Jan. 11, 1966 E. MULITZ 3,228,154

STAIRWAYS

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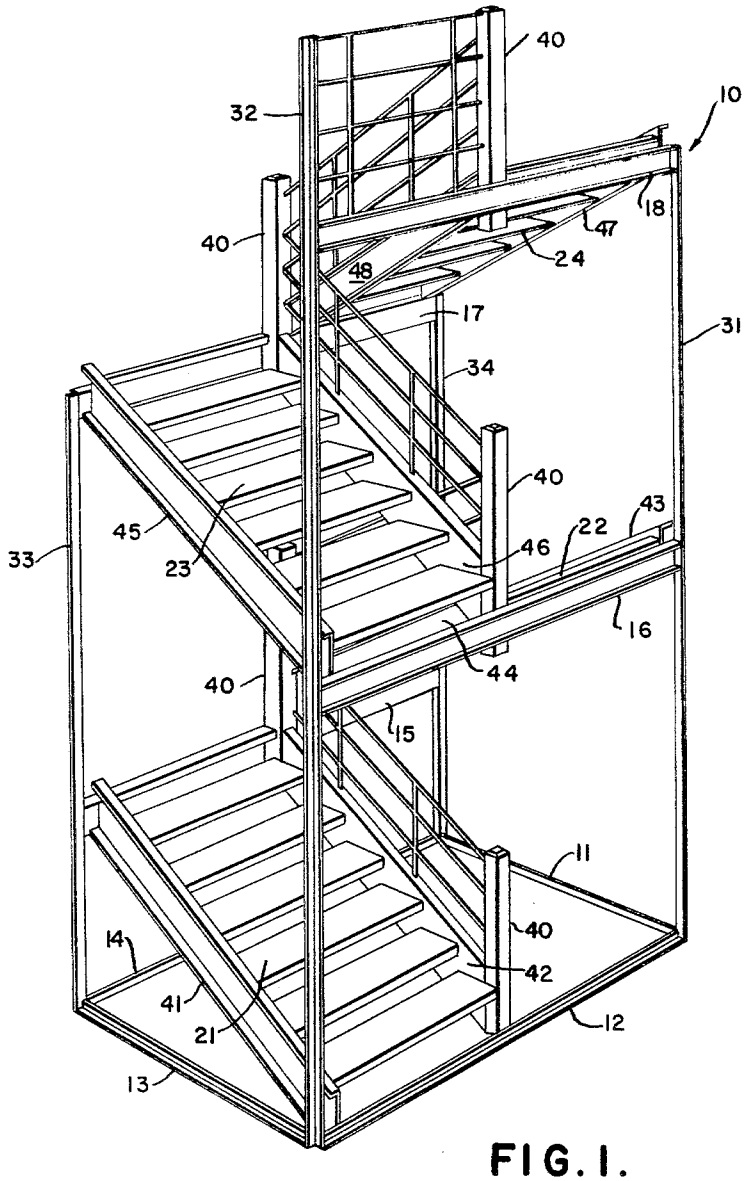


FIG. 1.

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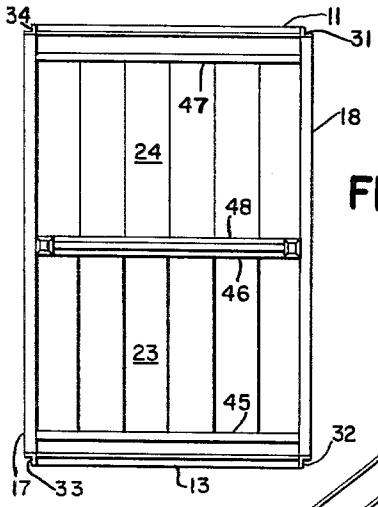


FIG. 3.

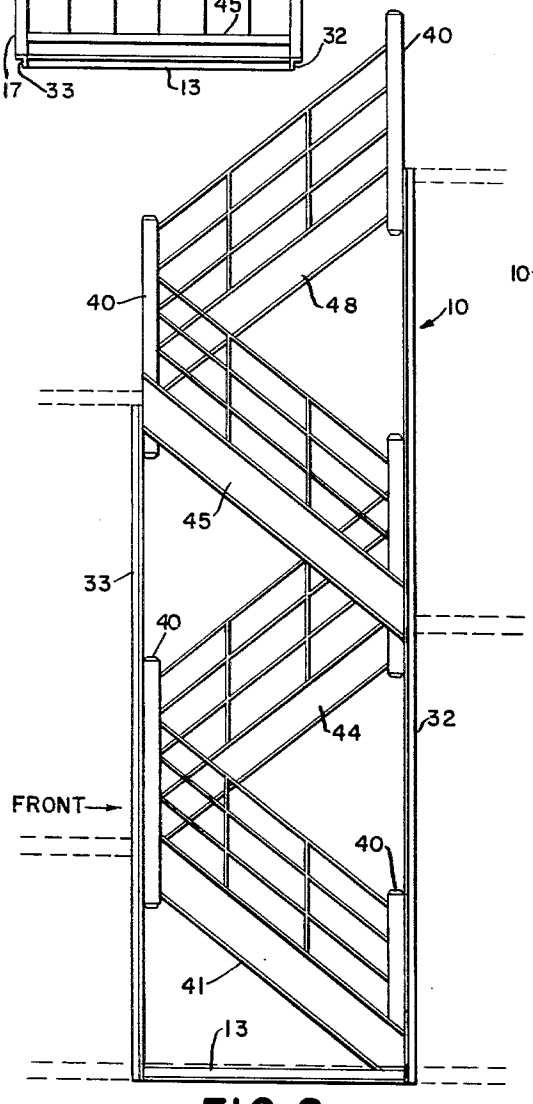


FIG. 2.

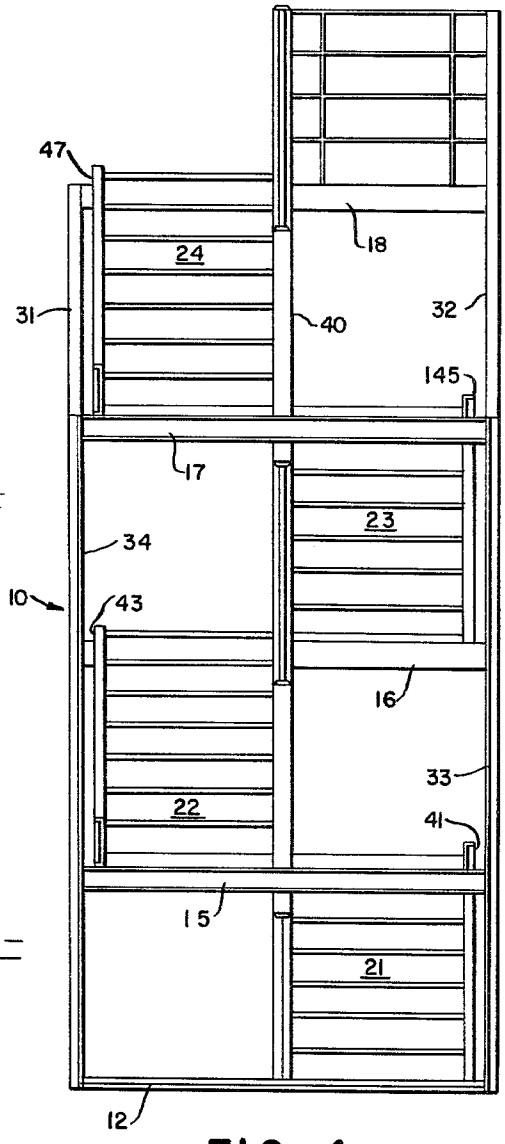


FIG. 4.

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STAIRWAYS

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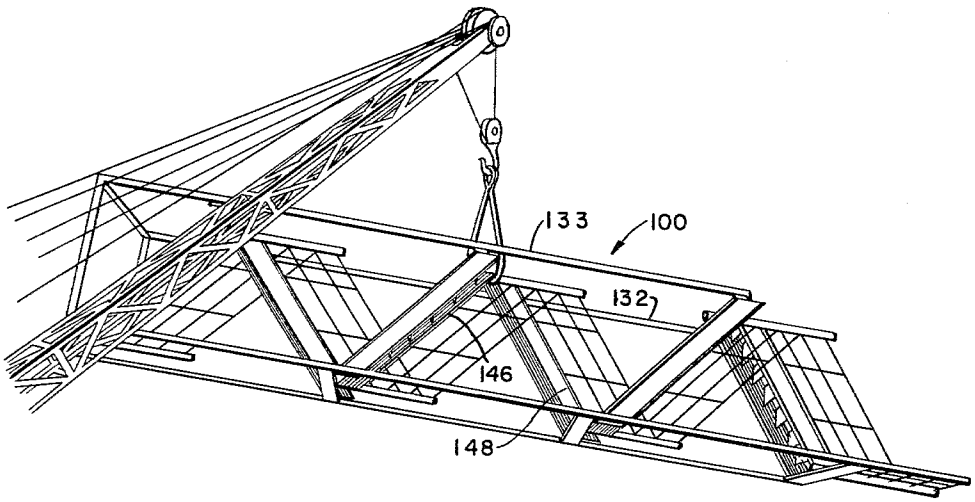


FIG. 5.

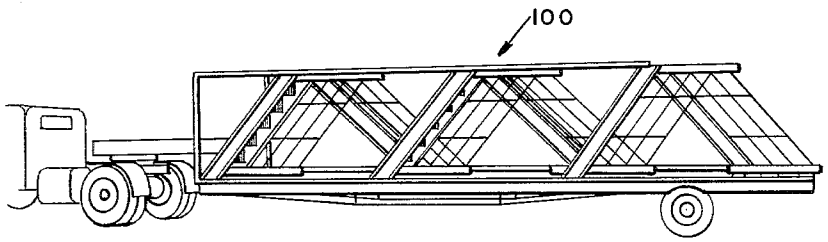


FIG. 6.

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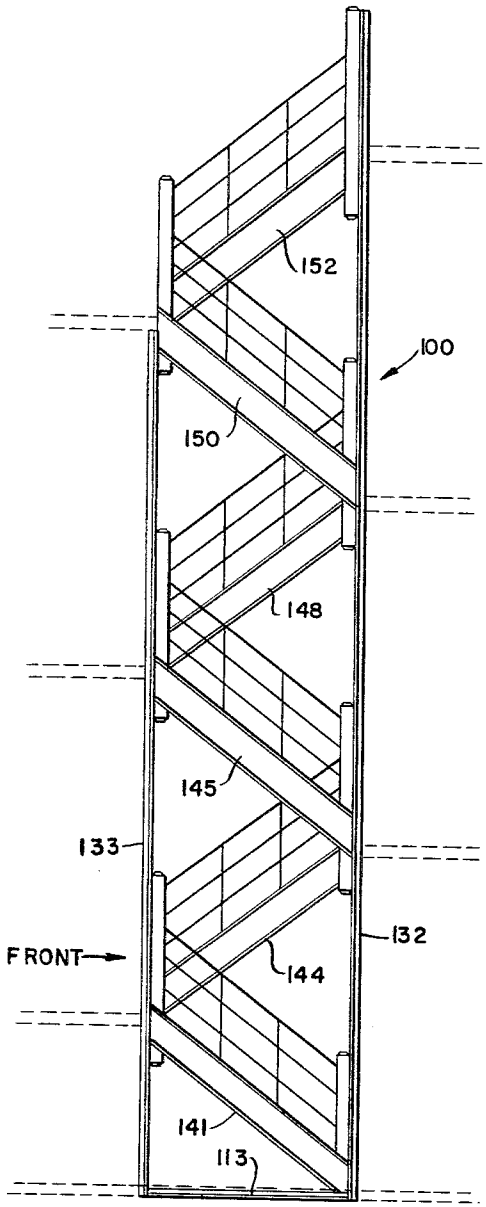


FIG. 7.

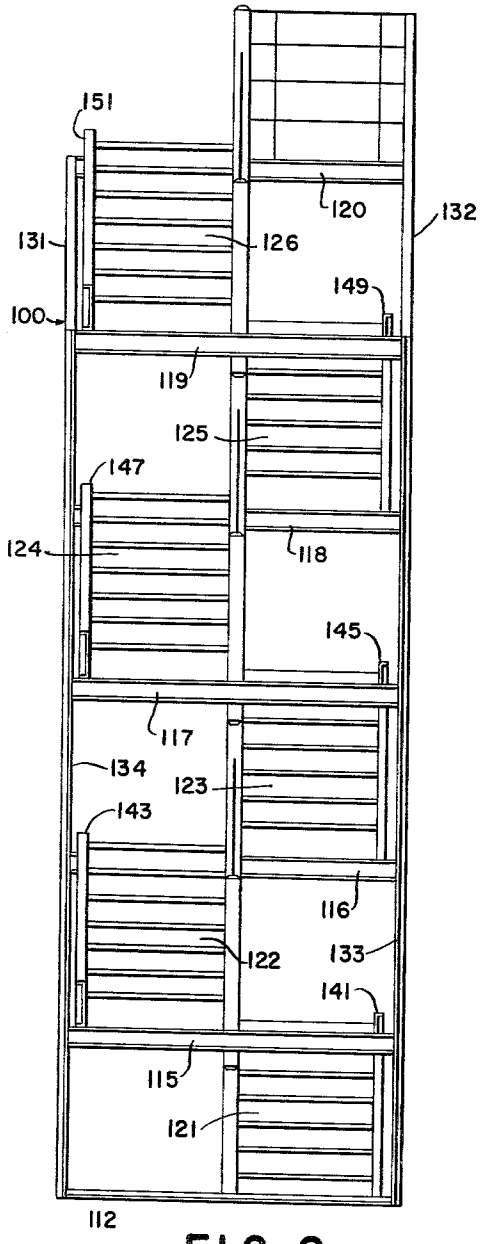


FIG. 8.

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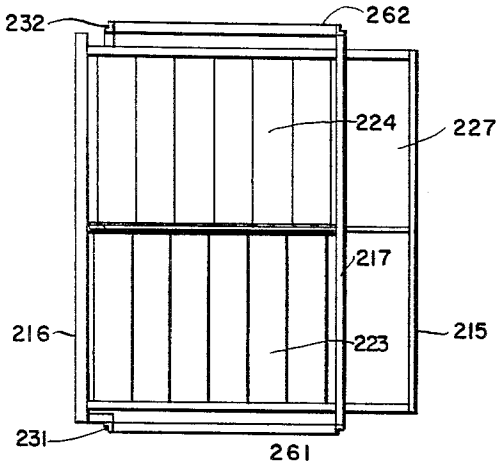


FIG. 10.

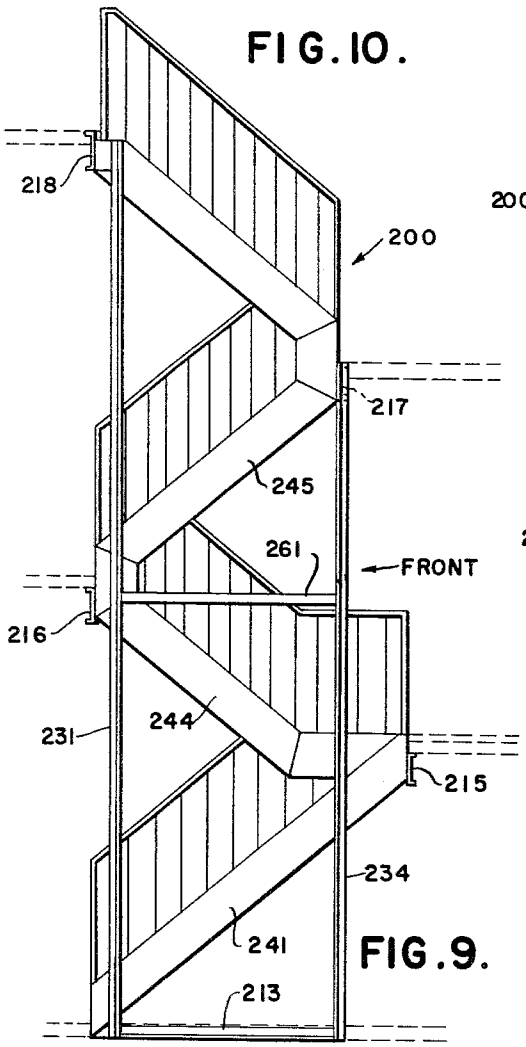


FIG. 9.

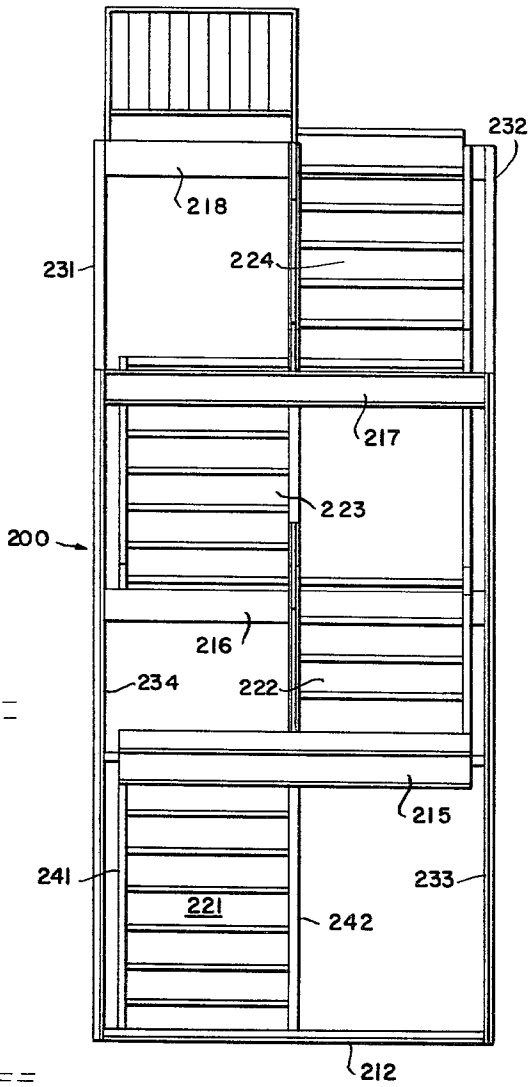


FIG. 11.

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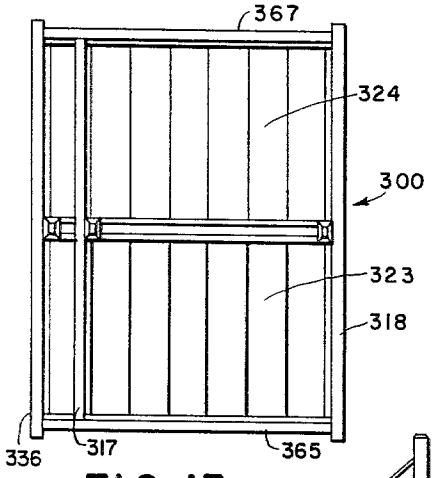


FIG. 13.

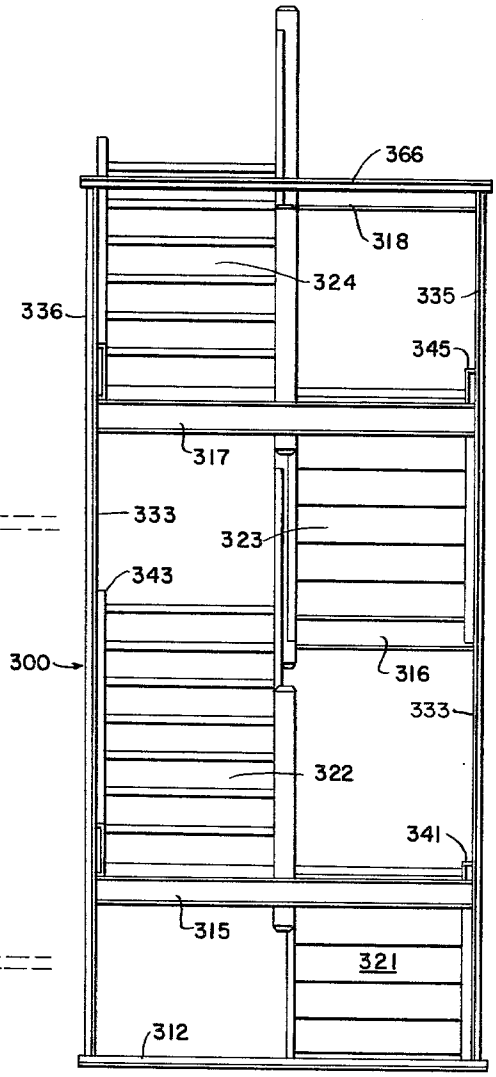


FIG. 14.

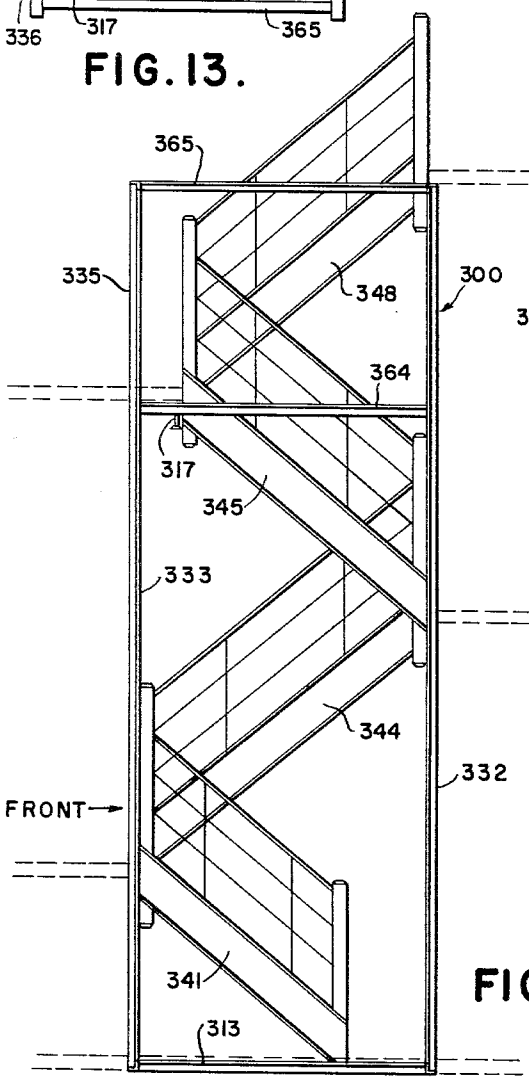


FIG. 12.

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3,228,154

STAIRWAYS

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Filed May 18, 1964, Ser. No. 368,080
4 Claims. (Cl. 52—185)

This invention relates to stairways and more particularly to prefabricated metal stairways combining several floor levels in one unit.

A need has been found for units of two to four stories that can be fabricated completely in the factory and transported to the sites of building construction. In buildings of these lower heights it is more economical to have the several levels of stairs already fabricated instead of resorting to the connection of single floor or story units at the site of construction.

Accordingly, the present invention is directed to a prefabricated stairway of more than one floor level of such construction that it may be easily transported by truck or railroad flat car and may be lifted as a single unit without any undue strain on any of the structural members.

The invention also seeks to provide a stairway construction with inherent strength not requiring any additional bracing during the transportation thereof.

Basically the present invention provides a novel and improved prefabricated stairway construction of a truss type construction with a fundamental W-shaped construction and supporting tension members. The stairway unit may be increased in height by additional V member construction.

Among the advantages found in this type of construction are the maximum strength obtained with a minimum number of structural members and the ease with which the units may be moved during their transportation to the sites of construction.

These as well as further advantages which are inherent in the invention will become apparent from the following description reference being had to the accompanying drawings, wherein:

FIG. 1 is a rear-left side perspective view of one embodiment of a two floor level unit;

FIG. 2 is a right side elevation of the unit shown in FIG. 1;

FIG. 3 is a plan view of the unit as shown in FIG. 2;

FIG. 4 is a front elevation of the unit as shown in FIG. 1;

FIG. 5 is a view of a different embodiment of a stairway unit being lifted by a crane;

FIG. 6 is a view of the stairway unit shown in FIG. 5 loaded on a flat bed truck;

FIG. 7 is a right side elevation of a stairway unit of the type shown in FIG. 5;

FIG. 8 is a front elevation of the stairway unit shown in FIG. 7;

FIGS. 9, 10 and 11 are a left side elevation, a plan view, and a front elevation, respectively, of a cantilever embodiment of the stairway unit of the present invention; and

FIGS. 12, 13 and 14 are a right side elevation, a plan view and a front elevation of still another embodiment of the stairway unit of the present invention.

In the various figures the stairway units have been illustrated with certain faces designated as front, rear, left side, or right side. This is done merely for the convenient identification of the different parts and continuity between figures showing different views of the same embodiment. Actually in practice the determination of front or rear can depend upon whether the base is at ground level or below thereby allowing original entrance to the building and stairway at the bottom of other than the first or lower run of stairs. The front portions of all the embodiments have been designated as if the latter is the case and the main entrance will be made to the building at the level at the top of the first run of stairs.

In addition, the stairways may be made either right or left side models whereby the first run is either to the right as in FIGS. 4, 8, and 14 or to the left as in FIG. 11. Usually both types are delivered to any one building site and used in the same building.

It will also be noted that I beams and U beams are used interchangeably and steps are used with or without backing plates. This is only for convenience of construction and models with any of the above combinations may be used and remain within the scope of the invention.

Referring now to FIG. 1, there is shown therein a perspective view of a stairway unit **10**, two stores in height, which can be shipped to the construction site as the single unit shown and standing on its horizontal base members **11–14** it is then in a position for masonry, brick, wood or whatever construction is preferred to be installed around it. Other views of this same stairway unit are shown in FIGS. 2–4. During the construction of the building, landings shown in dashed outline in the various side elevational views, FIGS. 2, 7, 9, and 12, will be attached at horizontal structural members **15–18** and, of course, at horizontal base member **12** and the equivalent members in each of the figures. At each end of the four runs of stairs **21–24** vertical members **31–34** are connected at the four corners of the rectangle formed by horizontal base members **11–14**. Horizontal structural members **16** and **18** have their ends attached to vertical members **31** and **32**. In a similar manner horizontal structural members **15** and **17** have their ends attached to vertical members **33** and **34**. Included in the support of the first run of stairs **21** are diagonal structural members **41** and **42** with diagonal structural member **41** located on the outer side of stairway run **21** and connected at the intersection of vertical member **32** and horizontal base member **12** and at its other end to horizontal structural member **15**. Inside diagonal structural member **42** is connected to horizontal base member **12** at an intermediate point on member **12** and at an intermediate point on horizontal structural member **15**. The location of this intermediate point of course depends upon the width of the first run of stairs and is usually located at the center point of horizontal base member **12** and horizontal structural member **15**. In a similar manner the diagonal structural members **43** and **44** supporting the second run of stairs **22**, the diagonal structural members **45** and **46** supporting the third run of sairs **23**, and the diagonal structural members **47** and **48** supporting the fourth run of stairs **24**, are connected respectively between horizontal structural members **15** and **16**, and horizontal structural members **16** and **17**, and finally between horizontal structural members **17** and **18**. In the support of each run of stairs one diagonal structural member, either member **41**, **43**, **45** or **47**, is connected with its ends at the ends of the respective horizontal structural members adjacent thereto and the other diagonal structural member, either member **42**, **44**, **46**, or **48** respectively, is connected with its ends attached at an intermediate point on the respective horizontal structural members adjacent thereto.

Railings supported by newel posts **40** are added at the factory and included as part of the prefabricated stairway unit. As shown in FIG. 1 the diagonal structural members may or may not be connected directly to the horizontal base members and the horizontal structural members but as an alternative may be connected to the bottoms of the newel posts and thereby connected to the horizontal members.

In the embodiment shown in FIGS. 1–4, which is a basic embodiment of the present invention, the diagonal structural members form a generally W shape construction. The actual W shape is formed by the centrally located diagonal structural members **42**, **44**, **46**, and **48** which are those connected at the centers of the base member **12** and horizontal structural members **15–18**. The four runs of stairs in combination with the diagonal structural members form a generally W-shaped structure. Connected between what would be considered the upper three points on the W are the vertical members **31** and **32**. As will be discussed further herein, this construction is of utmost importance in the transportation and movement of the units of prefabricated stairways. This W formation is most apparent in the side elevational view of FIG. 2.

FIG. 5 is a view of a prefabricated stairway unit **100**, another embodiment of the present invention further disclosed in FIGS. 7 and 8, as it is being lifted by a crane. This illustrates the importance of the basic W formation. The cable from the crane is attached at the center point of the W to obtain best balance for ease of attachment and lifting. The cable is attached to horizontal structural member **117** at a point where diagonal structural members **146** and **148** are attached to horizontal structural member **117**. With the weight distribution and attachment made in such a manner vertical members **132** and **133** are now tension members and as such play an important part in the support of the prefabricated stairway during such carrying.

This construction of a W structure with tension members wherein the stairway unit forms a W structure and the vertical members form the tension members is also important during the transporting of these prefabricated stairways on flat bed trucks as shown in FIG. 6. Because of the inherent strength in such a structure these stairways may be transported in completed form without damage thereto and without any undue strain being placed on any of the individual members. Because of the strength found in such a stairway construction, additional economies are forthcoming through special shipping allowances since additional supporting structure is not necessary during the transporting of a completed stairway unit on a truck or by railway flat car.

In addition, because of this type of construction it has been found that these stairways may be piled one upon the other while lying on the front or rear of the unit and that the structural form allows the support of the additional weight without damage to the bottom unit.

The units depicted in FIGS. 7 and 8, and also in FIGS. 5 and 6 are similar to those previously shown in FIGS. 1–4 except that a fifth and sixth run of stairs, **125** and **126** respectively, have been added thereby adding an additional V structure to the basic W structure or more in keeping with the discussion of stresses on the structure it may be said that additional sloping sides are an addition to the basic W structure. This additional V is formed by adding to the previous structure a fifth run of stairs **125** and a sixth run of stairs **126** and horizontal structural members **119** and **120** with two additional diagonal structural members **149–150** and **151–162** respectively, for each of the two additional runs of stairs **125** and **126**. Cable attachment is still to the W structure in the center as illustrated in FIG.5. Of course, additional newel posts and railing are added as needed.

It should be noted that the cables from a lifting crane can be attached to the stairway unit at other points than those stated above and in some cases these other connections are made, but for quick handling and ease of operation the single point connection of the cable is available for use and the structure of the stairway unit is such as to bear all the strains incurred by this one point connection. Also, in moving the stairway from the positions shown in FIGS. 5 and 6 wherein the stairway unit is lifted or transported, a connection is made to a different point

to right the stairway and place it in the upright positions shown in the other figures so that the building structure may be built around it.

It should be noted that all numbers in the drawing in the 100 series designate equivalent parts as those in the tens series where such numbers are found in both series. In the 200 and 300 series the parts so numbered are generally equivalent parts but some differences do exist in comparative dimension because of differences in structure which are pointed out in the discussions of figures pertaining thereto.

FIGS. 9, 10 and 11 show the side elevation plan, and front elevation views respectively of a different embodiment **200** of the stairway unit having the W configuration. In this configuration the second run of stairs **222** from the bottom contains less steps than the first run of stairs **221** at the bottom of the stairway structure **200** and in this case a cantilever type of construction is formed. Because of this variation in construction intermediate structural members **261** and **262** are connected on each side to the respective vertical members **231**, **234** and **232**, **233** on that side. Also, horizontal structural members **216** and **218**, and horizontal structural member **215** between the first and second run of stairs **221** and **222** respectively, is outside of the area enclosed by the vertical members **231–234** of the stairway unit **200**. In the case of member **215** a projecting platform **227** is formed whereby a part of the landing construction at that level is already available before construction of the building reaches that height.

An additional embodiment shown in FIGS. 12, 13 and 14 discloses a stairway unit **300** with a second run of stairs **322** having more steps therein than any of the other runs of stairs **321**, **323** or **324**. In this embodiment the horizontal structural unit **317** between the third and fourth runs of stairs **323** and **324** respectively is inside the area delineated by the four vertical members **332–334** and a fourth not visible in the drawings. Intermediate structural members **364** which is one of two similar structural members connecting the vertical members on each side of the stairway unit **300** has horizontal structural member **317** therebetween and is connected to horizontal structural member **317** at its ends. In this embodiment it will also be noted that the first run of stairs **321** is supported by having the diagonal structural member **341** connected to base member **313**. Also because of the short-ended construction of runs of stairs **323** and **324** additional portions **335** and **336** are added at the top of vertical members **333** and **334** respectively so that horizontal members **365–367** may be added to connect the tops of the extended vertical members at the front of stairway **300** and with those in the rear.

In both of these last two embodiments depicted in FIGS. 9–11 and 12–14 the W structure with some form of tension members is the basic form of construction. Therefore the cable connection for lifting is made as in the previous cases at the center of the horizontal structural member located at the center point of the W and again in both cases the tension members are formed by the members extending from this center point of the W to the end points of the W. In the embodiment of FIGS. 12–14 the tension members on one side of the W are composed of both a portion of the rear vertical members and a portion of the side base members.

All of the embodiments shown having the W type of structure can be extended as in the embodiments shown in FIGS. 7 and 8 to add an additional V part of the structure comparable to a V formed by adjacent runs of stairs in each of the embodiments. The structural stresses would then be as discussed in connection with FIGS. 7 and 8. In addition, it is possible to use a structure combining two W's in one prefabricated stairway unit. This can be done because of the great structural strength exhibited by the use of such W construction in combination

with vertical members which become members in tension during the lifting and hauling of the stairway units.

The practical length of such stairway units, or rather the height of such stairway units, is limited by the economic and practical aspects of transporting these units. It is felt that a unit extending more than four stories in height would be impractical for transportation by truck or railroad flat car, and therefore the economy of using a single prefabricated construction would, to a great extent, be lost.

In addition to the embodiments shown additional embodiments comprising the same basic structure of the present invention may be built with individual runs of stairs having more or less steps than the other runs of stairs in the same stairway units. These other embodiments would still conform to the spirit of the invention.

It will be obvious to those skilled in the art that various changes may be made without departing from the scope of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. A prefabricated metal stairway comprising a permanently self-supporting stairway unit having a rectangle formed by horizontal base members,

first, second, third, and fourth vertical members attached at corners of said rectangle in successive rotational positions,

a first horizontal bar extending between said second and third vertical members at an intermediate position along said vertical members,

a second horizontal bar extending between said second and third vertical members at a higher position than said first horizontal bar,

a third horizontal bar extending between said first and fourth vertical members at an intermediate position along said vertical members,

a fourth horizotnal bar extending between said first and fourth vertical members at a higher position than said third horizontal member,

said horizontal bars each positioned at a different height above said rectangle formed by said horizontal base members,

at least three runs of stairs having diagonal members forming the sides thereof with said diagonals connected to and between said horizontal bars,

an additional run of stairs having diagonal members forming the sides thereof with at least one of said diagonals connected between the lowermost of said horizontal bars and at least one of said horizontal base members,

said diagonal members of the uppermost run of said at least three runs of stairs connected between said second and fourth horizontal bars,

said second horizontal bar located at a lower height than said fourth horizontal bar with said first and fourth vertical members connected to said fourth horizontal bar and extending to a height above the height of said second and third vertical members, connected to said second horizontal bar.

2. A prefabricated metal stairway comprising a permanently self-supporting stairway unit having a rectangle formed by horizontal base members,

first, second, third and fourth vertical members attached at corners of said rectangle in successive rotational positions,

at least four runs of stairs supported by said vertical members with a first pair of alternate runs adjacent said first and second vertical members and a second pair of alternate runs adjacent said third and fourth vertical members,

a first group of horizontal bars extending between said first and fourth vertical members and a second group of horizontal bars extending between said second and third vertical members,

at least two pairs of diagonal members forming the sides of said first pair of alternate runs and at least a second two pairs of diagonal members forming the sides of said second pair of alternate runs, attached between said first and said second groups of horizontal bars,

the portions of said first and fourth vertical members supporting the weight of said runs extending only to the highest placed of said first group of horizontal bars and portions of said second and third vertical members supporting the weight of said runs extending only to the highest placed of said second group of horizontal bars from their positions of attachment at the corners of said rectangle,

said uppermost pair of diagonal members connecting the highest placed of said first group of horizontal bars with the highest placed of said second group of horizontal bars.

3. The prefabricated metal stairway of claim 2, further characterized by

at least one of said runs being shorter than an adjacent run,

and said shorter run being an intermediate run among said at least four runs of stairs.

4. The prefabricated metal stairway of claim 3, further characterized by

one of said runs being longer than the remaining runs,

said longer run and said shorter run being adjacent each other,

and a platform connecting an end of said shorter run with an end of said longer run,

said platform forming a cantilever arrangement in cooperation with a portion of said longer run.

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