Fig. 2.

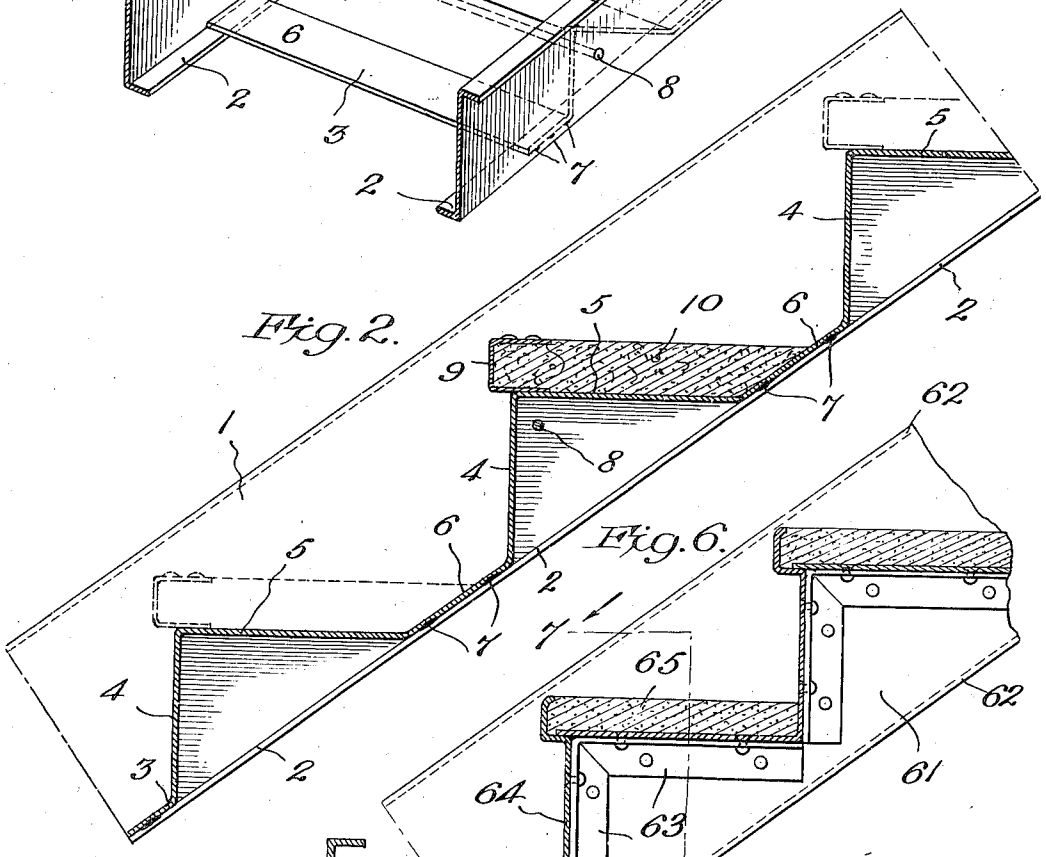
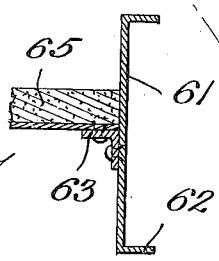


Fig. 6.

Fig. 7.



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Fig. 3.

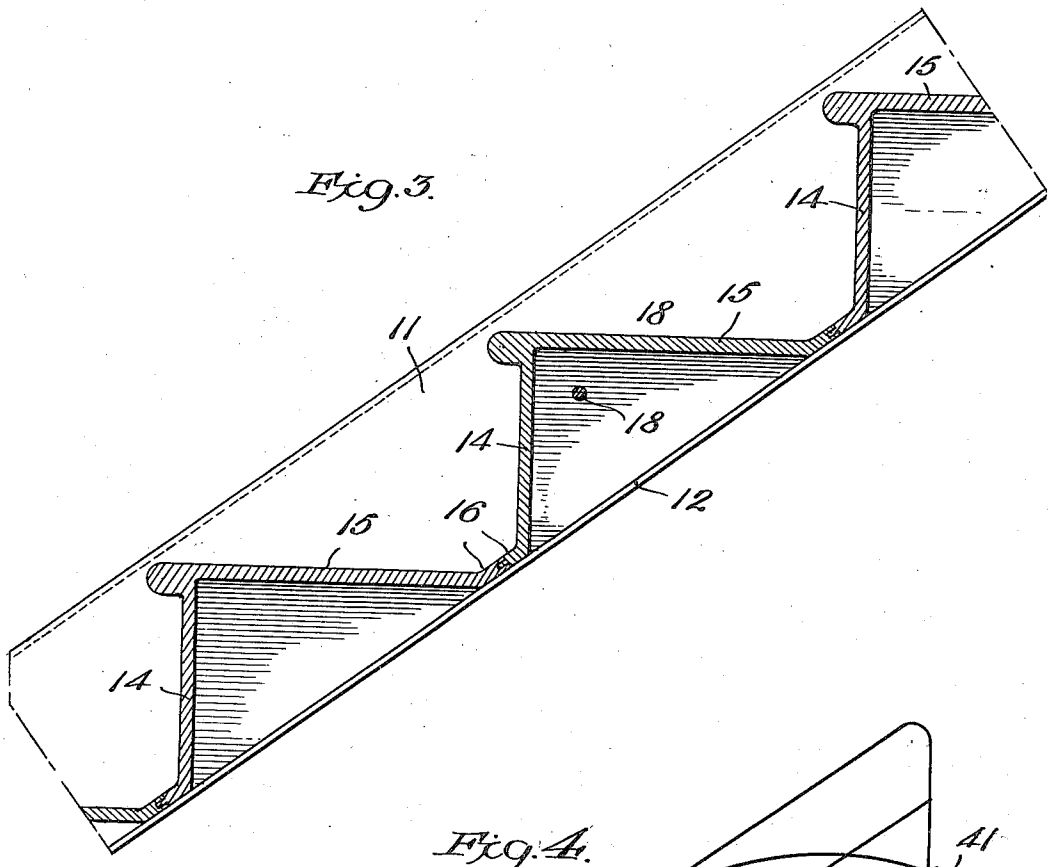


Fig. 4.

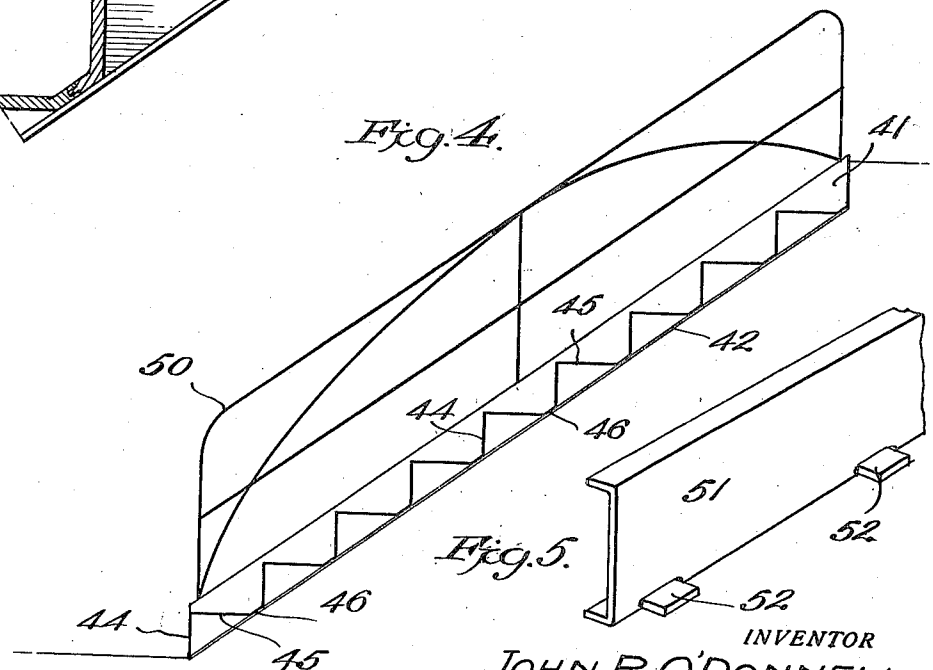


Fig. 5.

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STAIR CONSTRUCTION

John R. O'Donnell, Brooklyn, N. Y.

Application August 24, 1938, Serial No. 226,407

1 Claim. (Cl. 189—43)

The present invention relates to the art of stair construction, and, more particularly, to a stair construction of novel and improved character.

Heretofore, the type of construction most generally used in conventional stair construction was to employ integrally formed individual risers and treads which were supported by angle carriers of suitable shape riveted to steel stringers. Generally, light 10", mill-fabricated channels weighing about 8.2 pounds per foot or 12" by $\frac{3}{16}$ plate, weighing about 7.65 pounds per foot and bent in the shop to a 10" channel, were used. Angle carriers of suitable size and shape were riveted to the inner sides of these channels, and to these angle carriers were secured by means of rivets or similar fastening elements the individual risers and treads integrally formed for each step. Although this type of construction was satisfactory to a certain extent and was employed on a large scale, it had various serious disadvantages. Thus, the steel stringers of 10" were relatively heavy and expensive. In addition to this, the construction of these conventional stairs required a considerable amount of shop work, such as careful and accurate layout, punching, countersinking, fitting, and the like. The assembly of the complete stair construction required great skill and relatively long time. Although these disadvantages were well known in the art and from time to time various suggestions and proposals were made to solve the outstanding problem and to provide a simplified and improved stair construction, none, as far as I am aware, of these various suggestions and proposals was completely satisfactory and successful on a practical and industrial scale.

I have discovered that the problem may be solved in a remarkably simple manner.

It is an object of the present invention to provide a stair construction which eliminates the disadvantages of conventional designs.

It is another object of the present invention to provide a stair construction of novel and improved character embodying improved structural risers and treads supported in such a manner that they can be fitted into a stringer having a lesser depth to that employed and required in conventional constructions.

It is a further object of the invention to provide a stair construction which altogether dispenses with the conventional angle carriers and embodies arched risers and treads carried on the inturned leg or flange of Z-shaped stringers.

Still another object of the invention is to provide a novel and improved stair construction involving a plurality of risers and treads integrally formed from a single sheet of metal bent to form a plurality of stair treads and risers joined at their ends by a chamfer, said chamfer being secured to the lower and inwardly projecting flanges of a Z-shaped stringer by means of welding or some other appropriate fastening means.

The invention also contemplates a stair construction involving a steel sheet of appropriate width bent into a series of corrugations to form a plurality of stair treads and risers joined at their ends by a chamfer, said chamfer having such construction and arrangement as to conform to the inner face of the flanges of a Z-shaped stringer and to present only surfaces which are readily accessible for the purpose of cleaning.

It is also within contemplation of the invention to provide a staircase construction of improved character which is extremely light and simple in construction, requires a minimum of shop-work or skilled labor in its manufacture and erection, and which may be manufactured on a practical and industrial scale at a low cost.

Other and further objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings, in which

Fig. 1 illustrates a perspective view of a portion of a stair construction embodying the principles of the present invention;

Fig. 2 depicts a longitudinal sectional view on an enlarged scale, of the stair construction shown in Fig. 1;

Fig. 3 is a similar view of a modified embodiment of the invention;

Fig. 4 illustrates a side elevational view, somewhat diagrammatic in character, of another modified embodiment of the invention involving a trussed ornamental pipe rail;

Fig. 5 depicts a perspective view, somewhat fragmentary, of a modified form of a stringer;

Fig. 6 shows a longitudinal sectional view of a portion of a conventional stair construction; and

Fig. 7 is a cross-sectional view taken on line 7—7 of Fig. 6.

Broadly stated, according to the principles of my invention, a stringer considerably lighter than heretofore is provided, such as a Z-shaped stringer of about 7", weighing about 5.75 pounds per foot, and the inturned legs or flanges of such stringer are employed for supporting the stair structure proper. Instead of a Z-shaped stringer, a channel-shaped stringer having an inwardly directed plate or leg welded thereto may be employed with

equal or similar results. I render this relatively shallow stringer adaptable for the purposes of stair construction by eliminating the conventional angle carriers riveted to the stringers and heretofore employed for supporting the steel risers and treads and by employing arched risers and treads instead, having a junction surface therebetween which conforms to surface of the inturned flange of the Z-shaped stringer. In this manner expensive shop lay-out, punching, countersinking, fitting up and assembly operations are eliminated. I have found that arching the risers and treads from one supporting surface to the next has the advantage that by reducing the arch, the metal required for carrying a predetermined load can be likewise reduced. Thus, excellent results are obtained by integrally forming a plurality of risers and treads from a single piece of sheet metal which is corrugated to form a plurality of substantially vertical risers, a plurality of substantially horizontal treads, and a junction surface or chamfer at the junction of each riser and tread enclosing the same angle with the risers and treads as the stringer upon which they are to be mounted. This type of construction is not only very easily secured to the inturned flange of a Z-shaped stringer but at the same time eliminates any sharp angles and inaccessible corners from the stair construction in which dust and dirt can accumulate. I prefer to secure the chamfers to the lower, inwardly turned flanges of the Z-shaped stringers by means of spot welding, although, of course, any other appropriate method of fastening may be employed with equal or similar results. Thus, the risers and treads may be carried by stringers which are prevented from spreading by tie rods spaced at suitable intervals. Of course, instead of integrally forming a plurality of risers and treads of a single piece of material, it is also possible to provide individual combination risers and treads which are individually formed, for example, by means of casting.

The invention will now be more fully described to those skilled in the art in conjunction with the accompanying drawings.

Referring now more particularly to Figs. 1 and 2 of the drawings, a preferred embodiment of the invention is illustrated. Essentially, a pair of Z-shaped stringers 1 are provided, arranged in parallel-spaced position and having their lower flanges 2 turned inwardly. Between the inner faces of said stringers is mounted a corrugated plate 3 of steel bent to such shape as to provide integrally formed risers 4, treads 5 and connecting surfaces or chamfers 6. These connecting or junction surfaces of the risers and treads are so formed as to be parallel to the inwardly turned flanges 2 of the stringers and to securely rest thereon for transmitting the load on the treads to the stringers. Welds 7 are provided between the opposite surfaces of chamfers 6 and flanges 2 to positively and rigidly connect the corrugated plate to both stringers and to form a strong connection in between preventing lateral displacements thereof. In addition to these welds, or as an alternative, tie rods 8 may be provided between the stringers for securely connecting the same to a unitary structure and at the same time to provide support for the combination risers and treads resting thereon. A channel-shaped member 9 of suitable dimensions is welded or otherwise attached in a slightly protruding position to the outer extremity of treads 4 and defines a horizontal space above the tread which may subsequently be filled out with a suitable cementitious material 10 providing a strong wearing surface for the tread. This type of construction readily lends itself to the easy application of a flat soffit by bolting a flat, light steel sheet (not shown) to the finished structure. Where a flat soffit is a typical layout, each riser and tread may be bent in one piece and may be fastened to the soffit sheet where required. Although in Figs. 1 and 2 only three treads and risers have been shown, obviously, a greater or smaller number of treads and risers may be integrally formed in accordance with the length of the run or other considerations.

The modified embodiment of the invention shown in Fig. 3 is much similar to the one described in the foregoing and essentially comprises riser and tread members 14 and 15, respectively, which are integrally formed, for example, by casting. At their extremities, tread and riser members 4 and 5 are provided with extensions 16 of an interlocking character which are adapted to form the supporting surfaces for the combination risers and treads and at the same time form sanitary chamfers. The lower surface of said interlocking extensions 16 is formed at such an angle that they conform to the inner surface of lower flange 12 of stringer 11 which is of a character similar to stringer 1 in Fig. 1. Tread and riser members 14, 15 may be secured to flange 12 by means of rivets or bolts, although in some cases no special fastening elements are required and the members are retained on the stringer due to their interlocking character and weight. Tie rods 18 between the stringers may be employed for increasing the rigidity of the structure and to provide additional support for the tread and riser members. In view of the similarity of construction, this modified embodiment will be readily understood by those skilled in the art without any further explanation.

Where the load on the stair stringer requires a larger stringer than a Z-shaped, 7" stringer, I prefer to employ a reinforcing structure in the form of an ornamental rail designed as a truss, to carry the increased load on the exposed stringers. On the wall stringer, the same 7", Z-shaped stringer may be used with either a seat angle on a bearing wall or a hanger rod or strut to carry the increase. A structure of this type is illustrated in Fig. 4 in which reference character 41 denotes the stringer having integrally formed combination risers 44, treads 45 and chamfers 46 mounted on the lower inner flange, 42, thereof. To impart increased structural strength to the construction, ornamental rail 50 designed as a truss is mounted on the stringer.

Fig. 5 illustrates an alternative form of construction of a stringer employed in the stair construction of the invention. In contrast to the Z-shaped stringer employed in the previous embodiments, a channel-shaped stringer 51 is provided, having plates or lugs 52 welded to the inner faces thereof substantially at the level of the lower flanges thereof. These lugs serve for supporting the combination riser, treads and chamfers.

In Figs. 6 and 7 a conventional stair construction is illustrated in order to facilitate appreciation of the simplicity of my novel stair construction. The conventional construction comprises channel-shaped stringers 61 having externally protruding flanges 62, which do not take any part in supporting the structure. Angle carriers 63

are riveted to the inner side surfaces of the stringers and support combination tread and riser members 64 formed of a steel sheet bent at right angles, which are likewise riveted to said angle carriers. The upper end of the riser extends beyond the horizontal surface of the angle carrier and the interval thus formed is filled out with a cementitious material 65 which forms a tread surface. From the foregoing description, the simplicity of my novel stair construction in contrast to the conventional structures will be readily understood.

It will be noted that my novel stair construction provides a number of important advantages. Thus, a considerably lighter stringer may be employed with consequent saving of material and labor. For example, where short run stairs are used up to 8 risers, as is the case in the typical apartment houses, a 7", Z-shaped stringer is completely satisfactory, in contrast to the conventional construction where 10" channel-shaped stringers had to be employed.

It is also to be observed that arching the risers and treads reduces the amount of metal required to carry a predetermined load. In a conventional stair, the arch dimensions for a 10" tread and a 7½ riser are approximately, a rise of 6¼", and a span of 12½", whereas in the stair construction embodying my invention, the rise of the arch is about 4½", and the span is about 8½". In addition, my stair construction leaves a desirable sanitary chamfer at the junction of riser and tread and permits a greater head room, both of which are very important advantages in stair construction.

Moreover, my stair construction, due to its great simplicity, is readily adaptable to mass production methods of fabrication and may be manufactured and installed at a very low cost.

Although the present invention has been described in connection with a few preferred embodiments thereof, variations and modifications may be resorted to by those skilled in the art without departing from the principles of the present invention. I consider all of these variations and modifications to be within the true spirit and scope of the present invention as disclosed in the foregoing description and defined by the appended claim.

I claim:

In a stair construction, the combination comprising a pair of stringers having inwardly projecting flanges, a plurality of treads and risers having completely flat surfaces devoid of depressions and indentations of any kind integrally formed of a single sheet of metal mounted inbetween said stringers, junction surfaces between said treads and risers conforming to the upper surface of said inwardly turned flanges and being adapted to rest thereon, means for securing said junction surfaces to said inwardly projecting flanges, and separate and readily removable means mounted on said treads and protruding above the surface thereon to define therewith a space for a cementitious material adapted to form a wearing surface for said tread, said junction surfaces being of such accentuated length as to extend beyond the level of said wearing surface and being adapted to provide a sanitary chamfer preventing the accumulation of dust and dirt.

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