May 30, 1933. M. M. HOOVER 1,912,138

COLLAPSIBLE LADDER

Filed June 28, 1932

Fig. 1.

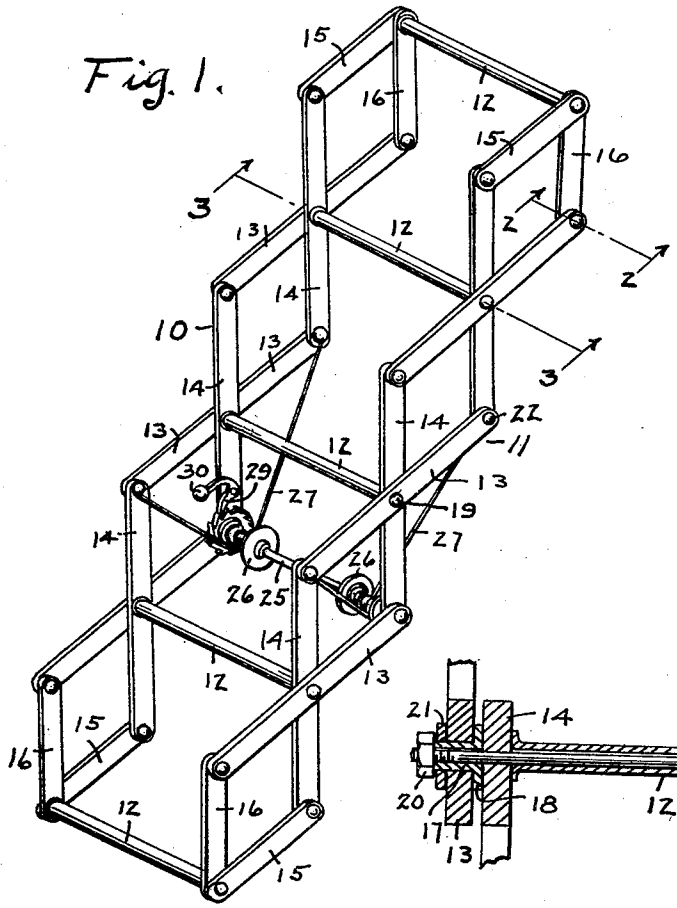


Fig. 2.

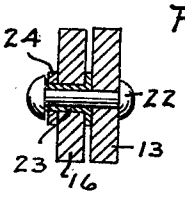


Fig. 3.

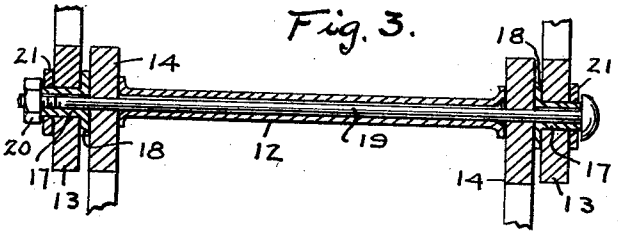
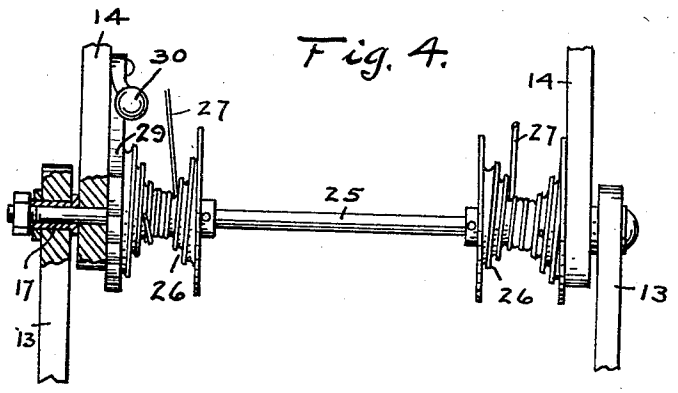


Fig. 4.



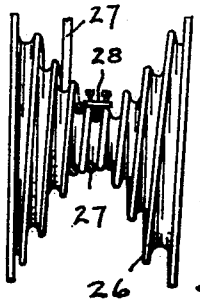


Fig. 5.

INVENTOR,
Martin M. Hoover,
By Minturn & Minturn,
Attorneys.

Patented May 30, 1933 1,912,138

UNITED STATES PATENT OFFICE

MARTIN M. HOOVER, OF HAGERSTOWN, INDIANA

COLLAPSIBLE LADDER

Application filed June 28, 1932. Serial No. 619,724.

This invention relates to the art of ladders and particularly to a collapsible type. It is a primary object of the invention to provide a collapsible ladder structure which may be relatively light in weight so as to permit the structure being easily carried about in the collapsed condition. It is also a primary object of the invention to provide in association with the collapsible structure means for automatically retaining the ladder in any desired extended position operated simply by pulling the rungs apart one from the other.

The invention finds particular use inside of a building where the ladder is to be transported from room to room in that the ladder may be collapsed and extended as desired in shifting about from place to place and passing through doors and around corners all without possible damage that would be likely to arise should a rigid type of ladder be employed.

These and other objects and advantages such as arise from the particular combinations of elements below claimed will become apparent to those versed in the art by the following description of one particular form of the invention in which

Fig. 1 is a front perspective view of a structure embodying my invention;

Fig. 2, a horizontal transverse section on the line 2—2 in Fig. 1;

Fig. 3, a horizontal transverse section on the line 3—3 in Fig. 1;

Fig. 4, a detail in fragmentary front elevation of the ladder length retaining mechanism, and

Fig. 5, a front elevation of one of the drums employed in such mechanism.

Like characters of reference indicate like parts in the several views in the drawing.

The ladder generally comprises the side rails 10 and 11 and interconnecting rungs 12. Each of the side rails 10 and 11 is built up in a lazy tong manner by having bars 13 and 14 crossed at their central points and pivotally secured by their ends to adjacent ends of pairs of like bars. The top and bottom ends of each of the rails are finished by having the links 15 and 16 pivotally secured by one set of ends to the ends of the last pair of crossed bars in each case and having the outer ends of these links pivotally connected together respectively.

In order to have the rungs positioned to be in a common plane, I place the rungs 12 to have their axes respectively pass through the central pivot points of the pairs of bars 13 and 14. Referring to Fig. 3, each rung 12 comprises a tube preferably having its ends flared outwardly to form flanges bearing against the inner sides of the bars 14 and each of the bars 13 has a thimble 17 inserted from the inner side and carried outwardly therethrough to have a flange 18 bearing against the outer sides of the bars 14. A bolt 19 is passed through the thimble 17 in one bar 13, through the adjacent bar 14, entirely through the hollow rung 12, the opposite bar 14, and out through the thimble 17 in the other bar 13 to project sufficiently therebeyond so as to receive a nut 20 screw-threadedly thereon as a means for compressively drawing the thimbles against the outer sides of the bars 14 to compressively engage the rung 12 therebetween. Washers 21 are preferably provided around the projecting ends of the thimbles and under the head and nut on the bolt 19 as means for rockably retaining the bars 13 on the thimbles 17, the lengths of the thimbles 17 being sufficient to prevent the bolt from forcing the bars 13 against the flanges 18 of the thimbles which would prevent rotation of the bars 13. The outer ends of the bars 13 and 14 are pivotally connected to the outer ends of the adjacent pair of like bars by connections as shown in Fig. 2 wherein a rivet 22 is passed through the bar 13, a thimble 23 resembling the above indicated thimble 17 and is headed over on the outer end of the thimble so as to force this thimble compressively against the bar 13 and have the other bar or link 16 in the case illustrated rockably retained on the thimble by the washer 24 under the head formed on the end of the rivet 22. Rungs are also placed between the connected together ends of the links 15 and 16 at both the top and bottom of the rails.

A shaft 25 is carried in parallel alignment with the rungs of the ladder between the intersecting ends of opposite bars 13 and 14, the shaft 25 being here shown, Fig. 4, as having two cable drums 26 fixed thereon, each drum being respectively mounted on the shaft adjacent the inner sides of the bars 14. Each of the drums 26 has a spiral groove therearound giving the drum the general shape of an hour glass whereby the drum increases in diameter from the center outwardly toward both ends. The shaft 25 is revolubly carried between the side bars so that as one drum may be revolved the other one will likewise be revolved, both drums being fixed to the shaft. Each drum 26 has a rope or cable 27 wrapped therearound by one or more turns to have one end of the cable carried forwardly to be attached to the rivet 22 which pivotally unites the ends of the respective bars 13 and 14 directly in front of the drum while the other end of the cable is carried upwardly from the back side of the drum to be secured to the rivet 22 which passes through the other end of the same bar 13, the lower end of which bar carries the rivet to which the other end of the same cable is attached. Preferably each cable 27 is attached to its respective drum as indicated in Fig. 5 by a clip 28 so as to prevent the cable from slipping around the drum. One of the drums 26, here shown as the left hand one, has the periphery of the end adjacent the bar 14 notched to form teeth against which a pawl 29 may drop automatically as the drum may be revolved so as to prevent rotation of the drum in one direction but permit the rotation in the other. Preferably some means is provided to urge the pawl into engagement with the teeth such means being here shown as the weight 30 on a horizontal arm extending from above the pivot point of the pawl.

In operating the ladder, the operator may grasp two of the rungs 12 and pull them apart which action will cause the outer ends of the respective bars 13 and 14 to travel inwardly one toward the other and thus through the connecting bars carry all of the rungs uniformly apart one from the other. During this travel of the side bars 13 and 14 about their central pivoted points, the ends of the respective cables 27 remain relatively stationary while the lower ends of the bars 14 through which the shaft 25 passes swing the drums 26 forwardly and during this travel the drums will be revolved in rolling over the cables as the distances between the ends of the crossed bars 13 and 14 decrease so that in reality the length of the end of the cable between the drum and the rivet 22 in front thereof decreases. The ladder is then ready for use and as the operator steps from rung to rung tending to force one rung down toward the lower rung, movement between the rungs is prevented by reason of the fact that the pawl 29 prevents reverse travel of the drums 26 whereby those ends of the cable between the drums and the forward ends of the bars 13 and 14 to which the cables are secured are placed under tension and prevent the spreading apart of the ends of the crossed bars. Of course the ladder may be further extended merely by pulling apart the rungs, but to collapse the ladder or reduce its extended length, the pawl 29 must be lifted away from the teeth on the drum 26 so as to permit reverse travel of the drums 26 to permit spreading apart of the ends of the pairs of bars 13 and 14. Since the total lengths of the cables 27 must be greater than the length of the bar 13 to permit the shaft 25 to swing as the bars 14 are moved, it is obvious that slack would exist in the cables 27 as the ends of the bars 13 and 14 approach each other and it is for this reason that the drums 26 are made in the hour glass form so that when the ladder is extended to some such position as indicated in Fig. 1, the turns of the cables will be wrapped around substantially the centers of the drums and as the ladder is collapsed, the turning of the drums will carry the cables up onto the portions having the larger diameters so as to take up the slack in the cable, the spiral groove on each drum being so formed as to maintain a uniform tension on the cables throughout movement of the two bars 13 and 14.

While I have here shown and described my invention in the form as now best known to me it is obvious that structural changes may be made without departing from the spirit of the invention and I, therefore, do not desire to be limited to that precise form, nor any more than may be required by the following claims.

I claim:

1. In a collapsible ladder, side rails each comprising a plurality of pairs of centrally crossed bars, the ends of bars of one pair being pivotally attached to ends of bars in adjacent pairs to form lazy tongs, rungs between the side rails having their axes pass through the axes of the pivot points of the bars in each of said pairs, and means for retaining said rails in extended positions comprising a cable having an end fixed between ends of a bar in one of said pairs, a drum carried by the other bar in the same pair engaging said cable, and means selectively holding said drum against rotation.

2. In a collapsible ladder, side rails each formed in the manner of lazy tongs from a plurality of pairs of crossed bars pivoted one to the other with ends of the bars pivoted to ends of bars in adjacent pairs, rungs between the side rails carried by the

bars at their points of crossing, a cable secured between ends of one of the bars, and a member carried by another bar shiftably engaging said cable as the two bars are rocked upon extending or contracting said side rails, and means for selectively retaining said member in stationary positions along the cable.

3. In a collapsible ladder, side rails forming lazy tongs including a pair of crossed bars in one rail centrally pivoted one to the other, a cable fixed between the ends of one of the bars, a drum rockably mounted on the other bar below the pivot axis of the bars and having said cable wrapped thereabout, whereby said cable passes from the lower part of the first bar around the drum on the second bar and thence up to the upper part of the first bar, and means holding the drum against rotation in one direction.

4. In a collapsible ladder, side rails forming lazy tongs including a pair of crossed bars in one rail centrally pivoted one to the other, a cable fixed between the ends of one of the bars, a drum rockably mounted on the other bar below the pivot axis of the bars and having said cable wrapped thereabout, whereby said cable passes from the lower part of the first bar around the drum on the second bar and thence up to the upper part of the first bar, and means holding the drum against rotation in one direction, said drum being tapered to have a varying diameter whereby a uniform tension may be maintained on said cable during the rocking of one bar relative to the other.

In testimony whereof I affix my signature.

MARTIN M. HOOVER.