March 1, 1955 W. H. M. DOBERMANN 2,703,005

PREFABRICATED STAIRWAY

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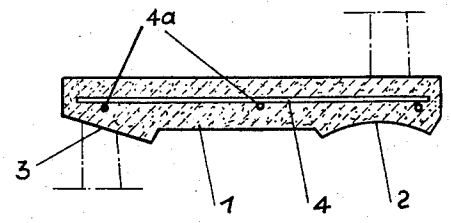

Fig. 1

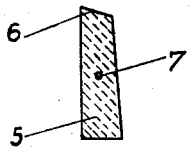

Fig. 2

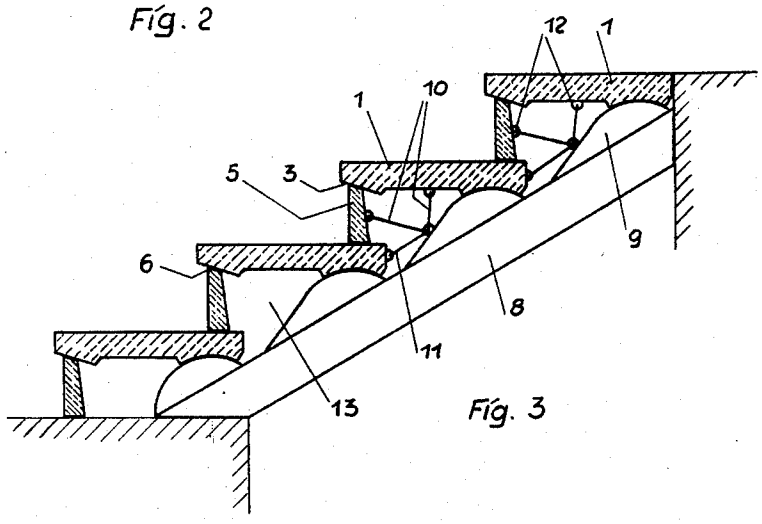

Fig. 3

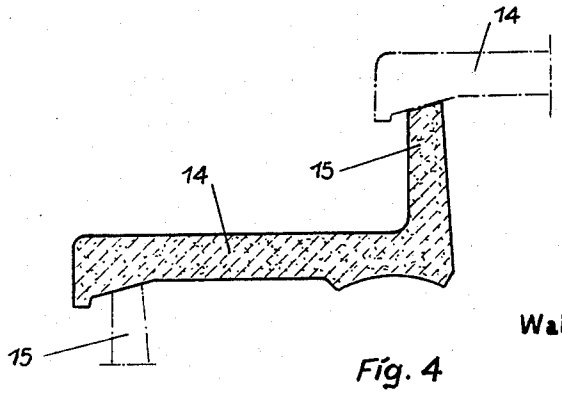

Fig. 4

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Fig. 5

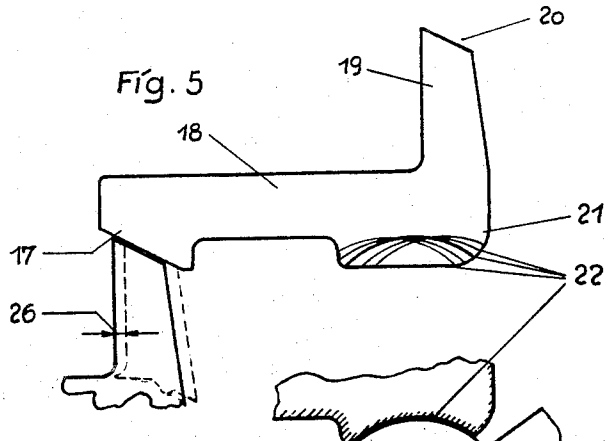


Fig. 6

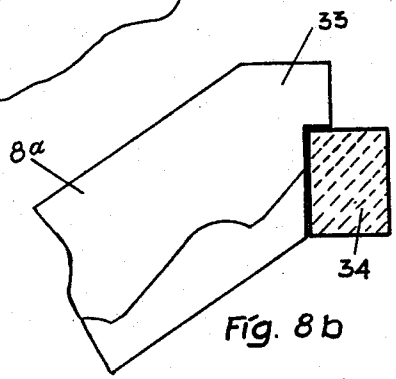
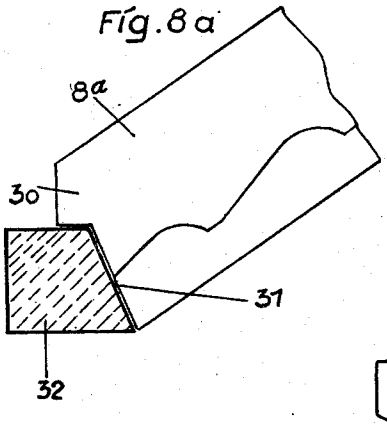


Fig. 8b

Fig. 8a



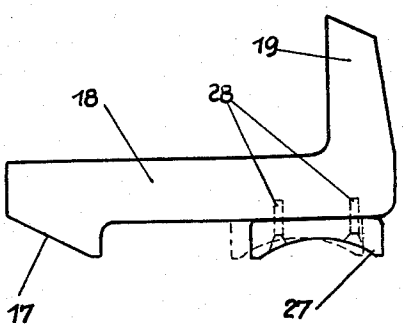


Fig. 7

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Fig. 9 a

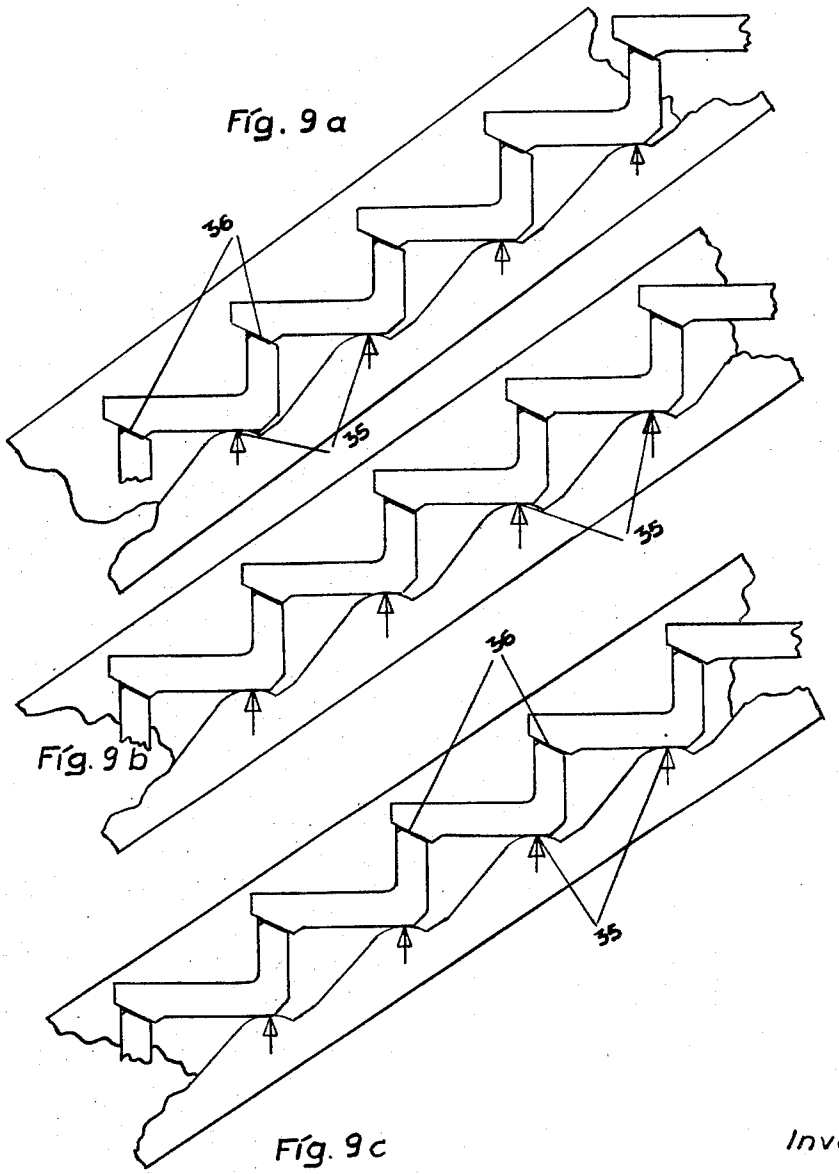

Fig. 9 b

Fig. 9 c

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United States Patent Office 2,703,005 Patented Mar. 1, 1955

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PREFABRICATED STAIRWAY

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Application January 9, 1951, Serial No. 205,075

15 Claims. (Cl. 72—96)

Most stairways in buildings have heretofore been built as so-called "clamped in stairways" by cutting into the masonary of a side wall of the stairwell correspondingly shaped openings into which one end of each step is inserted and is usually connected thereto by mortar. The other or free end of each step is unsupported. The interconnection of these free ends by means of a stringer has primarily decorative importance, while a support of the said free ends of the steps is not effected thereby. It is well known that the building of such a stairway is high in cost of labor.

It has also been suggested to build up stairways from prefabricated elements and to use stringers on both sides of the steps as supporting members therefor. With such stairways, however, either the step elements or the stringers are made according to a predetermined inclination of the stairways so that it is impossible to take care of tolerances and deviations which are practically unavoidable with regard to the height of the stories of a building.

It is, therefore, an object of the present invention to overcome the above-mentioned drawbacks while materially reducing the building costs for stairways.

It is another object of this invention to provide a way of building a stairway from prefabricated elements in which the steps are supported on both sides and in which the steps, although equal in size make it possible to vary the inclination of the stairways built therewith within predetermined limits so that more or less steep stairways can be built with the same prefabricated elements.

It is a still further object of this invention to provide a stairway of the above-mentioned type which will enable new ways and means for mounting the supporting stringers on the framework of the house for arranging additional parts, such as the bannister, for mounting covering panels at the lower surface of the supporting elements of the stairway and for filling in the hollow spaces inherent to the stairway construction, to increase the supporting ability of the stairway and to improve the appearance of the stairway.

These and other objects of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

Fig. 1 illustrates the tread element of a step according to a first embodiment of this invention.

Fig. 2 is a riser for use in connection with the tread of Fig. 1.

Fig. 3 illustrates a stairway built up of the tread and riser shown in Figs. 1 and 2.

Fig. 4 illustrates a second embodiment of a step according to the present invention in which the tread and the riser pertaining to one step are integral with each other.

Fig. 5 shows another modification of a step in which the riser and the tread are integral with each other.

Fig. 6 indicates how an elevation on the stringer engages a stud having a curved surface and provided on the tread element.

Fig. 7 illustrates a step with adjustable counter-bearing.

Figs. 8*a* and 8*b*, respectively, indicate how the lower and upper end of the stringers are mounted upon a landing joist or lower header and ceiling joist or upper header.

Figs. 9*a*, 9*b* and 9*c* illustrate stairway sections, which, while being built from one and the same type of prefabricated elements, have nevertheless a different inclination or slope.

General arrangement

According to the present invention, the prefabricated elements of the stairway, namely, the two stringers on each side of the steps and the tread and riser elements are so constructed that the stringers are provided at their upper surfaces with curved bearing or supporting areas for cooperation with and supporting of correspondingly shaped areas provided on the step members, while the steps are mounted upon and engage each other along inclined surfaces. Thus, for instance, the stringers may be provided at their upper surfaces with curved elevations equally spaced from each other in accordance with the desired distance between two adjacent steps. The treads may be provided with a plane lower side and rest with this lower side on the said curved elevations. However, if desired, the treads may be provided at their lower rear end with curved recesses in conformity with the curved elevations on the stringers for engagement therewith. In order to avoid such recesses on the tread where the latter rests on the respective elevation of the stringer —such recesses would weaken the tread at the respective portion—the lower side of the treads may be provided with studs which contain recesses to be engaged by curved elevations on the stringers. Such curved recesses are preferably provided at the tread elements, only when the stairway is being built up, since, as will be explained later, the supporting area along which the tread and the elevation on the stringer engage each other may be located more towards the front or towards the rear depending on the respective inclination or slope of the stairway. The treads may also be provided at the lower side thereof with supporting plates which form the supporting bearing and may be connected to the tread elements at different points thereof. The elevations on the stringers may be provided with small recesses or may have fluted surfaces in order to increase the adherence and to create an assurance against sliding. The same object may be obtained by the provision of other skid-proof elements such as rubber inserts or inserts of leather or synthetic material.

In addition to the curved elevations on the stringers, the present invention is characterized by the slant or sloped areas of riser and tread along which these two elements rest upon each other. More specifically, the lower front side of the tread element and the upper end of the riser are provided with correspondingly shaped slant or sloping surfaces along which these two elements engage each other. These slant areas of both the tread and the riser may either slope towards the rear or towards the front. For mass production purposes, it has been proved advantageous to make the tread and the riser of a single integral piece. As building material for the individual elements of the stairway, various products may be used, such as concrete, heavy metals, light metals, rubber, synthetic materials, natural or synthetic glass and the like. Advantageously, the individual elements when consisting of moldable material such as concrete are reinforced by reinforcement rods, reinforcement mesh or the like. The stringers, the tread and riser elements and also the supporting headers or joists may be provided with anchoring means and anchoring connections for rigid connection with the reinforcements of the individual elements. By assembling the individual elements of the stairway, a hollow space is created between the step, the riser and the stringers. This hollow space may be made use of for housing the anchoring means. Preferably the hollow space is filled with material corresponding to the material of the individual elements and, if desired, this filling material may also be provided outside the hollow spaces. In this way a sliding and loosening of the individual parts will be made impossible and the supporting ability of the stairway will be materially increased.

The lower end of the stringer may rest directly upon the floor of the respective story, while the upper end of the stringer may be provided with a protruding nose resting upon the ceiling joint or upper header. In many instances it is even more advantageous to rest the lower slant end of the stringer upon a correspondingly slanted surface of a header or landing joist while, if desired, a

nose on the foot of the stringer may extend over the header or landing joist.

While the stringers are being prefabricated, bolts or nuts or other fastening means may be inserted and may preferably be connected with the reinforcement, for instance by welding or screwing. These fastening means will facilitate the assembly of the bannister or other coverings. The bannister may advantageously be provided with an uninterrupted lower surface area for tight connection with the individual fastening means of the beam to thereby increase the rigidity of the bannister.

In order to facilitate the spacing of the various elements, and the assembly of the elements and in order to increase the rigidity of the assembled stairway, there may be provided between the beams turnbuckles, adjustable connecting rods, or adjustable connecting tubes. The elements necessary for holding such devices are preferably molded into the beam and rigidly connected with the reinforcement so that after the stairway has been assembled they will materially add to the stability of the stairway. The cover for the under surface of the stairway may be effected between the beams or may be secured to the stringers. For easy covering the under surface of the stairway, preferably wedge-shaped panels or panels provided with grooves are inserted between the stringers. If desired, various covering elements may be screwed to, riveted to, or otherwise be connected to the stairway elements. Corresponding holding or supporting elements are provided on the individual stairway elements. The connection of the fastening means to the prefabricated elements during the prefabrication thereof saves notching work which will otherwise have to be performed later and enables a direct connection of the bannister or bannister parts with the reinforcement in the stairway elements.

Structural arrangement

Referring now to the drawings in detail and Figs. 1 to 3 thereof in particular, the element **1** represents a tread element which is provided at the rear lower surface thereof with a recess **2** adapted to be engaged and supported by a correspondingly shaped elevation **9** provided on the stringer or beam **8**. The tread element **1** has its lower front surface **3** slanted or sloped. This surface **3** is adapted to engage and to be supported by a correspondingly shaped slanted or sloped surface **6** at the upper end of the riser **5**. The tread element **1** is furthermore provided with reinforcements **4** and **4***a* which may represent individual reinforcing elements or reinforcing mesh. The riser **5** is likewise provided with at least one reinforcement element **7**. As will be seen from Fig. 3, the assembled stairway comprises anchoring means **10**, **11** in form of irons or wires which are connected to fastening means, for instance eyes **12**, forming parts of elements molded into the material making up the tread, riser and stringer elements. These anchoring means **10**, **11** properly tighten and anchor the individual elements with regard to each other. The hollow space **13** in which these anchoring means are located may later on, after the stairway has been assembled, be filled up with material. The elevations on the stringers may be as wide as the stringers themselves but, if desired, they may also be smaller.

According to the embodiment shown in Fig. 4, the tread **14** and riser **15** are integral with each other while the tread **14** engages the riser underneath said tread along an inclined area which in contrast to the corresponding contact area between the tread element **1** and the riser **5** is sloping towards the front.

Also the stone illustrated in Fig. 5 represents an integral construction of tread **11** and riser **19**. The riser **19** has an upper slant surface **20** for engagement with the lower sloping surface of the front portion **17** pertaining to the tread element located adjacent to but higher than the riser **19**. The unitary step-riser element **18**, **19** is provided at the rear lower surface with an extension **20** having a curved bearing surface **22** arranged for engagement with the adjacent and correspondingly curved elevation **23** pertaining to the adjacent stringer. As will be clear from Fig. 5, the curved surface **22** may contact the elevation **23** selectively along an area located more towards the front or more toward the rear of the unitary element **18**, **19**. In this way the angle between the tread and the stringer may be varied. The recesses **22** of the stone shown in Fig. 5 may be provided by grinding, punching, or in any other suitable manner.

According to the embodiment shown in Fig. 7, the extension **21** of Fig. 5 is replaced by a separate adjustable bearing **27** which is connected to the tread element **18** by means of pins or bolts **28** while the stairway is being assembled. This arrangement makes it possible to vary the position of the bearing **27** and thus with each individual stone to vary the distance between the front end of the tread **18** and the adjacent stringer.

While according to Fig. 3 the stringer **8** rests directly on the floor and has its upper end with a correspondingly slanted surface in abutting engagement with the upper wall portion, the upper and lower ends of the stringer **8***a* are according to Figs. 8*a* and 8*b* provided with protruding noses. At the lower end, the stringer is provided with a slant area **31** abutting the lower header or landing joist **32** while the nose **30** of the stringer extends above the header **32**. At the upper end of the stringer **8***a* a nose **33** extends over the upper header or ceiling joist **34** which in this way is rectangularly gripped by the stringer.

Figs. 9*a*, 9*b* and 9*c* illustrate stairway sections made of similar individual elements, namely, similar stringers and unitary tread and riser elements. The inclination or slope of the three stairway sections differ. The stairway according to Fig. 9*b* has a medium slope. The bearing surfaces **36** for contact between the lower bearing surface of the tread and the upper bearing surface of the riser has a medium or intermediate position with regard to the corresponding area of the stairway illustrated in Figs. 9*a* and 9*b*. The lower surface of the tread rests upon the curved elevation of the stringer at a point **35** which with all steps has the same distance from the rear edge of the steps.

The stairway according to Fig. 9*a* has a greater inclination than the stairway of Fig. 9*b*. The distance from step to step, therefore, is greater. The bearing surface **36** in this arrangement is located more towards the rear on the tread. The bearing point **35** moves more and more to the rear with each higher step.

Finally, the stairway according to Fig. 9*c* has less inclination than the stairway according to Fig. 9*b*. To this end, the bearing areas **36** between tread and riser are located more towards the front end of the tread. The bearing point **35** moves from the rear towards the front with each step upwards.

It is, of course, understood that the present invention is by no means limited to the particular constructions shown in the drawings, but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. A stairway comprising in combination, a plurality of steps, each step having a tread portion with a bearing area extending across the underneath side at the front and sloping upwardly toward the front of the step and a riser portion with a bearing surface at the upper end parallel to said bearing area, the arrangement being such that the sloped bearing surface of each riser slidably engages the inclined bearing area of the tread portion of the next higher step, and stringer means under the steps tiltably supporting said steps.

2. A stairway comprising in combination, a plurality of steps, each step having a tread portion with an inclined bearing area at the lower front surface thereof and also having a riser portion with its upper surface sloped so as to be parallel with said inclined bearing area for slidable engagement with the inclined bearing area of the adjacent upper tread portion, and stringer means extending under the steps at the sides of the stairway having surfaces engaging surfaces on the underneath sides of said steps, one of the interengaging surfaces of said stringer means and steps being convex for tiltably supporting the steps on the stringer means.

3. A stairway comprising in combination, a plurality of steps, each step having a tread portion with an inclined bearing area and a riser portion with a sloping surface shaped so as to be parallel with said inclined bearing area and arranged for slidable engagement with the inclined bearing area of the tread portion of an adjacent step, and stringer means extending under the steps at the sides of the stairway having surfaces engaging surfaces on the underneath sides of said steps at the ends thereof, the points of engagement of said stringer means and said steps comprising interengaging curved surfaces.

4. A stairway comprising in combination, a plurality

of steps, each step having a tread portion with an inclined bearing area at the lower front surface thereof and also having a riser portion with its upper surface sloped so as to be parallel with said inclined bearing area, said steps being arranged so that the inclined bearing area of one tread portion is slidably engaged by the sloped surface of the riser portion of the next lower step, and stringer means extending under the steps at the sides of the stairway having at their upper surface substantially equally spaced upwardly convex projections for engagement with the underneath sides of said steps at the ends thereof for tiltably supporting said steps.

5. A stairway comprising in combination, a plurality of steps, each step having a tread portion with an inclined bearing area at the lower front surface thereof and also having a riser portion with its upper surface sloped so as to be parallel with said inclined bearing area, said steps being arranged so that the inclined bearing area of one tread portion is slidably engaged by the sloped surface of the next lower riser, and stringer means extending along beneath said steps having at their upper surface substantially equally spaced upwardly convex projections, the underneath sides of said steps comprising correspondingly curved recesses at the rear end of the tread portions thereof engaging said projections.

6. A stairway comprising in combination, a plurality of steps, each step having a tread portion with an inclined bearing area at the lower front surface thereof and also having a riser portion with its upper surface sloped so as to be parallel with said inclined bearing area, the arrangement being such that the sloped upper surface of each riser portion slidably engages the inclined bearing area of the tread portion of the next higher step, and stringer means extending along beneath said steps provided with a plurality of spaced curved elevations for engagement with the underneath sides of said steps, said steps comprising studs connected to the rear ends of the said tread portions thereof provided with correspondingly curved surfaces for engagement with said curved elevations.

7. A stairway according to claim 6 in which the studs at the rear ends of the tread portions are integral therewith.

8. A stairway according to claim 6, in which the studs are separate from said tread portions and are arranged for connection therewith when the stairway is assembled.

9. A prefabricated step for use in connection with a prefabricated stairway, which is composed of a tread portion having a bearing area at the lower front surface thereof that slopes upwardly toward the front of the step, a riser portion with its upper surface sloped so as to be parallel with said inclined bearing area, and bearing means separate from said tread portion and arranged for connection with a desired rear portion of said tread portion on the underneath side thereof, said bearing means being provided with a curved area for engagement with a correspondingly curved area on stringer means of such prefabricated stairway.

10. In a stairway, a plurality of prefabricated steps, each having a riser portion with its entire upper end surface sloping downwardly toward the rear and also having a tread portion with an inclined bearing area at the lower front end thereof sloping in a direction parallel to the said upper surface of said riser, the arrangement being such that the sloping upper surface of each riser slidably engages the adjacent sloping area of the tread portion of the next higher step, whereby the steps can be

tilted relative to their supporting stringers while the treads remain parallel with each other and a bearing is maintained between each riser and the tread thereabove.

11. In a stairway, a plurality of prefabricated steps, each step having a tread portion with a bearing area on the lower front surface that slopes upwardly toward the front of the step, and each step also having a riser portion upstanding toward the rear of the tread portion with its upper surface sloping in the same direction as said inclined bearing area, the tread portion and the riser portion pertaining to one and the same step being integral with each other.

12. In combination in a stairway, a plurality of steps, each step having a tread portion with an inclined bearing area at the lower front surface thereof and also having a riser portion having its upper surface sloped so as to be parallel with said bearing area, the arrangement being such that the sloped upper surface of each riser portion engages the inclined bearing area of the tread portion of the next higher step, stringer means extending along beneath said steps at both sides of said stairway and comprising spaced curved elevations engaging said steps on their underneath sides, fastening elements rigidly connected to said steps and said stringer means, and means interconnecting said fastening elements and extending through the hollow spaces defined by said stringer means and said steps.

13. A stairway according to claim 12 in which the hollow spaces are filled in with moldable load supporting material.

14. In a stairway, a plurality of prefabricated steps, each step having a tread portion with an inclined bearing area at the lower front surface thereof and also having a riser portion with its upper surface solped so as to be parallel with said bearing area, the arrangement being such that the upper sloped surface of each riser engages the inclined bearing area of the tread portion of the next higher step, stringer means extending along beneath said steps provided with curved elevations engaging the underneath sides of said steps, said steps being provided with correspondingly curved areas on the tread portions for engagement with said elevations, said stringers and said tread portions being provided with metal reinforcements, fastening means rigidly connected to said reinforcements, and connecting means interconnecting said fastening means.

15. A stairway comprising in combination, a plurality of steps, each step being composed of a tread element and a separate riser element, each tread element being provided at the lower front surface thereof with an inclined bearing area, and each riser having its upper surface sloped so as to be parallel with said bearing area and in engagement with the adjacent bearing area of the tread element of the next higher step, stringer means extending along beneath said steps provided with spaced upwardly convex supporting surfaces in engagement with each said tread element at the rear thereof, and means connected to and extending between said stringers, risers, and tread elements and fixedly interconnecting the same.

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