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LADDERS

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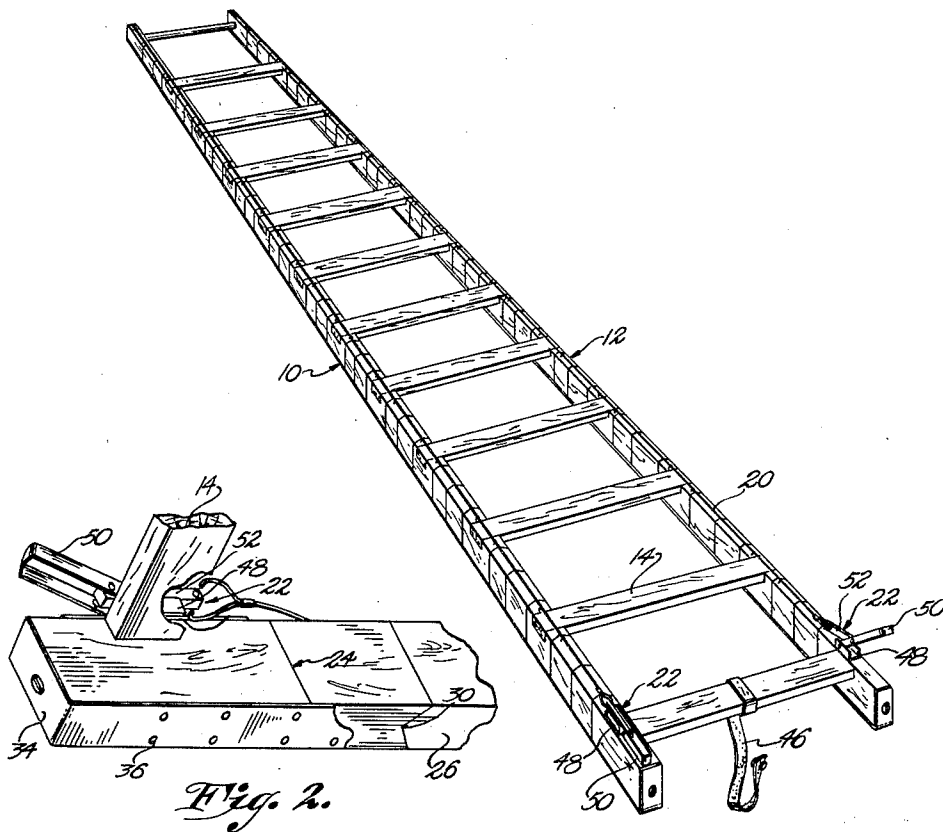


Fig. 1.

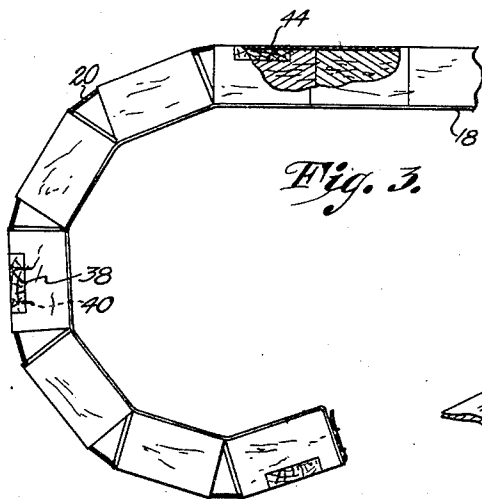


Fig. 3.

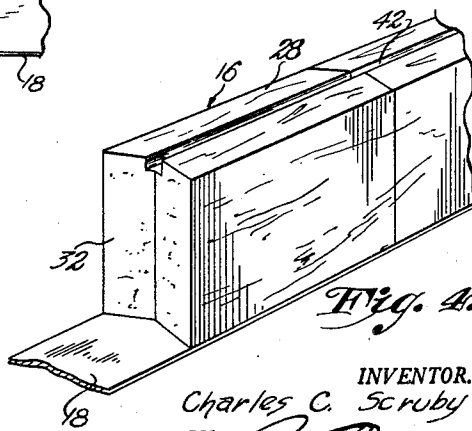


Fig. 4.

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Continuation of application Ser. No. 604,979, Aug. 20, 1956. This application Aug. 3, 1959, Ser. No. 831,430
11 Claims. (Cl. 182-163)

This application is a continuation of application Serial No. 604,979, filed August 20, 1956, now abandoned.

This invention relates to a collapsible ladder and has for its primary object the provision of a novel arrangement of parts permitting winding of the same into a relatively small, compact, lightweight roll for storage or shipment.

It is the most important object of the instant invention to provide a plurality of end-to-end blocks forming a part of the side rails of a collapsible ladder, which rails are interconnected by rungs and the blocks being interconnected by opposed, flexible devices for normally holding the blocks in an operable position and permitting the aforementioned winding of the ladder upon release of one end of one of the devices of the rails.

Another important object of the present invention is the provision of an elongated, continuous, flexible strap interconnecting the end-to-end blocks of the rails along one edge of the latter to present an unusually strong structure still capable of being wound into a roll by virtue of the flexible nature of the strap.

A further object of the instant invention is to provide a collapsible ladder wherein one of the said devices of the rails is in the nature of a cable permanently attached to the rails at one end thereof and provided with releasable take-up means at the opposite ends of the rails for holding the cables in a taut condition during use of the ladder.

Other objects include the way in which the rungs are inset within the rails to permit winding in a relatively small, compact roll; the manner of providing tongue and groove joints between the blocks to hold the latter against lateral displacement; the way in which the rails converge as one end of the ladder is approached so that the blocks and rungs nest properly during winding into a roll; and the way in which longitudinal grooves are provided in the rails and the rungs for receiving the cables.

In the drawing:

FIG. 1 is a perspective view of a collapsible ladder made pursuant to my present invention;

FIG. 2 is an enlarged, fragmentary, detailed perspective view illustrating one end of one of the rails of the ladder.

FIG. 3 is an enlarged, fragmentary, side elevational view showing the manner of winding the ladder into a roll; and

FIG. 4 is a fragmentary, perspective view still further enlarged showing the form and arrangement of the blocks of the rails.

The collapsible ladder illustrated in the drawing includes a pair of side rails broadly designated by the numerals 10 and 12, a plurality of rungs 14 interconnecting the rails 10 and 12, a plurality of initially separate blocks 16 forming a part of the rails 10 and 12, elongated continuous straps 18 interconnecting the blocks 16, and a flexible cable 20 for each rail 10-12 respectively and each of which is provided with take-up means broadly designated by the numeral 22.

The blocks 16 are polygonal and arranged in end-to-end relationship when the ladder is extended ready for use as shown in FIG. 1, there being provided novel joints 24 between the blocks 16 formed to hold the same

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against lateral displacement. Joints 24 extend from one face 26 of the blocks 16 to the opposite face 28 thereof and consists of V-shaped tongues 30 fitting into correspondingly shaped grooves 32.

The continuous, elongated strap 18 is preferably made from a strong metallic flexible material and extends throughout the lengths of the corresponding rails 10-12 on the said face 26 of the blocks 16. It is desirable that ends 34 of the straps 18 overlap the corresponding ends of the rails 10 and 12 and each block 16 is permanently attached to the corresponding strap 18 by a plurality of fasteners 36 extending into the faces 26 of the blocks 16.

Certain of the blocks 16 are provided with recesses 38 for receiving the rungs 14 that are attached thereto through use of suitable fasteners 40. By virtue of the provision of recesses 38 thereby inseting the rungs 14 into the blocks 16, the said rungs 14 are flush with the faces 28 of the rungs 14 and manifestly, the outermost ends of the rungs 14 are likewise flush with the outer faces of the rails 10 and 12.

In addition to the recesses 38 formed in certain of the blocks 16, all of the blocks 16 are provided with longitudinal grooves 42 extending throughout the lengths of the rails 10 and 12 for receiving the cables 20. By the same token, the rungs 14 are provided with transverse grooves 44 in alignment with the grooves 42 to clear the cables 20 when the latter are in the position shown in FIG. 1.

Cables 20 are permanently fastened to the rails 10 and 12 at one end thereof in any desired manner (not shown) but are releasably attached to the rails 10 and 12 at the opposite ends thereof through the medium of take-up means 22 serving to maintain cables 20 in a taut condition when the ladder is placed in use.

It is to be preferred that the rails 10 and 12 diverge as that end of the rails adjacent tightening devices 22 is approached.

It is seen, therefore, that when the cables 20 are tightened through use of the devices 22, the ladder is ready for use and cables 20, as well as straps 18, cooperate to present an extremely strong overall structure. Tests have proved that it is impossible to break the rails 10-12 and that at most, when excessive loads are placed thereon, a bending or deformity takes place which is not likely to injure any user of the ladder.

When it is desired to collapse the ladder, it is but necessary to release the devices 22 whereupon winding into a roll in the manner illustrated by FIG. 3 commences at the narrow end of the ladder. Because of the relative convergence of the rails 10 and 12, the shorter rungs 14 and the proximal blocks 16 progressively nest between and are embraced by the blocks 16 at the wider end of the ladder.

Each take-up means 22 is an "over-center" or toggle type tightening device consisting of a transversely V-shaped bracket secured to the endmost block 16, a lever 50 pivotally mounted at its one end and a link 52. Link 52 is pivotally attached at one end to lever 50 intermediate the ends thereof while the opposite end is in connection with the proximal end of cable 20. Swinging lever 50 about its pivotal mounting thereof tightens and releases cable 20 and when the cable is pulled taut, lever 50 is in a locked condition due to the "past-center" position thereof as regards the pivotal point thereof and cable 20.

Suitable tying means 46 may be provided to hold the roll in a compact bundle during storage or transportation between points of use.

It is to be understood that the above described embodiments of my invention are for the purpose of illustration only and various changes may be made therein

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without departing from the spirit and scope of my invention.

I claim:

1. A ladder comprising a pair of elongated rails each having a single, continuous, longitudinally extending, elongated strap of flexible material flatly engaging one face thereof and a single continuous longitudinally extending flexible cable engaging the opposite face thereof, said straps each being co-extensive in width with the corresponding one face of said rails; means rigidly joining one of the ends of the cables to the corresponding ends of their rails; take-up means joining the opposite ends of the cables to the corresponding opposite ends of their rails, each rail including a number of end-to-end blocks; tongue and groove joints formed by the abutting ends of the blocks and extending from said one face to said opposite face; a plurality of rungs interconnecting the rails and inset into said opposite face thereof, the outer surfaces of the inset portions of said rungs being flush with said opposite face; and means rigidly attaching each block to the corresponding strap, each block being in contact throughout the length thereof with its strap, said take-up means being releasable whereby the ladder may be wound into a roll, said opposite face of the rails and the outer surfaces of the inset portions of said rungs being provided with cable receiving grooves, said rails converging relatively and said rungs progressively decreasing in length as one end of the ladder is approached whereby the blocks and rungs at the opposite end of the ladder from said one end embrace the remaining blocks and rungs when winding is commenced at said one end of the ladder.

2. A ladder comprising a pair of elongated rails each having a single continuous longitudinally extending, elongated strap of flexible material flatly engaging one face thereof and a single, continuous longitudinally extending flexible cable engaging the opposite face thereof, said straps each being co-extensive in width with the corresponding one face of said rails; means rigidly joining one of the ends of the cables to one end of their corresponding rails, each rail including a number of end-to-end blocks; tongue and groove joints formed by the abutting ends of the blocks and extending from said one face to said opposite face, the blocks being in abutting engagement throughout the tongue and grooves thereof when the ladder is extended ready for use, the tongues and the grooves being so formed as to be readily separate when the ladder is wound into a roll; a plurality of flat rungs interconnecting the rails and inset into said opposite face thereof, the outer surfaces of the inset portions of said rungs being flush with said opposite face, said opposite face of the rails and the outer surfaces of the inset portions of said rungs being provided with cable receiving grooves; means rigidly attaching each block to the corresponding strap, each block being in contact throughout the length thereof with its strap; and take-up means joining each cable to the opposite end of its corresponding rail, each of said take-up means including a bracket secured to the endmost block of its corresponding rail, a lever mounted within said bracket and a link interconnecting said lever and the proximal end of its corresponding cable, said lever being pivotally mounted within said bracket whereby said take-up means may be released and the ladder wound into a roll, said rails converging relatively and said rungs progressively decreasing in length as one end of the ladder is approached whereby the blocks and the rungs at the opposite end of the ladder from said one end embrace the remaining blocks and rungs when winding is commenced at said one end of the ladder.

3. A roll up ladder comprising two elongated side rails, each having a top end and a bottom end, and each made up of a plurality of segments, some of which are rung-bearing segments and some of which are non-run-bearing

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spacer segments, there being at least one spacer segment between each pair of rung-bearing segments;

each side rail having on one side of the longitudinal center line thereof a continuous flexible element on which all of the segments are mounted;

means comprising a flexible tensile member for at times applying tension to each side rail on the side thereof opposite to the side on which the flexible element is positioned, to draw the top end of the side rail toward the bottom end and to draw the segments closely together and thus to establish a substantially elongated rigid structure with said segments in end-to-end contact; and

a plurality of rungs inter-connecting the rung-bearing segments of said side rails.

4. The structure of claim 3 in which the flexible tensile member is a pair of cables.

5. The structure of claim 3 in which the means comprising a continuous flexible tensile member for at times applying tension to each side rail, comprises a cable positioned on the side of the longitudinal center line of each side rail opposite to the flexible element, having one end fixedly attached to one end of its associated side rail and means for connecting the cable to the opposite end of the rail comprising take up means for maintaining the cable in tension when the ladder is in operation and for releasing the tension on said cable when it is desired to coil said ladder.

6. The structure of claim 3 in which there is provided means for securing the structure in coiled condition when not in use.

7. The structure of claim 3 in which the rails converge and the rungs progressively decrease in length as one end of the ladder is approached whereby the segments at the opposite end of the ladder from said one end embrace the remaining segments when the ladder is coiled in a roll.

8. The structure of claim 3 in which the rungs are inset in the faces of the runged segments opposite to the faces at which the segments are mounted on the associated flexible element.

9. The structure of claim 3 in which the rungs are offset from the center of the rails and secured to the associated segments adjacent to the edges thereof which are opposite to the faces at which the segments are mounted on the associate flexible element, and

in which there is provided means for at times holding said flexible tensile member in tension for making the structure operative as a ladder and at times releasing said tensile member, whereby when said tensile member is released said ladder may be coiled away from said tensile member and rungs.

10. The structure of claim 3 in which the flexible elements are separate metallic straps for each rail and in which the flexible tensile member is a pair of cables, and

in which there is provided means for exerting tension on the cables for holding the ladder against bending.

11. The structure of claim 3 in which the segments are grooved blocks;

in which the rungs are attached to the grooved side of the runged blocks and have grooves corresponding to the grooves of the blocks;

in which the tensile element is a pair of cables fitting in the grooves of the blocks; and

in which means are provided for exerting tension on the cables for holding the cables in said grooves and holding the ladder against bending.

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