Nov. 12, 1957 A. W. ODELL 2,812,528

EXTENSIBLE STAIRWAY

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FIG. 1.

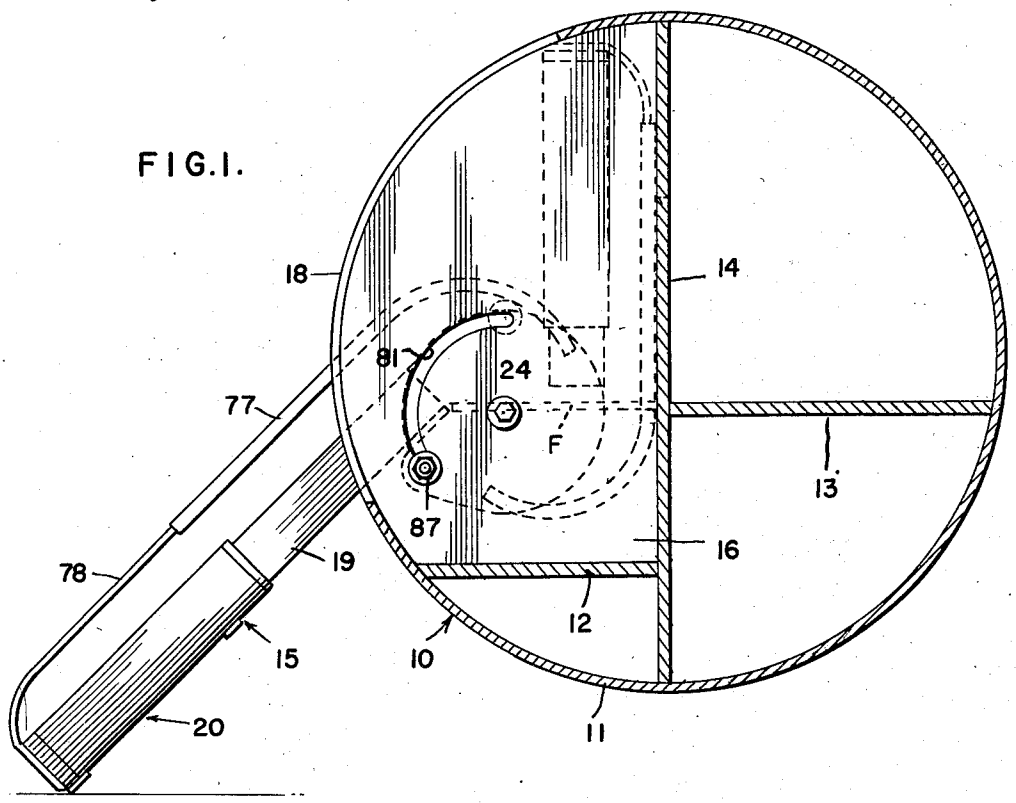


FIG. 9.

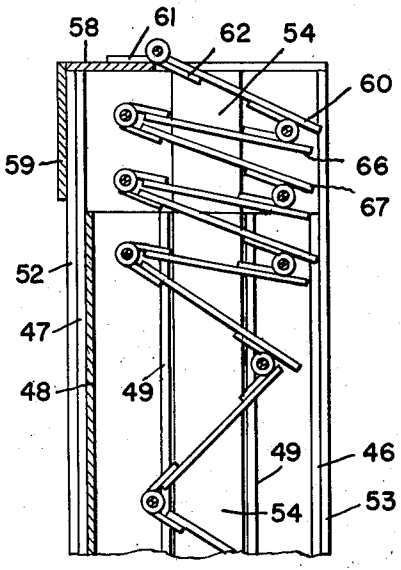
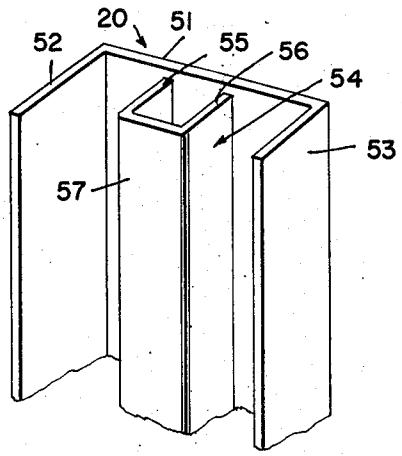


FIG. 5.



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EXTENSIBLE STAIRWAY

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FIG.2.

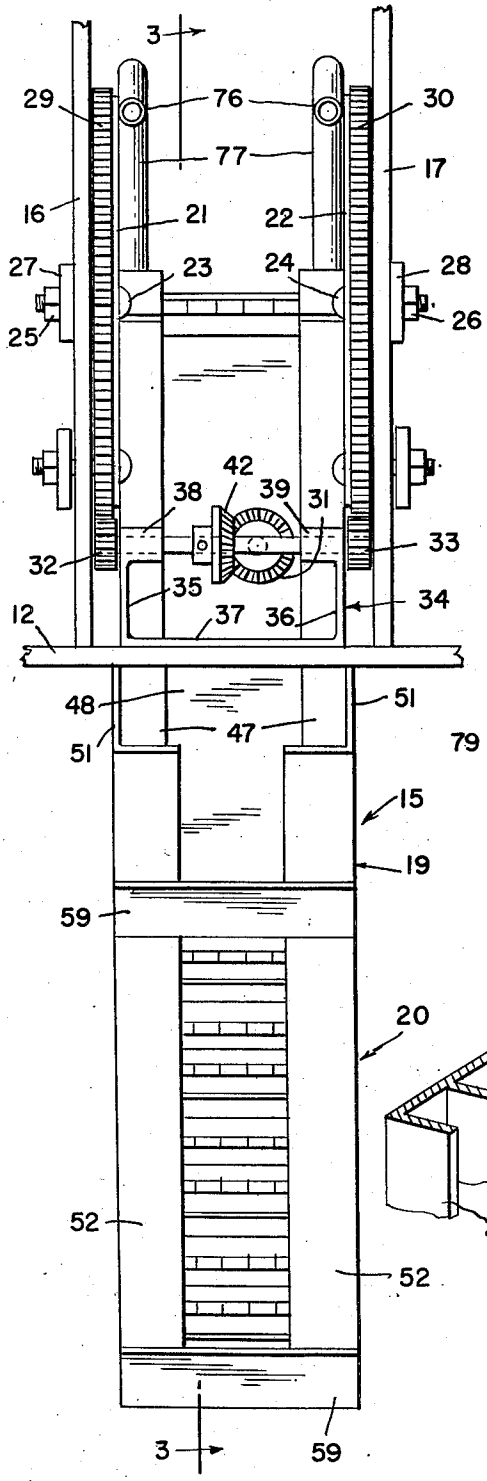


FIG.7.

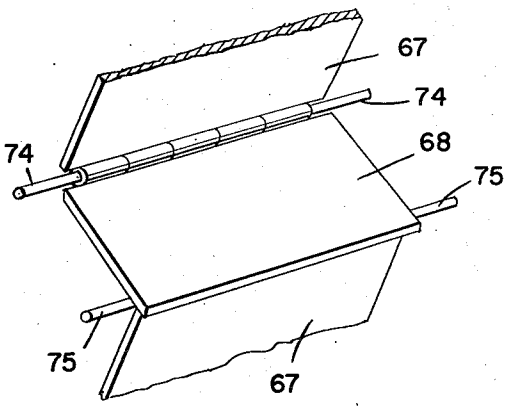


FIG.8.

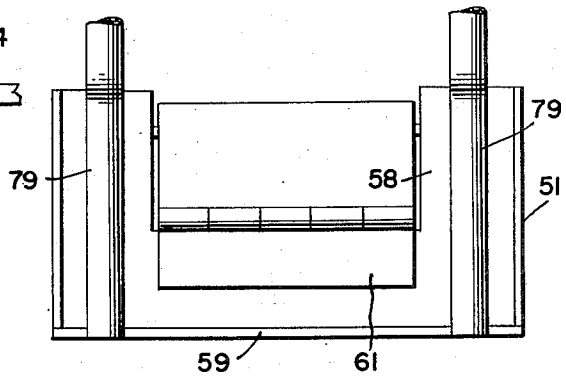
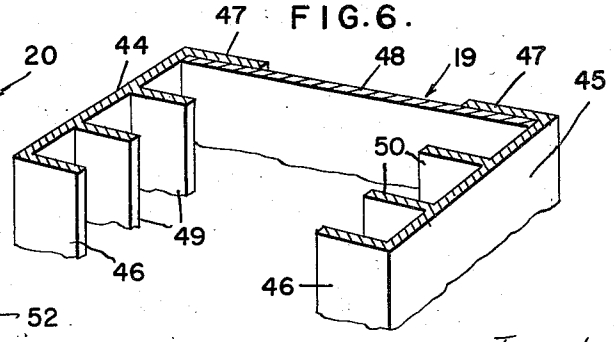


FIG.6.



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EXTENSIBLE STAIRWAY

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FIG.10.

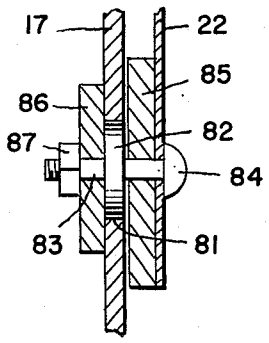


FIG.3.

FIG.4.

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2,812,528

EXTENSIBLE STAIRWAY

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Application May 3, 1955, Serial No. 505,787

12 Claims. (Cl. 14—71)

This invention relates to an extensible stairway construction and pertains more particularly to structural improvements and refinements in the same.

This invention contemplates improved structural characteristics in connection with sliding, extensible stairways which are particularly adapted for use in aircraft.

One object of the invention resides in the provision of an improved extensible stairway which is of compact form and which is so constructed as to readily be adapted to form an integral part of the structure with which it is associated so as to reinforce the same and generally enhances its structural rigidity.

Another object of this invention is to provide an improved form of extensible stairway which includes two or more slidably, telescopically engaged stair sections having a series of hingedly connected steps secured therebetween such that when the stair sections are collapsed, the steps will be folded within the confines of the sections and when the sections are extended fully, the steps will be constrained to assume positions effecting a stairway the full length of the sections.

A further object of this invention is to provide an improved collapsible stairway having at least two telescopically interfitted sections acting as carriages which have connected at remote ends a series of hingedly interconnected risers and treads with abutment means located at each hinged connection between the same cooperable with carriage elements so that the treads and risers are held in proper position to present a series of steps when the sections are extended.

Another object of the invention is to provide an extensible stairway which includes at least two telescopically engaged carrier sections each including spaced side wall members with the side wall members of one section receiving therebetween the side walls of the other section and with the inner section having longitudinally extending spaced abutment flanges projecting laterally inwardly from the inner surface of each side wall so as to receive therebetween longitudinally extending abutment runners which are end connected at one end to the outer section and which extend longitudinally thereof but in spaced relation to the side walls of the outer sections so as to be disposed inwardly of the side walls of the inner section, the abutment runner being projected partially between the abutment edges even when the sections are in fully extended position so that the free end of the same is supported by the abutment flanges even in the fully extended position of the sections.

Another object of this invention is to provide an improved form of extensible stairway which includes at least two telescopically engaged carriage sections having abutment means associated therewith serving as the sole support means for a plurality of hingedly interconnected alternate tread and riser plates which, when the sections are fully extended, are constrained to move into a position effecting a series of steps.

Another object of this invention is to provide an improved form of extensible stairway particularly adapted

for use in aircraft in that the support means for the stairway includes a pair of spaced parallel uprights which in themselves may be integrated with the aircraft frame constructions so as to rigidify the same and materially enhance the strength of the aircraft frame without appreciably adding to the weight thereof.

Another object of this invention is to provide an improved extensible stairway construction wherein the sole means for support of the steps constitutes abutment means carried by the extensible carriage sections and wherein the step means cooperable with the abutment means to support the steps constitutes in part the means for hingedly interconnecting alternate tread and riser plates wherein the steps may be collapsed when the carriage sections are likewise collapsed.

Still another object of this invention is to provide an improved extensible stairway construction wherein one of the carriage sections includes enlarged, generally circular plate portions at its upper end which are pivotally connected to supporting uprights and which carry gear segments operatively related with drive gear mechanism whereby the stairway may be moved between a substantially vertical inoperative position and a lowered operative and extended position.

With the above and other objects in view, the invention consists in the construction and novel combination and arrangement of parts hereinafter fully described, illustrated in the accompanying drawings and pointed out in the claims hereto appended, it being understood that various changes in the form, proportions, and minor details of construction, within the scope of the claims, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:

Fig. 1 is a transverse sectional view through an aircraft frame showing the extensible stairway associated therewith and in operative position in full lines, the dotted line position of the extensible stairway indicating the inoperative or stored position within the aircraft frame;

Fig. 2 is an enlarged rear elevational view of the extensible stairway assembly;

Fig. 3 is a vertical section taken substantially along the plane of section line 3—3 in Fig. 2, illustrating details of the internal construction of the stairway;

Fig. 4 is an enlarged transverse section taken along the plane of section line 4—4 in Fig. 3 and illustrating the manner in which the tread and riser plates are supported on the carriage sections;

Fig. 5 is a perspective view of a portion of the outer carriage section;

Fig. 6 is a perspective view of a portion of the inner carriage section;

Fig. 7 is a perspective view of several of the alternate tread and riser plates showing their manner of interconnection;

Fig. 8 is an end elevational view showing the lower end of the outer carriage section;

Fig. 9 is a vertical section taken through the carriage assembly and showing the same in collapsed position with the steps folded therewithin; and

Fig. 10 is an enlarged sectional view taken substantially along the plane of section line 10—10 in Fig. 3.

Referring now more particularly to Figs. 1 and 2, the reference numeral 10 indicates generally an aircraft fuselage section having an outer skin 11, stepped deck portions 12 and 13 and a vertical wall section 14 substantially vertically dividing the aircraft frame. It will be understood that the precise and exact structural characteristics of the aircraft frame form no part of this invention and those shown in Fig. 1 are illustrative only.

The extensible stairway is indicated generally by the

reference character **15** in Fig. 1 and, as will be more clearly illustrated in Fig. 2, the stairway is supported wholly between a pair of uprights **16** and **17** which, in themselves, preferably form an integral part of the aircraft frame so as to rigidify the same while at the same time supporting the stairway. As particularly shown in the drawings, the uprights **16** and **17** are upstanding from the deck portion **12** and extend therefrom into contact with the inner surface of the outer skin **11** from the point of intersection of the deck portion **12** with the outer skin to the point of intersection between the outer skin and the vertical wall section **14**. The outer skin **11** is provided with a vertically elongate opening **18** which extends between the uprights **16** and **17** and forms therewith an entrance passageway into the interior of the aircraft. Any suitable closure means, not shown, may be provided for entrance thereinto.

The extensible stairway proper consists essentially of the two carriage sections **19** and **20** which are telescopically interengaged so as to assume the full line position shown in Fig. 1 when fully extended and the dotted line vertical position shown in Fig. 1 when fully collapsed and stored within the aircraft. The construction is such that the stairway moves from its inoperative vertical position to full line operative position in Fig. 1 through the entrance opening **18** of the aircraft.

The means by which the stairway is operated between the two positions shown in Fig. 1 will be more readily apparent from Figs. 2 and 3. The upper carriage section **19** includes a pair of generally circular support plate members **21** and **22** which are disposed between the uprights **16** and **17** in closely spaced relation thereto. Projecting centrally through the circular portions **21** and **22** are pivotal members **23** and **24** which also project through suitable openings in the uprights **16** and **17** and which are provided at their outer threaded ends with retaining nuts **25** and **26** respectively and intermediate washers **27** and **28**. Preferably there is disposed between the pivotal bolts and the uprights, in surrounding relation to the pivot bolts, bearing or bushing members, not shown, to serve as low friction pivot means for supporting the stairway.

To effect the pivoting movement of the stairway, each circular plate **21** and **22** is provided with a gear segment as indicated at **29** and **30**, each gear segment being rigidly connected to its associated circular plate and disposed along a portion of the periphery thereof such that the gear teeth project radially outwardly of the marginal edges of the plates. Supported on the section **12** which interconnects the uprights **16** and **17** is a horizontal drive shaft **31** having a pair of pinion members **32** and **33** rigidly fixed thereto which are in engagement with the teeth of the gear segments **29** and **30** such that when the drive shaft **31** is rotated, for example counterclockwise in Fig. 3, the stairway **15** will be moved from the position shown toward the dotted line or inoperative position shown in Fig. 1.

The drive shaft **31** may be supported in vertically spaced relation above the deck section **12** by means of the bearing bracket indicated generally by the reference character **34** which includes the spaced vertical leg portions **35** and **36** interconnected between transverse portion **37** and which legs have at their upper ends the bearing bosses **38** and **39** suitably bushed to rotatably receive the drive shaft **31** therein. The plates **21** and **22** are, of course, spaced from their associated uprights **16** and **17** respectively a suitable distance to accommodate the width of the gear segments **29** and **30**, it being preferred that very little clearance be had between the outer surfaces of the gear segments **29** and **30** and the corresponding surfaces of the uprights **16** and **17**.

For the purpose of transmitting drive to the shaft **31** and consequently causing rotation of the plates **21** and **22**, there may be provided a power shaft **40** in the manner shown in Fig. 3 which intersects the drive shaft **31** and is provided at such intersection with a drive pinion **41** mating with a corresponding miter gear **42** feathered to the drive shaft **31**. The remote end of the power shaft **40** is connected to any suitable source of power, not shown, such as an electric motor or a hydraulic motor. Also, a suitable support such as the bearing bracket **43** may be provided at a convenient location or locations to rotatably support the power shaft **40**.

Having reference at this point most particularly to Fig. 6 wherein a portion of the inner carriage section **19** is shown, it will be seen that this carriage section includes a pair of spaced side wall members **34** and **35** which are elongate and extend the full length of the carriage section. Each side wall has at its upper and lower longitudinal edges the inturned flange portions **46** and **47** respectively, and the side walls are interconnected by means of a longitudinally extending bottom wall member **48** which rests upon the bottom flanges **47** and is securely affixed thereto by any suitable means. Fixedly secured to the inner surface of each side wall **44** and **45** is a pair of spaced parallel abutment flanges such as those indicated by the reference characters **49** and **50**. The abutment flanges extend the full length of the side walls **44** and **45**, their purpose being more readily apparent presently.

The generally circular support plate members **21** and **22** are enlarged continuations of the side wall members **44** and **45** and may be either formed integrally therewith or pivotally and rigidly attached thereto. Thus rotation of the plate members **21** and **22** directly rotates the upper or inner carriage section **19**.

A portion of the lower or outer carriage section **20** is indicated in Fig. 5. The portion shown constitutes only one side of the outer carriage section and it will be seen to include only one side wall portion **51** thereof. In the complete assembly there are two such side wall portions and each is provided with the upper and lower inwardly extending retaining flanges **52** and **53** which extend longitudinally the full length of the side walls **51**. Further, each side wall **51** has associated therewith an inverted channel shaped abutment runner **54** which extends longitudinally the full length of the side wall but in slightly spaced relation thereto. The runner consists of spaced leg portions **55** and **56** which extend inwardly of the inner surface of the side wall **51** and which are connected at their intermost edges by the bight portion **57** which is substantially parallel to the side wall **51**.

Fig. 4 illustrates the manner in which the inner and outer carriage sections are telescopically interengaged, and from a study of the figure, it will be appreciated that the side walls **51** of the outer section are disposed in closely spaced relationship to the side walls **44** and **45** of the inner sections with the abutment runner **54** received between the laterally inwardly projecting abutment flanges **49** and **50** which are connected to the inner surface of the side walls **44** and **45** of the inner section. The abutment runners **54** are connected only at their lower ends to the outer section **20**. As will be seen most clearly in Figs. 3 and 8, the lower end of the outer section **20** is provided with a generally U-shaped plate **58** extending transversely thereof and connected between the opposite side walls **51—51**. The lower ends of the abutment runner **54** are attached directly and only to this plate **58** so as to extend longitudinally of the outer section in cantilever fashion to derive support at their upper ends only from the abutment flanges **49** and **50** even when the carriage sections are fully extended.

The side walls **51—51** of the outer carriage section **20** are rigidly affixed in spaced relationship by any desired number of cross members **59** extending therebetween. Such cross members are rigidly secured to the undersurface of the lower flange members **52** which extend longitudinally along the side walls **51—51** so that the net effect of these cross members is to fix the spacing between the side walls and form a rigid unit of the lower carriage section.

As seen most clearly in Figs. 3 and 8, there is connected

to the lower end of the outer section **20** a riser plate **60**. This riser plate is hingedly connected to the outer section through the medium of a hinge which includes the hinge plate **61** directly attached to the cross plate member **58** at the lower end of the outer section and the secondary hinge plate **62** which is fixed along the lower edge of the riser plate **60**.

At the upper end of the inner section **19** is attached an uppermost tread plate **63**. This tread plate is hingedly affixed to the inner section by means of a hinge which includes the hinge plate **64** attached directly to the upper end of the bottom wall **48** and the hinge plate **65** which is attached to the undersurface of the tread plate **63** at its rear edge.

Extending between the lowermost riser plate **60** and uppermost tread plates **63** are a plurality of alternate tread and riser plates **66** and **67** which are arranged in zig-zag fashion and which are hingedly secured together so as to be collapsible and extendable. The rear edge of each tread plate **66** is hingedly secured to the lowermost edge of each adjacent riser plate **67** by means of the hinge plates **68** and **69** connected to these members respectively, the hinge plates being pivotally or hingedly interconnected by means of the transversely extending pintles **70**. Likewise, each tread plate **66** is connected adjacent its forward edge to the upper edge of the next adjacent riser plate by means of the hinge plate **71** and **72** respectively and with associated pintles **73**.

As will be seen most clearly in Figs. 4 and 7, each pintle **70** and **73** is projected laterally from the side edges of the tread and riser plate **66** and **67**, the lateral projections of the pintle **70** being indicated by the reference character **74** where as the lateral projections of the pintle **73** are indicated by the reference character **75**. The projections **74** and **75** of the pintles are such as to extend nearly the full distance between the opposed inner surfaces of the side walls **44** and **45** of the inner carriage section and are arranged so that alternate pairs of the pintle projections **74** and **75** straddle the abutment flanges **49** and **50** and the abutment risers **54**. Thus, the carriage sections **19** and **20** may be extended only to such position as will be permitted by engagement of the pintle projections **74** and **75** with the corresponding surfaces of either the abutment flanges **49** and **50** or the abutment runner **54**. That is to say, the pintle projections form stops engageable with the abutment means to limit the extensibility of the assembly. When all of the pintle projections have engaged with their associated abutment means, further extension of the carriage sections **19** and **20** is precluded and in that position the sole means of support for the series of stops provided by the tread and riser plates is by the engagement of the pintle pin projections with corresponding surface portions of the abutment flanges **49** and **50** and the abutment runners **54**.

Since the abutment runners **54** are narrower than the distance between the abutment flanges **49**, those steps which are below the lower end of the inner section **19** when the stairway is fully extended, must, of necessity, have their pintle pin projections disposed in slightly closer relationship than those steps which are above the lower end of the inner section **19**. For this reason, the lowermost steps shown in Fig. 3 are effected by hingedly connecting the upper edge of the riser plate **67** to the tread plate **66** at a point which is more remote from the forward edge of the tread plates than is the same connection in the uppermost steps in that figure.

Since either the abutment flanges **49** and **50** or the abutment runners **54** carry the full weight of the steps and any load placed thereon, it is important that the upper end portions of the abutment runners **54** are never disengaged from between the abutment flanges **49** and **50** since such engagement is effective to support the upper free ends of the abutment runners when the carriage sections are fully extended. This is necessary because the abutment runners **54** are connected only at their lower ends to their associated carriage section **20**.

For the purpose of providing a hand rail for the stairway, it is preferred that a rather large tube be bent into the substantial J-shape indicated in Figs. 1 and 3 with the upper end of each tube so bent being connected as at **76** to the corresponding plate **21** or **22** with the remainder **77** of such tube projecting substantially in parallelism with the inner section **19**. A second hand rail tube **78** is secured at its lower end portion **79** to the cross member **58** at the lower end of the outer section **20** by any suitable means, such as welding or the like, and the uppermost free end portion **80** of this hand rail tube is projected into the lower free end of the upper tube portion **77**. Therefore, as the carriage sections are collapsed or extended, the hand rail tube members are likewise associated, it being merely necessary that the inside diameter of the tube portion **77** be sufficient to telescopically receive the lower tube portion **78**. Of course, one such hand rail assembly is provided at each side of the stairway.

Fig. 9 illustrates the approximate position of the tread and riser plates when the device has been disposed in the collapsed position. It is illustrated in Fig. 9 that the lowermost riser and tread plates, due to the close disposition of their pintle pin extensions, are disposed in relatively closely spaced relationship since the free ends of the abutment flanges **49** and **50** engage the same and force the lowermost steps which are shown uppermost in Fig. 9 into a position in which the plates are closely folded. The remainder of the plates are suspended within the confines of the inner section **19**, some of them stacking up at that portion of the intersection which is lowermost in the position of the carriage sections illustrated in Fig. 9 similar to the stacked position of the plates shown uppermost in that figure.

Fig. 10 illustrates the guide means which services to stabilize the stairway construction between the uprights **16** and **17**. Each upright **16** and **17** is provided with an arcuate slot **81** whose center of radius is the axis of the pivot bolts **23** and **24** and within which a ball bearing **82** is disposed. The inner race of the ball bearing is fixed on the shank **83** of a retaining bolt member **84** which projects through both the circular plate and its associated upright, there being a washer **85** disposed between the plate and the upright and a washer **86** on the outer side of the upright between the same and a retaining nut **87** secured on the threaded end of the bolt **84**. Thus, as the plates **21** and **22** are rotated the associated bearings **82** roll within the arcuate slots **81** and stabilize the assembly.

It will be appreciated that Fig. 1 is not intended to show an exact aircraft frame construction with which the stairway is used but is only illustrative in showing the manner in which the stairway is mounted within a theoretical aircraft frame. The top step plate, of course, would have to be associated with a floor plate of the aircraft so that a passenger ascending the steps would step directly from the uppermost tread plate onto the floor of the aircraft. This floor is indicated by the reference character F in Fig. 1 and it is to be understood that this showing is only illustrative and need not be strictly adhered to. It will be further noted that as the stairway moves from the full line lowered position of Fig. 1 to the dotted line upright position of Fig. 1, the entire stairway assemblage will clear the floor plate F and the stairway construction proper will be nested within the aircraft above such floor portion F.

It will also be appreciated that although the drawings illustrate the assemblage used specifically in conjunction with the aircraft frame, the invention is not intended to be limited to this usage. The extensible stairway construction herein shown and described can be utilized to advantage wherever an extensible stairway construction is desired. For example, the construction can be used

in connection with a ship's ladder or gangplank, for a fire escape or for attic or basement steps, in other words wherever it may be desired to utilize the feature of extensibility and compact storage.

I claim:

1. An extensible stairway comprising a pair of spaced parallel uprights, a plurality of telescopically engaged carriage sections, one of said sections at one end of the carriage sections being pivotally connected at one end to said uprights and between the same for movement between a substantially vertical inoperative position and an operative lowered position, a step assembly comprising a series of alternate tread and riser plates hingedly secured together and connected at opposite ends to opposite remote ends of the carriage sections, and stop means on the step assembly disposed in alternate straddling relation with portions of the carriage sections said stop means being engaged with such portions when the sections are extended to support the tread and riser plate and limit the extension of the carriage sections and being moved out of engagement therewith when said carriage sections are collapsed.

2. In an extensible stairway, a pair of spaced, parallel uprights, an elongate carriage section including opposed side walls, said side walls terminating at one end in generally circular enlarged plate portions disposed between said uprights, pivot means projecting centrally through said plate portions and through said uprights whereby to pivotally connect said carriage section between the uprights, an arcuate gear segment secured to each plate portion, a drive shaft having a pair of gears thereon in mesh with said gear segments to rotate said carriage section between a substantially vertical inoperative position to a lowered, operative position, each of said uprights having an arcuate slot therein, and guide means carried by said plate portions received in said arcuate slots.

3. In an extensible stairway, a pair of spaced, parallel uprights, an elongate carriage section including opposed side walls, said side walls terminating at one end in generally circular enlarged plate portions disposed between said uprights, pivot means projecting centrally through said plate portions and through said uprights whereby to pivotally connect said carriage section between the uprights, an arcuate gear segment secured to each plate portion, a drive shaft having a pair of gears thereon in mesh with said gear segments to rotate said carriage section between a substantially vertical inoperative position to a lowered, operative position.

4. In an extensible stairway, a pair of telescopically engaged carriage sections, each section including spaced elongate side walls with the side walls of one section disposed inwardly of and closely adjacent the corresponding side walls of the other section, said one section having a pair of spaced, longitudinally extending abutment flanges secured to each side wall and extending inwardly therefrom, said other section having a pair of elongate abutment runners secured at one end to the free end of such section and extending longitudinally along the inner sides of the associated side walls and in slightly spaced relation thereto so as to be received between the corresponding pairs of abutment flanges on said one section, a plurality of alternate tread and riser plates hingedly secured together, there being a lowermost riser plate at one end hingedly secured to the lower end of said other carriage section and there being an uppermost tread plate at the other end hingedly secured to the upper end of said one carriage section, and there being a laterally projecting abutment pin on either side of each hinged connection between adjacent tread and riser plates, adjacent pairs of such abutment pins being positioned to straddle an associated pair of abutment flanges and an associated abutment runner so as to limit the extensibility of the carriage sections.

5. In an extensible stairway, a pair of telescopically engaged carriage sections, each section including spaced elongate saide walls with the side walls of one section

disposed inwardly of and closely adjacent the corresponding side walls of the other section, said one section having a pair of spaced, longitudinally extending abutment flanges secured to each side wall and extending inwardly therefrom, said other section having a pair of elongate abutment runners secured at one end to the free end of such section and extending longitudinally along the inner sides of the associated side walls and in slightly spaced relation thereto so as to be received between the corresponding pairs of abutment flanges on said one section, a plurality of alternate tread and riser plates hingedly secured together, there being a lowermost riser plate at one end hingedly secured to the lower end of said other carriage section and there being an uppermost tread plate at the other end hingedly secured to the upper end of said one carriage section, the hinged connection between adjacent tread and riser plates consisting of a pair of hinge plates affixed to the adjacent members and a pintle pin pivotally connecting the hinge plates, said pintle pins being elongate so as to project on opposite sides beyond their associated tread and riser plates with adjacent pairs of the pintle pins straddling the associated abutment flanges and the associated abutment runner whereby to limit the extensibility of the carriage sections.

6. In an extensible stairway, inner and outer carriage sections, the inner section including an elongate bottom wall having upstanding side walls extending along opposite sides thereof, and said side walls having a pair of spaced, parallel and longitudinally extending abutment flanges projecting laterally inwardly therefrom, said outer section including spaced side walls each having laterally inwardly projecting retaining flanges along the top and bottom thereof with the side walls being interconnected by a plurality of cross members secured to the undersurfaces of said bottom retaining flanges and extending therebetween, an elongate abutment runner secured at its lower end to the lower end of each side wall of the outer section and extending longitudinally along its associated wall and in spaced relation thereto, whereby the inner carriage section is slidably, telescopically received within the outer carriage section with the abutment runner of the outer section disposed between said abutment flanges of the inner section, an upper tread plate hingedly secured at its rear edge to the uppermost end of said inner section, a lowermost riser plate secured at its lower edge to the lowermost end of said outer section, there being a plurality of alternate tread and riser plates hingedly secured together and to said uppermost tread plate and said lowermost riser plate so as to form a series of steps when the carriage sections are fully extended, each tread and riser plate having a pair of laterally projecting abutment pins straddling the associated abutment flanges and abutment runner so as to limit the extensibility of the carriage sections.

7. In an extensible stairway, inner and outer carriage sections, the inner section including an elongate bottom wall having upstanding side walls extending along opposite sides thereof, and said side walls having a pair of spaced, parallel and longitudinally extending abutment flanges projecting laterally inwardly therefrom, said outer section including spaced side walls each having laterally inwardly projecting retaining flanges along the top and bottom thereof with the side walls being interconnected by a plurality of cross members secured to the undersurfaces of said bottom retaining flanges and extending therebetween, an elongate abutment runner secured at its lower end to the lower end of each side wall of the outer section and extending longitudinally along its associated wall and in spaced relation thereto, whereby the inner carriage section is slidably, telescopically received within the outer carriage section with the abutment runner of the outer section disposed between said abutment flanges of the inner section, an upper tread plate hingedly

secured at its rear edge to the uppermost end of said inner section, a lowermost riser plate secured at its lower edge to the lowermost end of said outer section, there being a plurality of alternate tread and riser plates hingedly secured together and to said uppermost tread plate and said lowermost riser plate so as to form a series of steps when the carriage sections are fully extended, the hinged connection between adjacent tread and riser plates consisting of a pair of hinge plates affixed to the adjacent members and a pintle pin pivotally connecting the hinge plates, said pintle pins being elongate so as to project on opposite sides beyond their associated tread and riser plates with adjacent pairs of the pintle pins straddling the associated abutment flanges and the associated abutment runner whereby to limit the extensibility of the carriage sections.

8. An extensible stairway comprising a pair of spaced parallel uprights, a plurality of telescopically engaged carriage sections, one of said sections at one end of the carriage sections being pivotally connected at one end to said uprights and between the same for movement between a substantially vertical inoperative position and an operative lowered position, a step assembly comprising a series of alternate tread and riser plates hingedly secured together and connected at opposite ends to opposite remote ends of the carriage sections, and stop means on the step assembly disposed in alternate straddling relation with portions of the carriage sections said stop means being engaged with such portions when the sections are extended to support the tread and riser plate and limit the extension of the carriage sections and being moved out of engagement therewith when said carriage sections are collapsed, said stop means including pintle pins projecting laterally from opposite sides of said tread and riser plates and constituting part of the means for hingedly interconnecting said plates.

9. In an extensible stairway, a pair of spaced, parallel uprights, an elongate carriage section including opposed side walls, said side walls terminating at one end in generally circular enlarged plate portions disposed between said uprights, pivot means projecting centrally through said plate portions and through said uprights whereby to pivotally connect said carriage sections between the uprights, an arcuate gear segment secured to each plate portion, a drive shaft having a pair of gears thereon in mesh with said gear segments to rotate said carriage section between a substantially vertical inoperative position to a lowered, operative position, there being another carriage section telescopically engaged with the first mentioned carriage section, each section including spaced elongate side walls with the side walls of one section disposed inwardly of and closely adjacent the corresponding side walls of the other section, said one section having a pair of spaced, longitudinally extending abutment flanges secured to each side wall and extending inwardly therefrom, said other section having a pair of elongate abutment runners secured at one end to the free end of such section and extending longitudinally along the inner sides of the associated side walls and in slightly spaced relation thereto so as to be received between the corresponding pairs of abutment flanges on said one section, a plurality of alternate tread and riser plates hingedly secured together, there being a lowermost riser plate at one end hingedly secured to the lower end of said other carriage section and there being an uppermost tread plate at the other end hingedly secured to the upper end of said one carriage section, and there being a laterally projecting abutment pin on either side of each hinged connection between adjacent tread and riser plates, adjacent pairs of such abutment pins being positioned to straddle an associated pair of abutment flanges and an associated abutment runner so as to limit the extensibility of the carriage sections.

10. In an extensible stairway, a pair of spaced, parallel uprights, an elongate carriage section including opposed side walls, said side walls terminating at one end in generally circular enlarged plate portions disposed between said uprights, pivot means projecting centrally through said plate portions and through said uprights whereby to pivotally connect said carriage section between the uprights, an arcuate gear segment secured to each plate portion, a drive shaft having a pair of gears thereon in mesh with said gear segments to rotate said carriage section between a substantially vertical inoperative position to a lowered, operative position, there being another carriage section telescopically engaged with the first mentioned carriage section, each section including spaced elongate side walls with the side walls of one section disposed inwardly of and closely adjacent the corresponding side walls of the other section, said one section having a pair of spaced, longitudinally extending abutment flanges secured to each side wall and extending inwardly therefrom, said other section having a pair of elongate abutment runners secured at one end to the free end of such section and extending longitudinally along the inner sides of the associated side walls and in slightly spaced relation thereto so as to be received between the corresponding pairs of abutment flanges on said one section, a plurality of alternate tread and riser plates hingedly secured together, there being a lowermost riser plate at one end hingedly secured to the lower end of said other carriage section and there being an uppermost tread plate at the other end hingedly secured to the upper end of said one carriage section, the hinged connection between adjacent tread and riser plates consisting of a pair of hinge plates affixed to the adjacent members and a pintle pin pivotally connecting the hinge plates, said pintle pins being elongate so as to project on opposite sides beyond their associated tread and riser plates with adjacent pairs of the pintle pins straddling the associated abutment flanges and the associated abutment runner whereby to limit the extensibility of the carriage sections.

11. In an extensible stairway, a pair of spaced, parallel uprights, an elongate carriage section including opposed side walls, said side walls terminating at one end in generally circular enlarged plate portions disposed between said uprights, pivot means projecting centrally through said plate portions and through said uprights whereby to pivotally connect said carriage section between the uprights, an arcuate gear segment secured to each plate portion, a drive shaft having a pair of gears thereon in mesh with said gear segments to rotate said carriage section between a substantially vertical inoperative position to a lowered operative position, an outer carriage section telescopically receiving the inner first mentioned carriage section, the inner section including an elongate bottom wall having upstanding side walls extending along opposite sides thereof, and said side walls having a pair of spaced, parallel and longitudinally extending abutment flanges projecting laterally inwardly therefrom, said outer section including spaced side walls each having laterally inwardly projecting retaining flanges along the top and bottom thereof with the side walls being interconnected by a plurality of cross members secured to the undersurfaces of said bottom retaining flanges and extending therebetween, an elongate abutment runner secured at its lower end to the lower end of each side wall of the outer section and extending longitudinally along its associated wall and in spaced relation thereto, whereby the inner carriage section is slidably, telescopically received within the outer carriage section with the abutment runner of the outer section disposed between said abutment flanges of the inner section, an upper tread plate hingedly secured at its rear edge to the uppermost end of said inner section, a lowermost riser plate secured at its lower edge to the lowermost end of said outer section, there being a plurality of alter-

nate tread and riser plates hingedly secured together and to said uppermost tread plate and said lowermost riser plate so as to form a series of steps when the carriage sections are fully extended, each tread and riser plate having a pair of laterally projecting abutment pins straddling the associated abutment flanges and abutment runner so as to limit the extensibility of the carriage sections.

12. In an extensible stairway, a pair of spaced, parallel uprights, an elongate carriage section including opposed side walls, said side walls terminating at one end in generally circular enlarged plate portions disposed between said uprights, pivot means projecting centrally through said plate portions and through said uprights whereby to pivotally connect said carriage section between the uprights, an arcuate gear segment secured to each plate portion, a drive shaft having a pair of gears thereon in mesh with said gear segments to rotate said carriage section between a substantially vertical inoperative position to a lowered operative position, an outer carriage section telescopically receiving the inner first mentioned carriage section, the inner section including an elongate bottom wall having upstanding side walls extending along opposite sides thereof, and said side walls having a pair of spaced, parallel and longitudinally extending abutment flanges projecting laterally inwardly therefrom, said outer section including spaced side walls each having laterally inwardly projecting retaining flanges along the top and bottom thereof with the side walls being interconnected by a plurality of cross members secured to the undersurfaces of said bottom retaining flanges and extending therebetween, and elongate abutment runner secured at its lower end to the lower end of each side wall of the outer section and extending longitudinally along its associated wall and in spaced relation thereto, whereby the inner carriage section is slidably, telescopically received within the outer carriage section with the abutment runner of the outer section disposed between said abutment flanges of the inner section, an upper tread plate hingedly secured at its rear edge to the uppermost end of said inner section, a lowermost riser plate secured at its lower edge to the lowermost end of said outer section, there being a plurality of alternate tread and riser plates hingedly secured together and to said uppermost tread plate and said lowermost riser plate so as to form a series of steps when the carriage sections are fully extended, the hinged connection between adjacent tread and riser plates consisting of a pair of hinge plates affixed to the adjacent members and a pintle pin pivotally connecting the hinge plates, said pintle pins being elongate so as to project on opposite sides beyond their associated tread and riser plates with adjacent pairs of the pintle pins straddling the associated abutment flanges and the associated abutment runner whereby to limit the extensibility of the carriage sections.

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