March 19, 1963 W. R. HIRE 3,081,840

FOLDABLE EXTENSION LADDER

Filed June 13, 1961

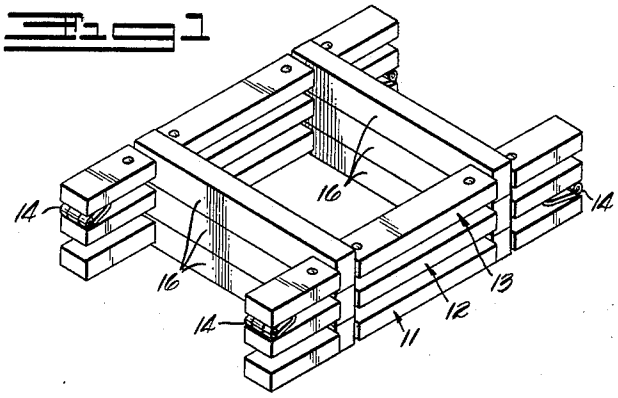


Fig. 1

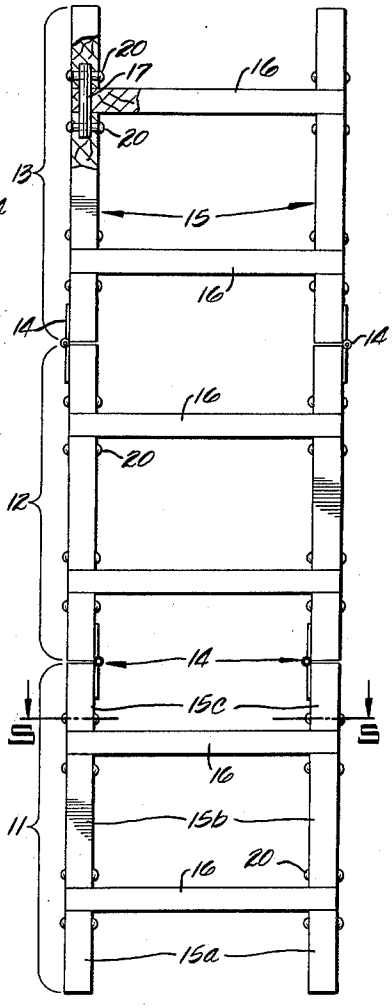


Fig. 3

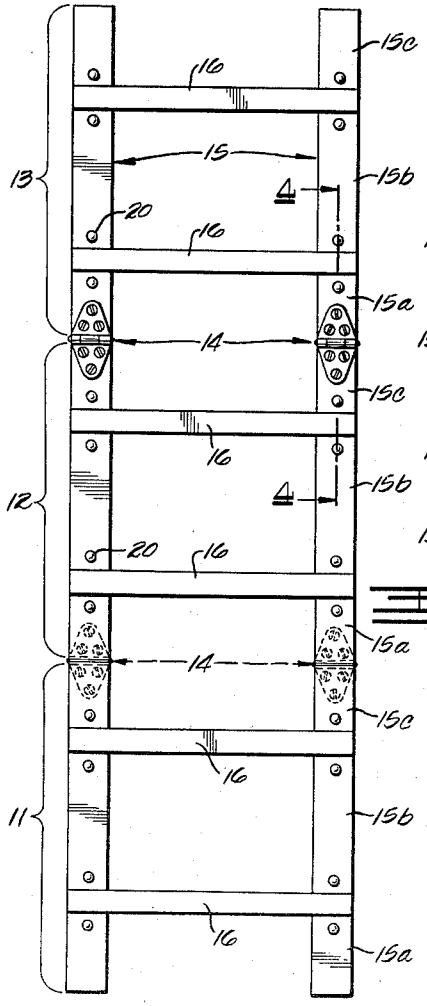


Fig. 4

Fig. 2

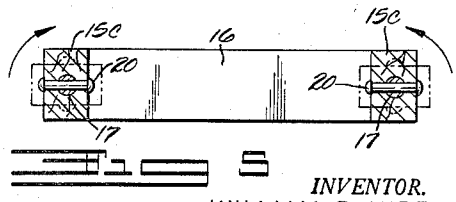


Fig. 5

INVENTOR.
WILLIAM R. HIRE

BY
MAHONEY, MILLER & RAMBO
BY W. S. Rambo
ATTORNEYS.

United States Patent Office 3,081,840 Patented Mar. 19, 1963

3,081,840

FOLDABLE EXTENSION LADDER

William R. Hire, 940 W. Main St., Newark, Ohio

Filed June 13, 1961, Ser. No. 116,715
2 Claims. (Cl. 182—163)

This invention relates to a foldable extension ladder. It has to do, more particularly, with an extension ladder composed of a plurality of hingedly connected sections so arranged as to be folded or collapsed into a compact structure, or extended into straight, longitudinally adjoining order for use.

The primary object of this invention is to provide a structurally simple, yet mechanically efficient, foldable extension ladder which may be easily collapsed into a compact package for storage or transportation from place to place, and which may be extended and rigidly locked into straight, extension ladder-forming order with minimum effort and without the aid of detachable fastening devices, braces, etc.

Another object is to provide a foldable extension ladder which is economical in construction, but sufficiently rugged to withstand the normal abuse to which an ordinary extension ladder is put during use.

According to the present invention, the ladder is composed of a plurality of identically formed, hingedly connected sections, with successive sections being preferably hinged to one another on opposite sides thereof, so as to permit the same to be folded in accordion style into a compact unit wherein each of the sections lies in flat superposed relation to an adjoining section. Each of the hingedly connected, ladder-forming sections comprises a pair of opposed side rails and a plurality of longitudinally spaced steps or rungs which extend transversely between the side rails and are joined therewith in a manner to permit relative rotation of the side rails about their longitudinal axes, so as to position the axes of the connecting hinges in 90 degree relation to the longitudinal axes of the transverse steps or rungs, to thus lock the side rails of the respective sections against relative folding or collapsing movement.

For a further and more detailed understanding of the present invention and the additional objects and advantages thereof, reference is made to the following description and the accompanying drawing wherein:

FIGURE 1 is a perspective view of a ladder formed in accordance with this invention and occupying a folded or collapsed position.

FIGURE 2 is an elevational view of the ladder in its initially extended condition and prior to the locking of the longitudinal side rail members.

FIGURE 3 is a similar elevational view, partly broken away, of the ladder in its extended and locked condition.

FIGURE 4 is an enlarged fragmentary vertical sectional view taken along line 4—4 of FIGURE 2.

FIGURE 5 is an enlarged horizontal sectional view taken along line 5—5 of FIGURE 3.

With reference to the drawing, the ladder of this invention is shown as comprising three identical sections designated generally at **11**, **12** and **13**. However, it is to be understood that this is for purposes of illustration only, and that the ladder may include two or more sections as desired. The adjoining sections of the ladder are connected together by sets of hinges **14**, with the individual sets of hinges located on opposite sides of the ladder, so that the sections can be folded together in accordion style as shown in FIGURE 1, wherein each of the sections lies flatly in superposed relation to the remaining sections. When unfolded into extended relation, the sections will all be in the same flat plane as shown in FIGURE 2.

Each section of the ladder comprises a pair of opposed, longitudinally extending side rails **15** and a pair of relatively opposed, transversely extending steps or rungs **16**. In the example shown, each side rail **15** of each section is composed of three separate but connected rectangular segments **15***a*, **15***b*, and **15***c* and two rectangular steps or rungs **16**, but the number of rungs in each section can be varied and the number of segments in each cooperating rail correspondingly varied. It will be noted that the outer ends of each rung are sandwiched between adjacent ends of the rail segments. The adjacent rail segments on opposite sides of each rung **16** are connected together for simultaneous rotation about a common longitudinal axis. This connection is made by a longitudinally extending dowel pin **17** of circular cross-section which extends through an opening **18** formed in the rung **16** and projects in opposite directions into sockets **19** formed in the adjacent ends of the rail segments. The dowel pins **17** are non-rotatively secured within the sockets **19** of the individual rail segments by means of transverse rivets or pins **20** which extend through the dowel pins and through the adjoining rail segments. Thus, with this arrangement, all of the rail segments of each ladder section are connected together for unified rotation relative to the rungs of that section. Furthermore, the adjacent ends of the rails of each section of the ladder are connected together by the hinges **14** so that when the sections are extended, as shown in FIG. 2, rotation of one segment of each side rail will cause simultaneous rotation of all remaining segments of that rail.

As shown particularly in FIGS. 2 and 3, the individual sets of hinges **14** are preferably mounted on opposite side surfaces of the side rails **15**, so as to permit the ladder sections to be folded in accordion style, as shown in FIG. 1. The axes or hinge pins of the individual hinges **14** are arranged in perpendicular relation to the longitudinal axes of the side rail forming segments, and the cooperative hinge plates may be screwed or otherwise rigidly fastened to the adjoining rail segment.

Assuming the ladder to be in folded condition as shown in FIG. 1, it will be noted that it is a very compact unit. It is a simple matter to unfold it to the flat condition shown in FIG. 2, but it will be understood that at this time the individual sections of the ladder will not be locked against relative folding movement.

To lock the ladder to prevent collapsing or folding is a simple matter and involves the mere rotation or turning of each of the side rails **15** of the ladder about their axes and through an angle of 90 degrees as indicated in FIG. 5 to the positions shown in FIG. 3. This 90 degree rotation of the side rails places the axes of the hinges of one side rail in parallel relation to the axes of the hinges of the opposite side rail and the axes of all hinges are then disposed in perpendicular relation to the longitudinal axes of the rungs **16**. The individual side rails are preferably turned in opposite directions as shown in FIG. 5, so that one set of hinges is located on the outside of the side rails while the other set is disposed on the inside of the rails. Thus, the ladder will be rigidly braced against longitudinal folding by the hinges **14**, and the rungs **16** will prevent relative lateral movement between the opposite side rails **15**.

As will be readily apparent, the side rail components of the individual ladder-forming sections could be made of single piece construction in lieu of the segmental construction as illustrated in the drawing, in which event, the side rail members would be formed with integral, relatively reduced, cylindrical dowel-forming areas in the regions of the steps or rungs, and the steps or rungs would be of sectional construction. Also, if desired, the individual hinge leaves could be cast integral with the ad-

joining side rail segments, particularly where the ladder is formed from cast metal construction.

It will be apparent from the above that this invention provides a mechanically simple ladder structure which can be folded into a compact unit suitable for carrying or storage or extended for use as a straight extension-type ladder. When extended, it can be locked quickly and positively to prevent collapsing.

According to the provisions of the patent statutes, the principles of this invention have been explained and have been illustrated and described in what is now considered to represent the best embodiment. However, it is to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

Having thus described this invention, what is claimed is:

1. A foldable extension ladder comprising a plurality of substantially rigid, relatively adjoining ladder-forming sections, each of said sections including a pair of relatively spaced apart, longitudinally extending side rails and at least one step-forming member extending transversely between said side rails, means rotatively connecting the side rails of each of said sections to the step-forming members thereof and providing for axial turning movement only of said side rails with respect to said step-forming members; and hinge means connecting the side rails of one of said sections to the side rails of an adjoining section, said hinge means including lineal hinge axes disposed in perpendicular relation to the longitudinal axes of said side rails, and said hinge means being turnable bodily with said side rails between a first position in which the hinge axes of said hinge means are disposed in parallel relation to the longitudinal axes of said step-forming members to permit said sections to be folded with

respect to one another and a second position in which said hinge axes are disposed in perpendicular relation to the longitudinal axes of the said step-forming members to thereby lock said sections against relative folding movement.

2. A foldable extension ladder comprising a pair of relatively spaced apart, longitudinally extending side rails each composed of a plurality of separate, relatively adjoining, straight sections; hinge means connecting the sections of said side rails to one another for movement between relatively folded and longitudinally extended positions, said hinge means having lineal hinge axes disposed in perpendicular relation to the longitudinal axes of said sections; and a plurality of straight, rigid, step-forming members extending transversely between and joining said side rails at longitudinally spaced intervals therealong, said step-forming members including opposite end portions rotatively, but non-slidably connected with said side rails and providing for axial turning movement of each of said side rails as a unit when the sections of said side rails occupy their relatively longitudinally extended positions, and said hinge means being turnable with said side rails to positions in which the hinge axes thereof are disposed in perpendicular relation to both the longitudinal axes of said side rails and the longitudinal axes of said step-forming members to thereby lock the adjoining side rail sections against relative folding movement.

References Cited in the file of this patent

UNITED STATES PATENTS

467,525	Strang	Jan. 26, 1892
1,004,883	Knollenberg	Oct. 3, 1911