

Aug. 4, 1964

G. WENGER

3,143,185

MULTI-PURPOSE FOLDING LADDER

Filed April 30, 1962

2 Sheets-Sheet 1

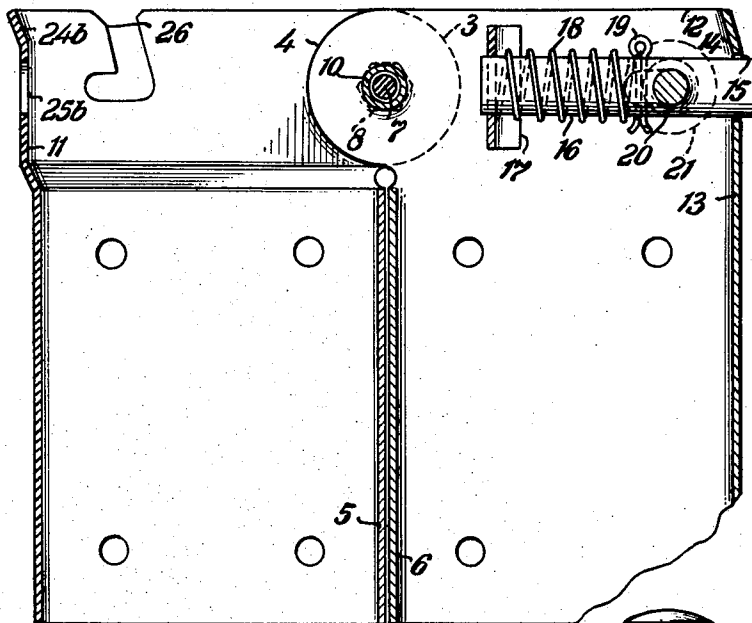


Fig. 1.

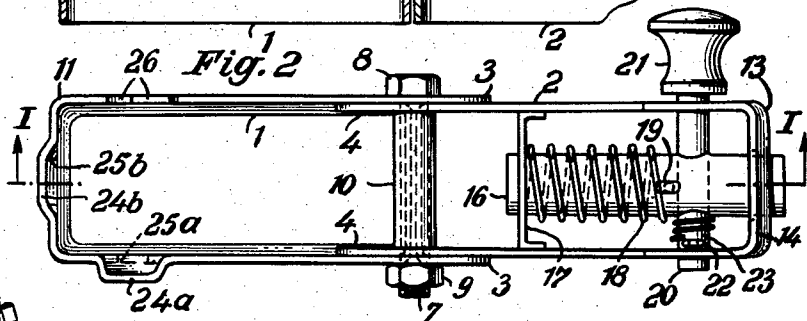


Fig. 2

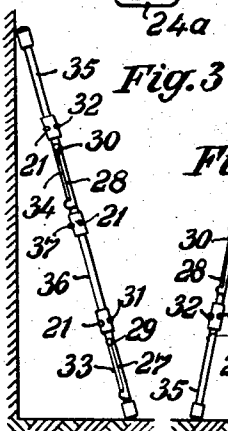


Fig. 3

Fig. 4

Fig. 5

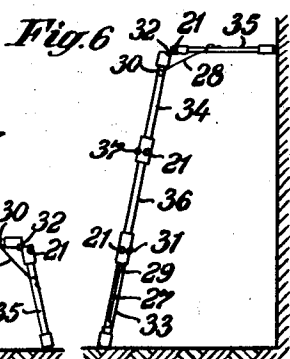


Fig. 6

INVENTOR
GERHARD WENGER
BY *Regent F. Brady*
ATTORNEY

Aug. 4, 1964

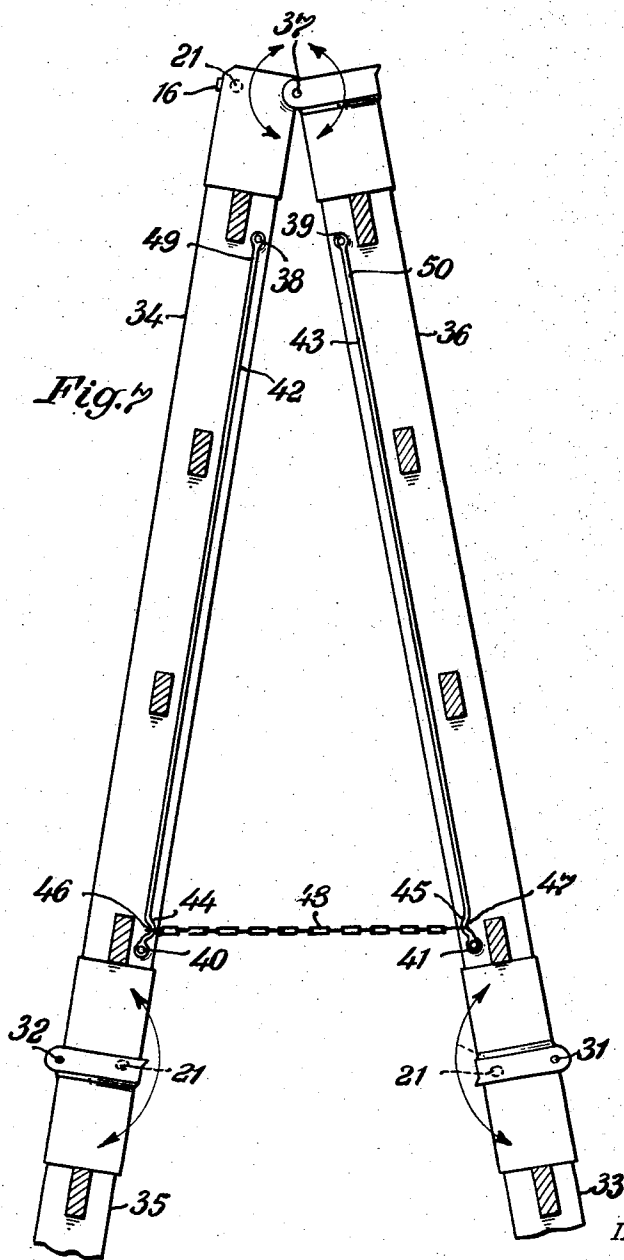
G. WENGER

3,143,185

MULTI-PURPOSE FOLDING LADDER

Filed April 30, 1962

2 Sheets-Sheet 2



INVENTOR

GERHARD WENGER

BY *Rupert J. Brady*
ATTORNEY

1

3,143,185

MULTI-PURPOSE FOLDING LADDER
Gerhard Wenger, Hebbelstrasse 5, Murrhardt,
Württemberg, Germany

Filed Apr. 30, 1962, Ser. No. 191,118

Claims priority, application Germany May 3, 1961

3 Claims. (Cl. 182-24)

This invention relates broadly to ladders and more particularly to a very expedient and versatile multi-purpose folding ladder.

It is known, from the prior art, to join two ladders or ladder sections by means of hinges at one end to form a double ladder which can be used from both ends. It is also customary in prior art teachings to join several ladder sections, end to end, to temporarily obtain a step ladder having greater reach. But the known ladder constructions of the prior art can only be used for a limited purpose, and in most cases their transportation is rather difficult, requiring sometimes even specially equipped cars or trucks to transport the same. It is therefore one of the objects of the invention to provide a construction of multi-purpose folding ladder in which these disadvantages are eliminated.

Another object of the invention is to provide a construction of relatively long reach, multi-purpose ladder which can be adjustably positioned into a variety of configurations and which can be folded into a small volumetric space for efficient transportation in the ordinary automobile.

Still another object of the invention is to provide a construction of joint hinge for a multi-purpose ladder which is rugged and simple in construction and provides means for automatically locking adjacent hinge sections together when moved into axial alignment.

A further object of the invention is to provide a construction of multi-purpose folding ladder having simple fail-safe locking means intermediate adjacent folding ladder sections.

Other and further objects of the invention reside in the joining hinge structure of the ladder, the manner in which duplicate hinge structures can be utilized throughout the length of the ladder construction, and in the means for securing adjacent ladder sections in the unlocked position; and still further objects and advantages of the invention are set forth more fully in the specification hereinafter following and which will become apparent by reference thereto with the accompanying drawings, in which:

FIG. 1 is a longitudinal sectional view through an open hinge portion of the ladder structure according to the invention, the view being taken substantially along line I—I of FIG. 2 and showing the hinge portion removed from the ladder for greater clarity;

FIG. 2 is a top plan view of the ladder hinge joint in the open position as shown in FIG. 1;

FIGS. 3-6 are schematic views showing several possible uses and adjusted positions of a ladder according to the invention with the ladder, according to FIGS. 3 and 4, being shown as seen from one side; and the ladder, according to FIGS. 5 and 6, being shown as seen from the opposite side; and

FIG. 7 is a vertical transverse sectional view through the rungs of a ladder according to the invention, showing the manner in which adjacent hinge members are positioned with respect to each other.

The invention is characterized by several pairs of ladder sections, joined with each other by hinge members which can be locked in axially extending position, which is the preferred operating position, and which can be pivoted at each end of a ladder section by 180 degrees about the longitudinal axis of the ladder sidepiece. This

2

has the result that the ladder can be folded accordion-like and stored conveniently in the luggage compartment of an ordinary passenger car. If all hinges of the ladder according to the invention are extended in axial alignment, a step ladder having a relatively long reach is obtained, as shown in FIG. 3. If the central pair of ladder hinges is bent or pivoted relatively back upon themselves, a double ladder structure is obtained, similar to that shown in FIG. 4, which can have rigid or moving legs, depending upon whether both halves of the ladder are held in their extreme position by rigid pairs of struts or by pairs of chains. If the center hinges are left in locked, extended position so that the central ladder sections are disposed in axial alignment, and the adjacent hinges on either side are bent off by approximately 110 degrees, a high working platform, such as shown in FIG. 5, is obtained. If the center hinges are released in addition to the hinges on either side thereof, two articulated roof-ladder halves are obtained, on or between whose rungs can be placed boards to form a working surface at a selected level, depending upon which ladder rungs are utilized. If only the hinges adjacent the upper end of the ladder are turned or pivoted by approximately 110 degrees, a wall ladder is obtained having a certain distance from the wall, as shown in FIG. 6.

Preferably, the hinges arranged at opposite ends of the same ladder section sidepieces are disposed 180 degrees relative to each other so that the hinge axes lie on opposite sides of sidepieces. This way it is possible to use only one universally fitting hinge joint and, nevertheless, have the hinge lock release handle 21 always disposed on the outside of the ladder, thus rendering it easily accessible for actuating the hinge release bolt 16. This objective is enhanced by the fact that a control button 21 is provided, having a pin extension 20, which extends into the release bolt 16 transverse to its axis, and which protrudes therethrough and to the outside of the hinge assembly on either side thereof through slots provided in the side walls of link box 2 parallel to the release bolt 16. This way the same movement perpendicular to the sidepiece toward its center will unlock the ladder hinge joint independent of the accidental position of the joint with regard to its ladder parts, although the perpendicular movement for oppositely disposed joints will be in opposite directions.

Referring to the drawings in greater detail reference characters 1 and 2 represent boxes of sheet metal or the like, each having a pair of tongues or ear pieces 3 and 4, respectively, extending from the inner narrow sides 5 and 6, and positioned in superimposed relation. The ear pieces are provided with apertures in registration and are rotatably or pivotally connected with each other by a hinge pin 7, such as a machine screw having a hexagonal head 8 and a cooperating fastening nut 9, extending through the apertures. A spacer member or sleeve 10, disposed on hinge pin 7 intermediate opposite pairs of superimposed ears, provides a firm connection between boxes 1 and 2 at their upper ends when nut 9 is tightened on screw 7, but enables the hinge box sections to freely pivot with respect to each other. The spacer sleeve and removable pivot pin assembly enables individual ladder sections to be easily replaced by other ladder sections, such as sections of greater length, or with different rung spacing, etc., or sections constructed of different material such as insulation material for working around electrical power lines and the like.

The inner end portion 11 of the box 1 is widened or expanded as indicated and can be folded or pivoted over the inner end portion 12 of the box 2, to thus overlap and encompass the same when the box members 1 and 2 are positioned in axial alignment, to further increase the strength of the joint between adjacent ladder sections.

3

The narrow side wall 13 of the box 2 disposed opposite the pivot pin 7 is provided with an inwardly sloping bevel 14 at its inner end. An aperture 15 is provided in the sidewall 13 adjacent the bevel 14 for the passage of a latch bar 16, whose rear end portion is supported in sliding relation in an aperture in a small crossplate 17. A return spring 18, having one end in abutting engagement with plate 17, is disposed to press against a cotter key 19, or the like, inserted through the latch bar 16, to thus normally urge the bar outwardly through the aperture 15. A lock release pin 20 is disposed to move transversely in a passage through the latch bar 16 and extends into sliding contact with slots in either side wall of box 2, the slots being disposed parallel to and extending longitudinally with the axis of the latch 16, and being of a length to allow the latch to be retracted into aperture 15. The lock release pin 20 is provided with a lock control or release button 21 on one outer end thereof and the opposite end protrudes somewhat outwardly from the opposite sidewall of box 2 to form a locking member to be described. A cotter key 22 or the like is provided through release pin 20 inwardly of the box sidewalls and a spring 23 is disposed intermediate the key and latch bar to normally urge release button 21 toward the box wall and the opposite end of pin 20 to an extended position as shown in FIG. 2. When the two hinge sections or boxes 1 and 2 are pivoted to their axially aligned position, the front end or extended terminating end of pin 20 is first forced flush with the box sidewall against the pressure of spring 23 by a bevel portion 24a on the enlarged inner end portion 11, which bevel portion tapers downwardly in a direction and in alignment with angular slot 26. Then the front end of latch bar 16 contacts the outwardly inclined bevel portion 24b on the widened end portion 11 of box 1, and the latch is moved inwardly against the tension of return spring 18, temporarily into its release position until the boxes reach their axially aligned positions at which time the front end of latch 16 and the terminating end of pin 20 snap into apertures 25b and 25a, respectively, in the sidewalls of box 1. An angular slot 26 is provided in the widened end portion 11 of box 1, opposite bevel portion 24a, as particularly shown in FIG. 1, to allow a passage for the end of release pin 20 carrying release button 21 as the boxes are pivoted to their locked positions. The slot 29 is provided with a sloping edge since the pin 20 moves inwardly with the latch as the sections are moved together. When the boxes snap into locked position the button end of pin 20 moves forward in the short transverse portion of slot 26. The slot provides for unhindered movement of the release button.

In the locked position of the hinge, neither pressure on the release button alone, nor a force exerted only on the latch bar in the direction of the release movement, can effect the unlocking of the ladder hinge joint. Only the positive accident-proof combined movement of the release button 21 away from the link box, by pulling outwardly on the same, and then simultaneously moving the button 21 and its pin extension 20 toward the inside of the ladder, can the unlocking of the hinge joint be effected. The first movement removes the end of pin 20 from locked engagement with aperture 25a and the second movement removes latch bar 16 from locked engagement with aperture 25b, thus leaving the boxes free to rotate with respect to each other. Thus it can be seen that this arrangement provides a fail-safe locking hinge which cannot become unlocked by any accidental movement.

FIGS. 3 to 6 show some of the various adjusting possibilities of a ladder according to the invention, and also show pairs of bracing struts 27, 28, for maintaining the ladder in the selected adjusted position, which are arranged on both sides of the ladder and which are articulated at 29 and 30, respectively, on side pieces 33 and 34 by bolts or the like in the vicinity of the common hinge joints 31 and 32. The free ends of the bracing struts are provided with slots to slidably engage fixed pins on the

4

adjacent ladder sections and be tightened thereagainst with wing nuts or the like on said fixed pins. When used as a step ladder according to FIG. 3, the pairs of bracing struts 27 and 28 are not needed. When in use they are held in the represented position, for example, by wing nuts or the like (not represented). When used as a rigid double ladder according to FIG. 4, only the struts 27 are used, and by inserting a bolt (not represented) into the slot at the free end of each strut, which bolts are rigidly connected on the outside of the sidepieces of the adjoining ladder section 35 and are provided with a cooperating wing nut for holding the struts in this position for rigidly bracing the double ladder structure. When the multi-purpose ladder according to the invention is used as a scaffold ladder, according to FIG. 5, both pairs of struts 27 and 28 are utilized. When used as a wall ladder with wall distance according to FIG. 6, only the bracing struts 28 are used, while the struts 27 remain in rest position pivoted back upon the sidepiece 33.

In another embodiment of the invention, according to FIG. 7, in lieu of bracing struts, pairs of guide rods 42, 43 are arranged on the inside of the sidepieces 34 and 36, at 38 to 41. The guide rods are somewhat spaced from the sidepieces and are provided on their lower or outer ends, as seen from the central hinge 37, with a sharply recessed part 44, 45 into which fit the terminal links 46, 47 of the holding chains 48, in such a way that the terminal links 46 and 47 cannot slide up along the guide rods 42 and 43, even under maximum tension of the chains 48, since the recessed parts 44, 45 extend toward the center of the chain, thus preventing collapse of the ladder.

If the ladder, according to FIG. 7, is to be used, for example, as a regular long reach ladder as shown in FIG. 3, the ladder sections 34, 35 and 33, 36, respectively are moved closer together to render the chains slack, and the chains 48 are lifted and slid upwards on the rods so that their ends 46 and 47 no longer lie in the recessed parts 44 and 45 of the guide rods 42 and 43. The hinge 37 is then pivoted to its axially aligned locked position and in this position the ends 46 and 47 of the chains 48 are then held according to the invention in stretched or taut position by the outer or opposite ends 49 and 50 of the guide rods 42 and 43, so that the chains 48 in no way interfere with the general use of the ladder, in case it is used for any other purpose.

Thus it can be seen that it is possible to use the multi-purpose ladder according to the invention, with this modified holding means, not only as a rigid double ladder, as shown in FIG. 7, but also as a painter's ladder or the like, which can be moved in known manner on the floor by the person standing on the ladder, without the necessary and prescribed holding chains 48 hindering the locked position of the central ladder hinge joint.

FIG. 7 also clearly shows that the hinge 37 is arranged turned by 180 degrees about the hinge axis with regard to the hinge 31 of the same sidepiece 36 and with regard to the hinge 32 respectively of the same sidepiece 34. In addition, FIGS. 3 and 4, which show the same side of the ladder, which is opposite from the side shown in FIG. 7, also show that the handles or release buttons 21 are arranged on each outer side, so that the hinges at the ends of the same ladder section are turned by 180 degrees about the hinge axis. This then enables the same hinge structure to be used throughout the ladder with the ladder sections being connected to the hinge boxes by means of bolts, pins, rivets, or the like, passing through the holes in the boxes shown in FIG. 1 and through the ends of the ladder sections.

The multi-purpose ladder according to the invention can be made of any material. Particularly advisable, however, for working under live wires, is a ladder of polyester with glass fiber addition, which is characterized not only by its low weight, but also by its excellent insulating properties. This material also has the advantage that the hinge boxes can be attached right away to the sidepieces or made integral with them.

While I have described my invention in its preferred embodiments, I realize that modifications may be made, and I desire that it be understood that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A folding multi-purpose ladder comprising a plurality of ladder sections, pairs of hinge means pivotally connecting the ends of adjacent ladder sections of said plurality of ladder sections, the pivots of said hinge means connected to opposite ends of each ladder section positioned on opposite sides of the ladder plane to allow zig-zag folding of said plurality of ladder sections, each of said hinge means including a pair of link boxes connected to the ends of adjacent ladder sections and pivotally connected adjacent their inner ends with the inner ends disposed in overlapping relation when said boxes are pivoted in axial alignment, a latch bar connected interior of one of said link boxes for movement transverse to the axis of the pivot and extending through registered apertures in said overlapping inner ends to lock said link boxes and ladder sections in axial alignment, a return spring connected to said latch bar to normally urge it to the locked position, said one link box having slots in the sidewalls thereof extending parallel to said latch bar, a latch release pin extending transversely through said latch bar in sliding relation and projecting through said slots, a pair of beveled surface portions carried by the other link box sloping inwardly from the inner end and terminating in apertures through the walls thereof, one of said beveled surface portions positioned to engage the end of said latch release pin and the other beveled surface portion positioned to engage the projecting end of said latch bar as said link boxes and ladder sections are pivoted into axial alignment to move said latch release pin relative to said latch bar and retract said latch bar and release pin against the force of said return spring to a release position and release the same into engagement with the apertures at the ends of said beveled portions to automatically lock

said link boxes and ladder sections in end to end axial alignment.

2. A folding multi-purpose ladder as set forth in claim 1, including a release knob connected to the opposite end of said latch release pin exterior of said link boxes, and the hinge means of each pair of hinge means being identical and connected intermediate adjacent ladder sections such that all the release knobs are directed outwardly of the sides of the ladder.

3. A folding multi-purpose ladder as set forth in claim 1 in which said plurality of ladder sections include hingedly connected central ladder sections having sidepieces, guide rods rigidly connected at opposite ends to the sidepieces of the adjacent central ladder sections and extending longitudinally and substantially coextensive therewith, a bracing chain connected for sliding movement at opposite ends on the guide rods of adjacent central ladder sections and bridging the same, said guide rods terminating adjacent the hinge means joining said adjacent central ladder sections such that said chain is held taut intermediate said rods and in longitudinal alignment therewith when said central ladder sections are disposed in axial alignment, and bent portions provided on said guide rods at the opposite ends for engaging the chain and holding it taut at an angle to said guide rods when the central ladder sections are pivoted out of alignment.

References Cited in the file of this patent

UNITED STATES PATENTS

70,933	Abbott	Nov. 19, 1867
1,508,029	Segal	Sept. 9, 1924
2,012,592	Skiba	Aug. 27, 1935
2,108,774	Lipert	Feb. 15, 1938
2,885,132	Campbell	May 5, 1959

FOREIGN PATENTS

6,884	Great Britain	Apr. 21, 1891
6,223	Great Britain	Mar. 25, 1901
404,248	France	June 21, 1909
534,068	Canada	Dec. 4, 1956