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Ingerson

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[54] **FOLDABLE WHEELCHAIR AND KIT THEREFOR**

[76] Inventor: **Philip E. Ingerson,** 4825 96th St., Oak Lawn, Ill. 60453

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[51] **Int. Cl.²** **A47C 4/28**

[58] **Field of Search** ..... 297/39, DIG. 4; 280/34 R, 280/36 R, 79.1, 242 WC; 301/1; 16/29, 31 R

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Primary Examiner—Roy D. Frazier
Assistant Examiner—William E. Lyddane
Attorney, Agent, or Firm—Bernard L. Kleinke; Thomas W. Speckman; Leonard J. Kalinowski

[57] **ABSTRACT**

A foldable chair of a light-weight construction having a seat, a back, and front and rear leg structures and foldable between a use position and a storage position, includes a pair of casters mounted in spaced-apart relationship to the front leg structure for partially and rollably supporting the chair over a supporting surface, a pair of wheels mounted in spaced-apart relationship to the rear leg structure for partially and rollably supporting the chair over the supporting surface, and at least one elongated strut element extending between the front leg structure and the rear leg structure, the strut element being connected swingably at one of its end portions to the associated leg structure and being movably connected at its opposite end portion to its associated leg structure so that the strut element may be swung between a substantially horizontal use position and a storage position. The foldable chair further includes a pair of large ambulatory wheels journaled for rotation on an axle connected to the rear leg structure, a foldable footrest connected to the front leg structure, and a package carrier support extending horizontally between the front and rear leg structures.

9 Claims, 8 Drawing Figures

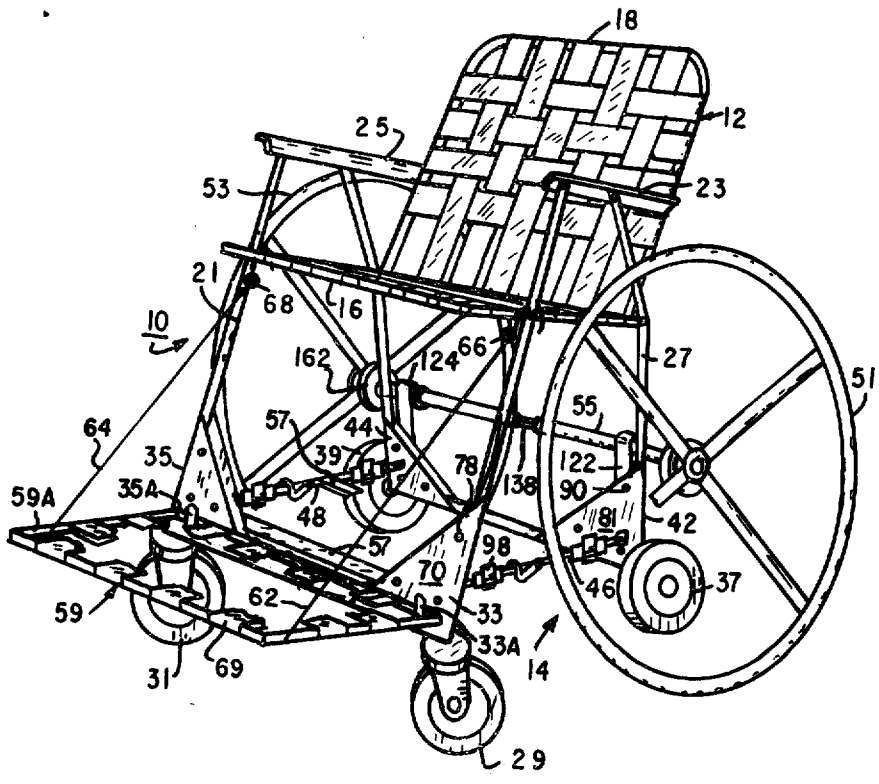


FIG. 1

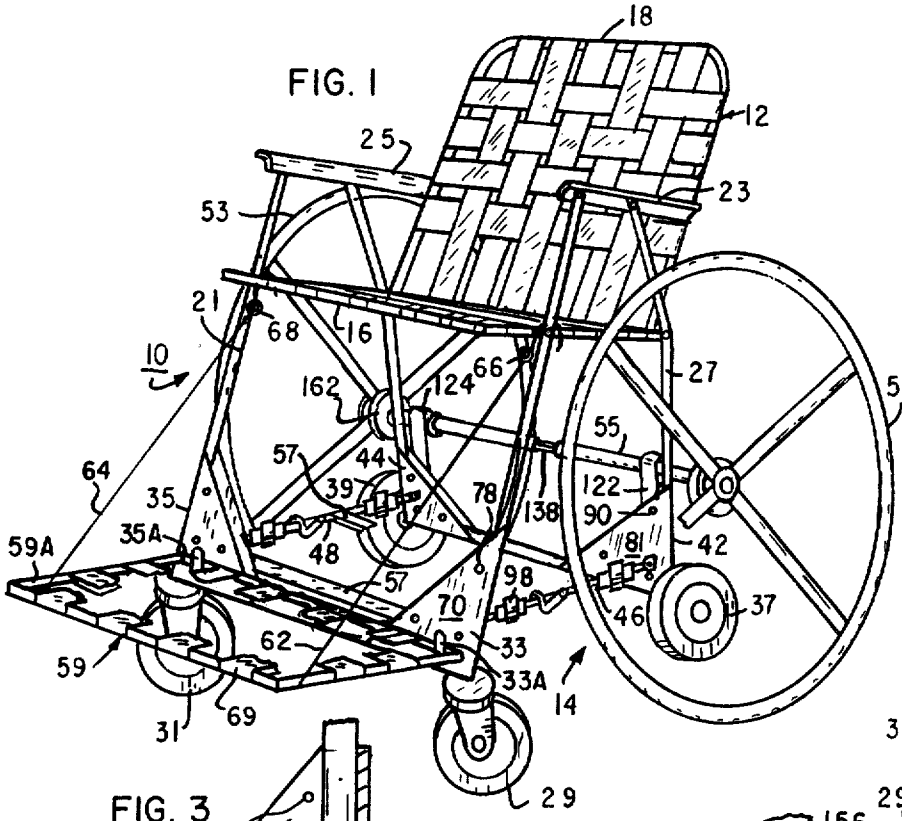


FIG. 2

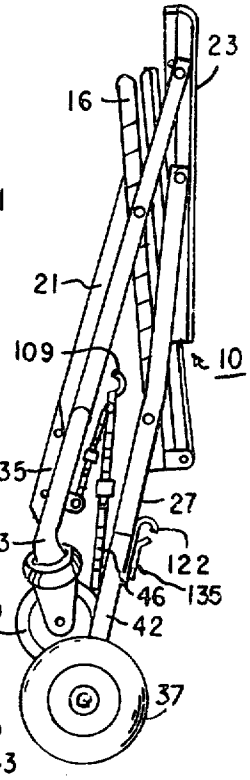


FIG. 3

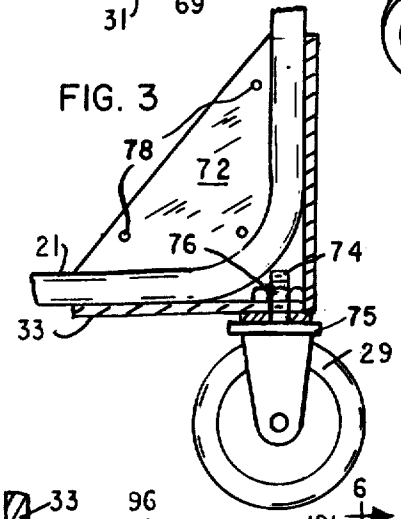


FIG. 8

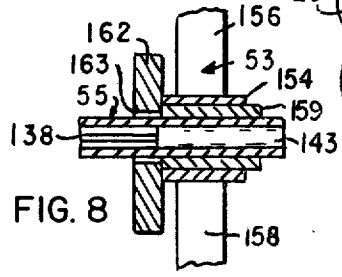


FIG. 5

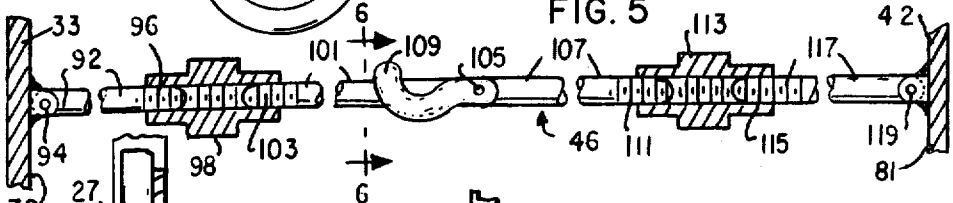


FIG. 6



FIG. 4

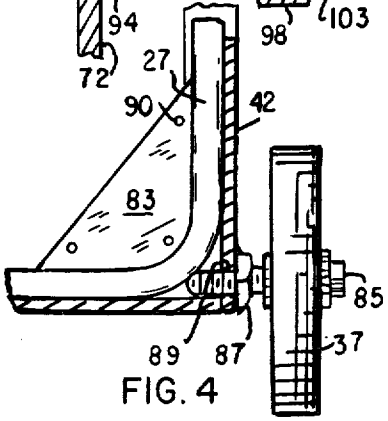
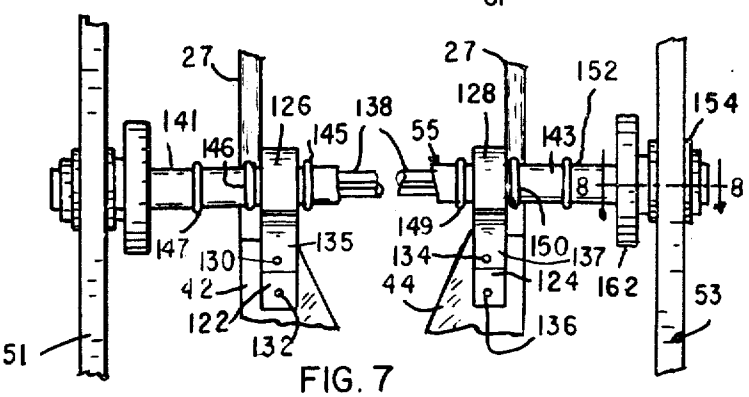


FIG. 7



FOLDABLE WHEELCHAIR AND KIT THEREFOR

The present invention relates to a light-weight foldable wheel chair and a kit therefor, and it more particularly relates to a light-weight chair foldable between a use position and a storage position and having a rollable undercarriage assembly.

Foldable wheel chairs have been employed by people of limited walking ability so that they may fold them into a storage condition to assume a convenient size and shape, whereby the user may, for example, transport the chair in its folded storage position in a vehicle. While such a wheel chair is satisfactory for some applications, it is relatively expensive to manufacture and is unduly heavy in weight so that lifting and manipulating the bulky wheel chair is difficult and for some people impossible to do. Therefore, it would be highly desirable to have a wheel chair which is relatively inexpensive and light in weight, whereby it would be convenient to use in that it would be readily transportable and could be stored with ease in small close spaces. Such a light-weight portable wheel chair should be readily and conveniently held in the hand of the user or rolled along a supporting surface. Also, it would be highly desirable to have a kit for converting an inexpensive light-weight foldable chair of the type made from aluminum and fabric web material, whereby the low cost chairs could be discarded, if desired, after long use and the kit transferred to a new similar chair.

Therefore, it is the principal object of the present invention to provide a new and improved light-weight and convenient to use and store foldable wheel chair and kit for making same.

Briefly, the above and further objects may be realized in accordance with the present invention by providing casters adapted to be connected to the front leg structure of a foldable chair for partially and rollably supporting it over a supporting surface, a pair of wheels adapted to be connected to the rear leg structure of the chair for partially and rollably supporting it over the supporting surface, and at least one elongated strut element extending between the front leg structure and the rear leg structure, the element being swingably connected at one of its end portions to its associated leg structure and movably connected at its opposite end portion to its associated leg structure so that the strut element may be swung between a substantially horizontal use position and a storage position. The strut element provides structural strength needed for enabling a light-weight chair to serve as a wheel chair, since a wheel chair in use oftentimes is subjected to rearwardly or forwardly directed forces which might otherwise tend to cause the chair to fold or collapse. The present invention also contemplates the provision of two large ambulatory wheels journaled for rotation on an axle mounted on the rear leg structure of the chair, and also the present invention contemplates the use of a footrest connected to the front leg structure of the chair and a package carrier support connected between the front and rear leg structures.

These and other objects will become more apparent by reference to the following detailed description and accompanying drawings, wherein:

FIG. 1 is a pictorial view of the foldable wheel chair constructed in accordance with the present invention;

FIG. 2 is an enlarged elevational view of the chair in its folded position with the ambulatory wheels and footrest removed;

FIG. 3 is a cross-sectional fragmentary enlarged view of one of the casters and mounting brackets therefor for the chair of FIG. 1;

FIG. 4 is an enlarged cross-sectional fragmentary view of one of the rear wheels and its mounting bracket of the chair of FIG. 1;

FIG. 5 is an enlarged fragmentary cross-sectional view of one of the strut elements of the chair of FIG. 1;

FIG. 6 is a cross-sectional view of the strut element of FIG. 5 taken substantially along the line 6—6 thereof;

FIG. 7 is a fragmentary enlarged elevational view of the back portion of the chair of FIG. 1, illustrating the ambulatory wheel axle assembly; and

FIG. 8 is an enlarged cross-sectional view of the assembly of FIG. 7 taken substantially along the line 8—8 thereof.

Referring now to the drawings, and more particularly to FIGS. 1 and 2 thereof, there is shown a foldable wheel chair **10**, which is constructed in accordance with the present invention. As shown in FIG. 1, the chair **10** comprises generally a conventional light-weight foldable chair **12** composed of light-weight metal and fabric material (generally referred to as a "lawn chair"), and a rollable undercarriage assembly kit generally indicated at **14**. The chair **12** generally comprises a seat **16** pivotally connected at its rear edge to the bottom edge of a back **18** which is supported from the ground by a front U-shaped leg structure **21** pivotally connected intermediate its ends to the seat **16** with its ends pivotally connected to a pair of spaced-apart arm rests **23** and **25**, respectively, and by a rear U-shaped leg structure **27** pivotally connected intermediate its ends to the seat **16** with its ends pivotally connected to the respective arm rests **23** and **25**. The assembly kit **14** generally comprises a pair of front casters **29** and **31** mounted to the front leg structure **21** by respective corner brackets **33** and **35**, a pair of rear wheels **37** and **39** similarly mounted to the lower corner portion of the rear leg structure **27** by means of the respective corner brackets **42** and **44**, a pair of foldable strut elements **46** and **48** pivotally connected between the front and rear brackets **33** and **42** and between the front and rear brackets **35** and **44** to maintain the chair **12** in its open or use position when it should strike an immovable object during use, and a pair of large ambulatory wheels **51** and **53** journaled for rotation on an axle assembly **55** to enable the user to move the chair along a supporting surface. It should be noted that in FIG. 1 of the drawings, the chair **12** is rollably supported by the front casters **29** and **31** and the rear ambulatory wheels **51** and **53**, the rear smaller wheels **37** and **39** being supported above the ground when the ambulatory rear wheels are employed. If it is not desirable to employ the ambulatory wheels, such as where another person is available to push the chair **12**, the wheels **51** and **53** are readily removable so that the wheels **37** and **39** may be employed in their place as hereinafter described in greater detail. A plurality of fabric bands, such as the band **57**, composed of fabric material similar to the fabric material of the seat **16** and the back **18** of the chair **12** surrounds tautly and extends across the strut elements **46** and **48** to form a package carrier support or rack under the seat **16**. It should be noted that the bands forming the carrier support extend crosswise and are not interwoven with

front-to-back bands as employed in the chair **12** to enable the strut elements **46** and **48** to be folded upwardly when the chair **12** is folded. A foot-rest **59** is pivotally connected to brackets **33** and **35** and cantilevered out therefrom, the outer edge portion being supported by a pair of chains **62** and **64** suitably connected to the footrest by brazing or the like with the free ends thereof connected to the respective hooks **66** and **68** for attaching to the pivot points between the leg structure **21** and the seat **16**. The foot-rest **59** generally comprises a rectangular frame **59A** which removably hooks onto a pair of struck-out tabs **33A** and **35A** on the corner brackets **33** and **35**, respectively. The frame is covered with fabric bands, such as the band **69**, in a woven arrangement in a similar manner to the seat **16** and the back **18**.

As shown in FIG. **2**, the chair **12** may be folded into its storage position by first removing the wheels **51** and **53**, the axle assembly **55**, and the foot-rest **59**, so that the chair may be then folded into the position as shown in FIG. **2**. If desired, the foot-rest **59** may remain attached to the brackets **33** and **35**, and then the chair may be folded into the position as shown in FIG. **2**, the wheels **51** and **53** together with the axle assembly **55** may be inserted between the foot-rest **59** and the seat **16** with the chains **66** and **68** hooking onto any convenient portion of the chair **12** if desired.

Considering now the front corner brackets **33** and **35** in greater detail with reference to FIGS. **1** and **3** of the drawings, the bracket **33** is similar to the bracket **35**, and thus only the bracket **33** need be described. The bracket **33** is generally tri-angular in cross-section and is cup-shaped to receive the complimentary-shaped corner portion of the leg structure. The shape and design of the corner bracket **33** enable it to fit many different kinds of existing foldable chairs. The bracket **33** includes a front triangular wall **70** and a rear triangular wall **72** joined smoothly together in a contoured manner along their side and bottom edges, the walls **70** and **72** being composed of stiff light-weight material, such as aluminum. In order to fasten the caster **29** to the bracket **33**, a threaded post **74** extends from the upper swivel plate **75** portion of the caster **29** through a hole in the bottom portion of the bracket **33** and tightened into a nut **76** fixed to the bracket **33** by a suitable technique, such as brazing. A plurality of screws **78** extend through aligned holes in the front wall **70** and the rear wall **72** and into nuts (not shown) fastened as by brazing to the outer rear surface of the rear wall **72** to secure the bracket **33** to the leg structure **21**.

Considering now the rear brackets **42** and **44** with reference to FIG. **4**, the brackets **42** and **44** are similar to one another and therefore only the bracket **42** need be described. The bracket **42** is also similar in size and shape to the front brackets and includes a front wall **81** and a rear wall **83**.

A bolt **85** extends through the wheel **33** to enable it to rotate on the unthreaded portion thereof, the threaded end portion of the bolt **85** being threaded into a nut **87** brazed to the outside of the bracket **42** and through a hole **89** in the bracket **42** as shown in FIG. **4**. A plurality of screws, such as the screw **90**, extends through aligned holes in the front and rear walls **81** and **83** and into a nut (not shown) brazed onto the back side of the wall **83**.

Referring now to FIGS. **5** and **6** of the drawings, the strut elements will now be considered in greater detail. The strut element **46** is similar to the element **48**, and thus only the element **46** need now be described in detail. The element **46** includes a short rod **92** pivotally connected at **94** to the back side of the wall **72** of the bracket **33**, the opposite threaded end portion **96** of the rod **92** being threaded into a turnbuckle **98** for adjusting the axial length of the element **46**. A rod **101** has one of its ends **103** threaded into the turnbuckle **98** and has its other end pivotally connected at **105** to a rod **107**. In order to retain and limit the downward movement of the rods **101** and **107** below a horizontal position as shown in FIG. **5**, an end portion **109** of the rod **107** extending from the pivotal connection **105** toward the turnbuckle **98** is bent into the form of a hook which fits over the rod **101** between the turnbuckle **103** and the pivotal connection **105**. Thus, the rods **101** and **107** may freely pivot relative to one another in an upward direction, but they are limited by the end hook portion **109** from moving below the horizontal position shown in FIG. **5**. Such an arrangement is highly desirable since the chair **12** may be folded or unfolded without the need for any additional manipulations of the strut elements.

The rear end portion **111** of the rod **107** is threaded into a second turnbuckle **113** to further aid in the longitudinal adjustment of the strut element **46**, the turnbuckle **113** threadably receiving at its opposite end a threaded end portion **115** of a rod **117** which in turn is pivotally connected at its opposite rear end to the wall **81** of the bracket **42** at **119**. In order to fold the element **46**, the rods **101** and **107** are gripped by the hand of the user under the pivotal connection **105** therebetween, and the pivotal connection is then moved upwardly for a short distance moving the two brackets **33** and **41** toward one another, whereby both of the strut elements **46** and **48** may be partially folded upwardly to thereafter permit the chair **12** to be completely moved into its folded position as illustrated in FIG. **2** of the drawings. As clearly shown in FIG. **2**, the combined length of the rods **92** and **101** and the combined length of rods **107** and **117** may be adjusted independently when the strut element is in its foldable position, thereby enabling the folded strut element to be adjusted into position within the confines of the folded chair. The various parts of the strut elements are composed of rigid material, such as aluminum, to permit the strut elements to withstand compressive forces acting on the strut elements tending to move the legs toward one another and thus fold up the chair **12**.

Considering now the axle assembly **55** in greater detail with reference to FIGS. **7** and **8** of the drawings, a pair of brackets **122** and **124** having respective rearwardly-extending hook end portions **126** and **128** fit over the axle assembly **55** and are fastened at their lower end portions by the screws **130** and **132** and the screws **134** and **136**, respectively, to the rear sides of the respective brackets **42** and **44**, whereby the rear end portion of the chair **12** is carried rollably by the axle assembly **55** supported above the ground by the wheels **51** and **53**. A pair of leaf springs **135** and **137** are fastened to the back sides of the brackets **42** and **44**, respectively, in overlying relationship with the respective brackets **122** and **124**, the springs **135** and **137** being secured to the back sides of the brackets **122** and **124**, respectively, by the same screws **130** and **134** fastening the respective brackets **122** and **124** to the respective corner brackets **42** and **44**. As best seen in

FIG. 2, the leaf springs, such as the spring 135, have an upwardly and outwardly-extending bent portion to help retain the axle assembly 55 seated against the hook portions of the brackets 122 and 124.

The axle assembly 55 includes an inner split tube 138 which fits telescopically within a pair of equal diameter, axially aligned tubes 141 and 143 to enable the axle assembly 55 to be longitudinally adjusted in length. In this regard, the hook brackets 126 and 128, as shown in FIG. 7, are positioned between the respective pair of retaining annular external ridges 145 and 146 and the pair of retaining external annular ridges 149 and 150 to limit the axial movement of the axle assembly 55. However, in accordance with the principles of the present invention, if it is desired to employ the wheel chair of the present invention in an area where space is limited such as in a residence, the smaller rear wheels 37 and 39 may be simply removed by removing the bolts retaining them to their respective brackets, whereby the axle assembly 55 may be shortened by moving the tubes 141 and 143 toward one another until the hook portions 126 and 128 engage the respective tubes 141 and 143 between the ridge 146 and an axially outwardly spaced-apart annular retaining ridge 147 and between the ridge 150 and an axially spacedapart outer retaining annular ridge 152. It should be understood that the retaining annular ridges may either be in the form of an integral member or in the form of an attachment, such as an O-ring.

In order to removably attach the ambulatory wheels 151 and 153 to the axle assembly 55, the wheel 53 will now be considered in greater detail, since the manner of attaching the ambulatory wheels to the axle assembly 55 is similar to one another. A hub 154 of the wheel 53 is connectible to the outer rim of the wheel via a plurality of spokes, such as the spokes 156 and 158, and the hub 154 rotatably fits over a bushing 159, which in turn surrounds the tube 143. An annular magnet 162 has a central hole 163 for receiving the tube 143. The magnet 162 is a permanent magnet, and is attracted to the tube 143 magnetically to be removably secured thereon, and similarly the magnet 162 is positioned against the hub 152 and the bushing 159 to be magnetically attached thereto to releasably retain the wheel 53 on the bushing 159. It should be understood that other types of bushings or bearings, such as roller bearings, may also be employed.

While there is described above the principles of the present invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of the present invention.

1. In a foldable chair of the type having a lightweight frame with interwoven flexible webs secured thereto to form a seat, a back, and front and rear leg structures, the chair foldable between a use position and a folded storage position, a rollable undercarriage assembly comprising:

a pair of casters connected to the front leg structure for partially and rollably supporting the chair over a supporting surface;

a pair of wheels connected to the rear leg structure for partially and rollably supporting the chair over the supporting surface;

at least one elongated folable strut element extending between the front leg structure and the rear leg structure;

first pivoting means for connecting swingably one of the end portions of said strut element to its associated leg structure;

second pivoting means for connecting movably the opposite end portion of said strut element to its associated leg structure so that said strut element may be swung between a substantially horizontal use position and a storage position; and

said strut element including a pair of first and second members pivotally connected together, third and fourth members pivotally connected respectively to said first and second pivoting means, and first and second adjusting means respectively connecting said first and third members together and connecting said second and fourth members together for adjusting the overall length of said first and third members and said second and fourth members when they are arranged in substantial axial alignment in the use position and for adjusting independently the combined length of said first and third members and the combined length of said second and fourth members when said strut element is in its folded position, thereby enabling the folded strut element to be adjusted into position within the confines of the folded chair.

2. An assembly according to claim 1, wherein one of said first and second members includes a hook for limiting downward motion of said first and second members substantially below a horizontal position when the chair is in its use position.

3. An assembly according to claim 2, further including large ambulatory wheels positioned near the seat, and an elongated axle assembly mounted on the undercarriage assembly for rotatably supporting said large wheels on opposite sides of the seat, said axle assembly being adjustable in size longitudinally to position adjustably said ambulatory wheels at different spaced-apart positions.

4. An assembly according to claim 3, wherein said axle assembly includes a split tube, and a pair of axially aligned outer tubes for telescopically receiving said split tube, said ambulatory wheels and said tubes being composed of metal, said ambulatory wheels being journaled for rotation on said outer tubes, a pair of magnets positioned on the outer ends of said outer tubes for attracting said wheels to said outer tubes.

5. An assembly according to claim 2, wherein each one of the front and rear leg structures is U-shaped, a rear pair of generally flattened, hollow cup-shaped corner brackets connected to the first-mentioned wheels for fitting over and receiving the rear corners of the rear leg structures, a front pair of generally flattened, hollow cup-shaped corner brackets connected to said casters for fitting over and receiving the front corners of the front leg structure.

6. A kit adapted to be attached to a foldable chair of the type having a lightweight frame with interwoven flexible webs secured thereto to form a seat, a back, and a U-shaped front leg structure and a U-shaped rear leg structure and foldable between a use position and a storage position, comprises:

a rear pair of generally flattened, hollow cup-shaped corner brackets adapted to fit over and to receive the corners of the rear U-shaped leg structures and adapted to be secured in place thereon;

a pair of wheels connected to the rear pair of brackets for partially and rollably supporting the chair over the supporting surface;

a front pair of generally flattened, hollow cup-shaped corner brackets adapted to fit over and to receive the corners of the front U-shaped leg structure and adapted to be secured in place thereon; a pair of casters connected to the front pair of brackets for partially and rollably supporting the chair over a supporting surface; and at least one elongated strut element connected between one of said rear pair of brackets and one of said front pair of brackets.

7. A kit according to claim **6**, wherein said strut element comprises pivotally interconnected first and second members, each one of said first and second members including a pair of rods, and means for adjustably connecting together said rods end-to-end so that the overall length of said rods can be adjusted.

8. A kit according to claim **6**, further including large ambulatory wheels positioned near the seat, and an elongated axle assembly, adapted to be mounted on said rear pair of brackets for rotatably supporting said large wheels on opposite sides of the seat, said axle assembly being adjustable in size longitudinally to position adjustably said ambulatory wheels at different spaced-apart positions.

9. A kit according to claim **8**, wherein said axle assembly includes a split tube, and a pair of axially aligned outer tubes for telescopically receiving said split tube, said ambulatory wheels and said tubes being composed of metal, said ambulatory wheels being journaled for rotation on said outer tubes, a pair of magnets positioned on the outer ends of said tubes for attracting said wheels to said outer tubes.

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