Sept. 18, 1956 R. G. HEBERT 2,763,420

COLLAPSIBLE LADDER ASSEMBLIES

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Fig. 1.

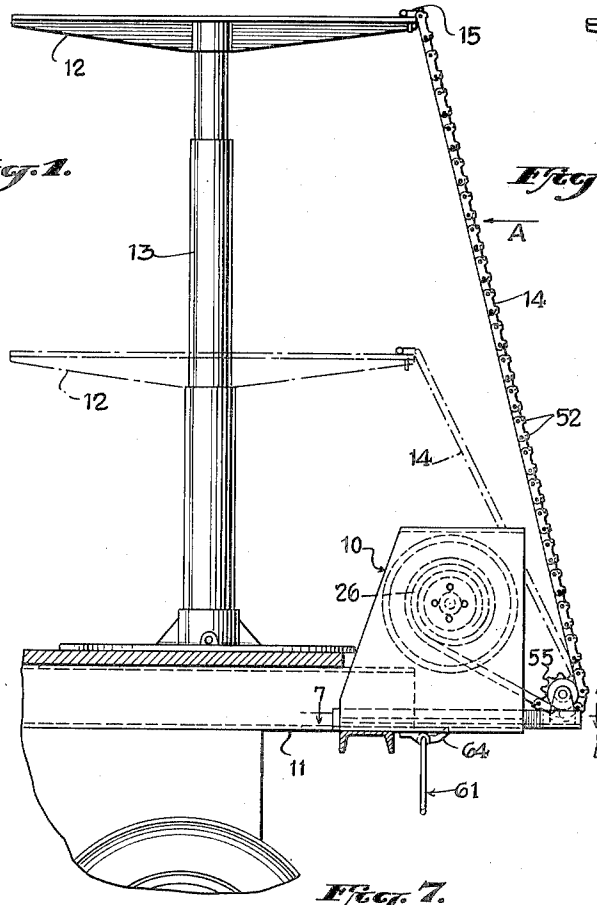


Fig. 2.

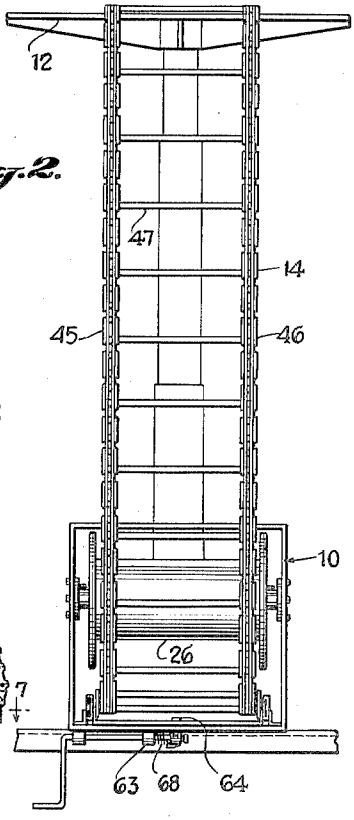


Fig. 7.

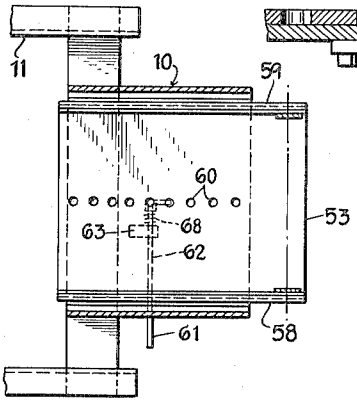


Fig. 8.

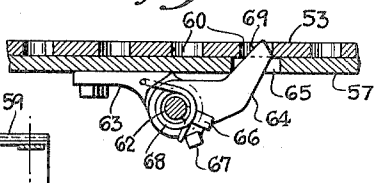


Fig. 5.

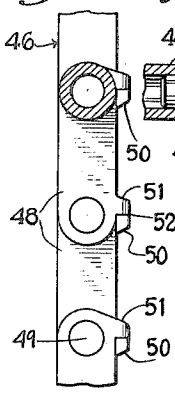
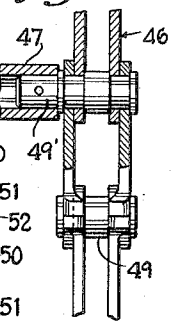


Fig. 6.



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Fig. 3.

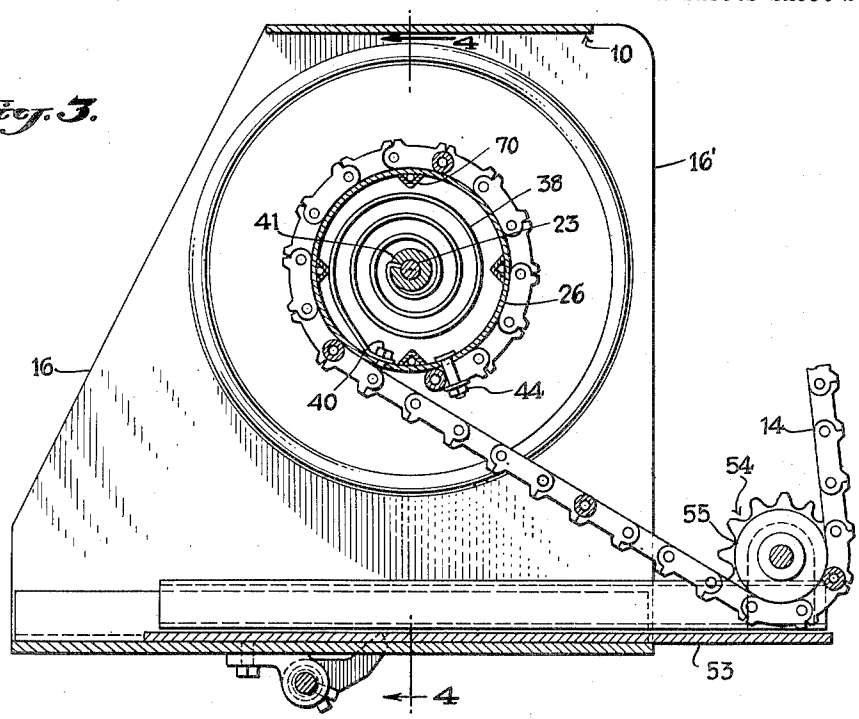
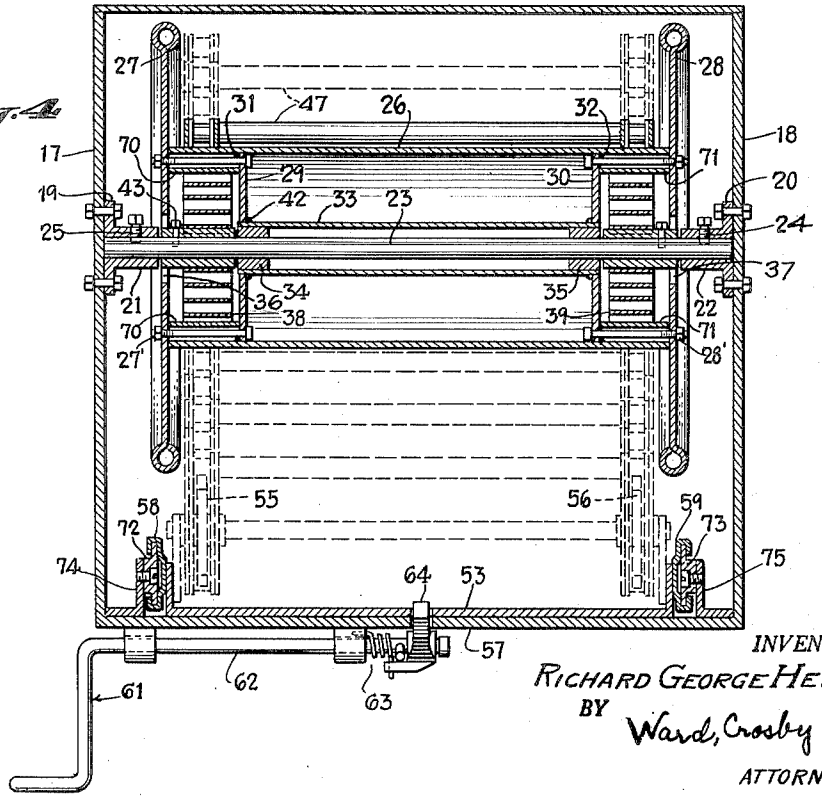


Fig. 4.



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COLLAPSIBLE LADDER ASSEMBLIES

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Application December 24, 1953, Serial No. 400,181

7 Claims. (Cl. 228—43)

This invention relates to collapsible ladder assemblies and more particularly to a self-winding, reel-type ladder assembly usable in conjunction with a platform which is adapted to be raised to varying heights above the base of said ladder.

It is an object of the invention to provide a platform access ladder which can be raised into rigid operative position automatically upon elevation of the associated platform itself, and which can wind itself upon a convenient storage reel upon lowering of the platform.

It is a further object of the invention to provide a platform access ladder equipped with means to adjust the ladder's angle of inclination to the vertical to compensate for the various heights to which the ladder may be raised.

A further object of the invention is to provide a ladder assembly of the type described which is adapted to be mounted on a vehicle such as a truck having a vertically movable platform to which access is desired.

A further object is to provide a ladder assembly of the type described characterized by its compactness, ease of assembly and relatively low cost.

Further objects, features and advantages of the invention hereof will appear from the detailed description given below, taken in connection with the accompanying drawings which form a part of this specification and illustrate by way of example a preferred embodiment of the invention.

In the drawings:

Fig. 1 is a fragmentary side elevational view of the ladder assembly of the invention showing the same supported in operative position on the rear end of a truck equipped with a vertically movable platform, with the ladder and platform elevated in full line and collapsed in broken line;

Fig. 2 is an end elevational view showing the ladder and platform in elevated position;

Fig. 3 is a side elevational view partially in section of the ladder assembly alone;

Fig. 4 is a cross-sectional view of the ladder assembly taken on the line 4—4 of Fig. 3, showing in broken line additional rungs of the ladder in the position that it would assume when said ladder has been further collapsed from the position shown in Fig. 3;

Fig. 5 is an enlarged partial side elevational view of a side rail of the ladder;

Fig. 6 is an enlarged partial sectional view showing the manner in which the horizontal rungs of the ladder are secured to the side rails thereof;

Fig. 7 is a sectional view taken on line 7—7 of Fig. 1, showing the adjustable ladder base and locking mechanism therefor; and

Fig. 8 is an enlarged partial sectional view showing the ladder base locking mechanism in the locked position.

The ladder assembly of the invention is designed to provide a convenient means of access to platforms of the type which may be elevated to positions of varying height. Such platforms are commonly provided on either the front, side or rear of trucks and mobile trailers where it is desired to provide a working space which may be elevated to various levels above the body of truck or trailer itself. The ladder assembly of the invention is particularly useful in conjunction with such vehicle platforms and for the purpose of illustration has been shown in Fig. 1 as secured to a vehicle. However it should be understood that it has utility in many other fields and may be used in conjunction with any platform which is to be raised and lowered.

Referring now in more detail to the drawings and particularly to Fig. 1, a collapsible ladder assembly **10** is there shown secured in operative position on the rear end of a truck chassis **11**. The truck chassis **11** is equipped with a vertically movable platform **12** and a lift mechanism **13**, which latter may be of any desired type such as hydraulic, pneumatic or the like. The ladder assembly **10** comprises a one-way flexible ladder **14** having suitable attachment means **15** at its upper end to permit said upper end of the ladder to be secured to the platform **12**. Therefore, when said platform is elevated, the ladder **14** can be automatically raised into operative position thereby providing access to the platform as is shown in full line in Fig. 1. Due to the provision of rewind means within the ladder assembly, which will be described in detail hereinafter, when the platform **12** is lowered, the ladder **14** will automatically collapse.

Referring now to Figs. 3 and 4, the ladder assembly **10** comprises a housing **16** open at one end as shown at **16** and having up-standing sides **17**, **18** to which are bolted plates **19**, **20** having cylindrical bosses **21**, **22** which latter are internally bored for the reception of a shaft **23**. This shaft is fixed relative to the plates **19**, **20** and therefore to the housing itself by means of set screws **24**, **25**. Rotatably mounted upon said shaft is a hollow cylindrical reel **26** having circular end plates **27**, **28**. Within the hollow interior of reel **26** and inwardly spaced from the end plates thereof are a pair of spaced circular discs **29**, **30** which are tack welded at their outer peripheries to the interior of the reel as shown at **31** and **32**, and are welded at their inner peripheries to a length of pipe **33** which surrounds the shaft **23** in spaced relation thereto and extends between said discs. This pipe **33** is provided with internal bushings **34**, **35** at each of its ends which serve as bearing surfaces to permit rotation of the pipe about the shaft. The end plates **27**, **28** of the reel are provided with central apertures **36**, **37** which are of sufficient size to provide clearance between the plates and the shaft so as to permit free rotation of the reel about said shaft. A coil spring **38**, preferably made of ribbon steel, is disposed in the space between end plate **27** and disc **29**. As best seen in Fig. 3, this spring **38** is coiled around the shaft **23** with one end secured by a rivet or other suitable means **40** to the interior of reel **26** and the other end hooked into a radial slot **41** formed in a sleeve **42** which is fixed relative to shaft **23** by means of a set screw **43**. A second coil spring **39** is similarly disposed about the shaft in the space between end plate **28** and disc **30**, with its ends similarly fixed to shaft and reel respectively thereby forming a resilient interconnection between said shaft and reel.

The end plates **27** and **28** are secured to the discs **29** and **30** by means of bolts **27'** and **28'** in order that said side plates may be easily removed thereby permitting convenient access to the springs **38**, **39**. V-shaped guide members **70** are welded to the interior of reel **26** in position so as to extend between the side plate **27** and circular disc **29**, thereby providing passageways for the bolts **27'** as shown. Similarly V-shaped guide members **71** provide passageways for the bolts **28'**.

Slidably positioned in the lower part of the housing **16**

beneath reel **26** is a ladder base tray **53** which is provided with a ladder base guide means **54** comprising a pair of freely rotatable sprocket wheels **55, 56**. Attached to the tray **53** are channel shaped side members **58, 59**, which slidably embrace a pair of longitudinally extending rail-like members **72, 73** so as to permit telescopic movement therebetween. These rail-like members **72, 73** are supported from and in spaced relation to the bottom **57** of the housing by angle members **74, 75**. The tray **53** therefore is movable inward and outward relative to the housing **16**. A series of spaced apertures **60** is provided in this tray **53**, and a lever actuated, locking pawl mechanism **61**, designed to co-operate with said apertures, is positioned exteriorly of said housing. This latter mechanism, as shown in Figs. 4 and 8, comprises an operating lever arm **62**, which is rotatably journalled in a flange **63** secured to the under side of the housing bottom **57**, and a locking pawl **64**, mounted free on shaft **62** adjacent the flange **63**. As seen in Fig. 8 the housing bottom is provided with an aperture **65** and the shaft **62** and pawl **64** carry co-operating lugs **66, 67** respectively. A coil spring **68** is disposed around shaft **62** with one end anchored in flange **63** and its other end bearing against locking pawl lug **67**, so as continuously to urge the pawl upwardly through housing bottom aperture **65** and any one of the tray apertures **60** which may at the moment be in line therewith. When the pawl is in the locked position shown in Fig. 8, extending upwardly through aperture **65** and one of the apertures **60**, the ladder base tray **53** cannot be moved from right to left, or in other words inwardly of the housing, because of the rigid contact between the pawl, tray and housing bottom. The tray is however free to be moved from left to right, or in other words outwardly of the housing, since the tray **53** will contact the inclined surface **69** of said pawl and cam it downwardly against the action of spring **68** out of the aperture **60**. As soon as the movement of the tray is reversed, however, the pawl will be returned to locking position by spring **68**. When it is desired to move the tray inwardly of the housing the locking mechanism may be released by rotating the shaft **62** clockwise as seen in Fig. 8, whereupon pawl lug **66** will engage the shaft lug **67** thereupon rotating the pawl out of contact with aperture **60**.

The ladder **14**, itself, comprises rungs **47** and side rails **45, 46** which latter are so constructed as to possess only one-way flexibility, or in other words, said side rails are designed so that they will maintain rod-like rigidity when (looking at Fig. 1) force is applied thereto in the direction of arrow A, and yet are capable of flexing around sprocket wheels **55, 56** and storage reel **26**. The precise design of these side rails may take many forms, one being the one-way flexible sprocket chains disclosed herein. Referring now to Figs. 5 and 6, these sprocket chains are comprised of a plurality of links **48** pivotally interconnected by pins **49**. Each link is provided on one side with lugs **50** and **51** which abut as at **52** when the ladder is elevated as shown in full line in Fig. 1 and thereby restrict the pivotal movement of said links in one direction about the pins **49**. However since no such lugs are provided on the other side of the links **48**, unrestricted pivotal movement in the opposite direction is permitted thereby providing the chain with one-way flexibility. As seen in Fig. 6 the horizontal rungs **47**, which may be formed of hollow pieces of pipe, are secured to the sprocket chains by the simple expedient of forming certain of the pivot pins **49** with extensions **49'** over which the hollow rungs **47** may be telescoped and suitably secured thereto.

As mentioned above, the upper end of ladder **14** is provided with attachment means **15** which permit said upper end to be connected to the platform **12**. The lower end of the ladder is riveted or otherwise suitably secured as at **44** to the reel **26**, and between said ends the sprocket chain risers **45** and **46** of the ladder pass around the sprocket wheels **55** and **56** of the ladder base guide means.

The mode of operation of the device will now be described:

When the platform **12** is at its lowermost position as shown in broken line in Fig. 1, the ladder **14** is collapsed and coiled about storage reel **26** as shown in broken line in Fig. 4. When desired the platform may be elevated by lift mechanism **13** to any desired height within the range of the particular mechanism. This range varies of course with the installation but when platforms of this type are provided on trucks or similar vehicles, said range usually permits elevation of the platform to a height in the order of 15 feet above the chassis. As the platform **12** rises to the full line position shown in Fig. 1, the ladder **14** is automatically raised into rigid operating position due to the connection of its upper end **15** to the platform. When in this operative position the ladder provides convenient access to the platform, since a worker may climb said ladder and the same will not yield or flex due to his weight. This rigidity is of course due to the one-way flexible sprocket chains **45, 46** having abutting lugs **50, 51** described above. During the simultaneous elevation of the platform and ladder, the reel **26** will be rotated on shaft **23** thereby permitting uncoiling of the ladder from the reel and at the same time storing energy in the coil springs **38, 39**, much in the same way that energy is stored in a watch spring upon winding. When the platform is lowered by releasing lift mechanism **13**, the ladder will collapse and be automatically rewound about reel **26** due to the rotation of said reel caused by the release of the stored energy in springs **38, 39**. As shown, the sprocket chain side rails of the ladder are continuously guided by the sprocket wheels **55, 56** of the ladder base guide means. These sprocket wheels are carried by the adjustable ladder base tray **53** and their position relative to the housing determines the ladder's angle of inclination to the vertical. This adjustable feature is necessary to compensate for the various heights to which the platform can be raised. For example, assuming that the platform **12** is raised to a higher elevation than shown in full line in Fig. 1, if the ladder base tray and sprocket wheels were to be left in the same positon, the ladder itself would approach more nearly to an absolute vertical position. Since, for ease of climb, a suitable inclination to the vertical is always desirable, this would be a disadvantage to the utility of such a ladder. However, because the ladder base tray herein is slidable relative to the housing, it may be moved outwardly relative to said housing for each additional elevation of the platform thereby maintaining the desired ladder angle of inclination to the vertical. When it is desired to move said ladder base tray and its sprocket guide wheels outwardly of said housing, to compensate for a higher elevation of the platform, the tray may be manually pulled outwardly of the housing. As described above in connection with Fig. 8, when the tray is pulled in that direction it will cam the locking pawl **64** downwardly out of engagement with the particular apertures **60** with which it is at the moment engaged. As outward movement of the tray is continued the pawl **64** under the action of spring **68** will automatically be urged upward into each of the apertures **60** as they pass over housing bottom aperture **65**. When the appropriate setting of the sprocket wheels relative to the housing has been reached so as to provide for proper inclination of the ladder, outward movement of the tray is discontinued and the pawl **64** will enter that aperture **60** which is then in alignment with aperture **65**. As has been described above, in this position the tray is locked against inward movement relative to the housing by virtue of the locking action of the pawl, and therefore the ladder base guide means will remain stationary when subjected to the weight of the worker climbing the ladder **14**. When it is desired to move the ladder base tray and guide means inwardly towards the housing, the same can easily be accomplished by means of operating lever arm **62**. This lever arm per-

forms in the same manner whether the ladder be in the elevated or collapsed position and, when rotated clockwise as shown in Fig. 8 and described above, will rotate the locking pawl downwardly and out of contact with the tray **53**, thereby permitting said tray to be pulled inwardly of the housing.

Although certain particular embodiments of the invention are herein disclosed for purposes of explanation, various further modifications thereof, after study of this specification, will be apparent to those skilled in the art to which the invention pertains. Reference should accordingly be had to the appended claims in determining the scope of the invention.

What is claimed and desired to be secured by Letters Patent is:

1. A self-winding, reel-type ladder assembly usable in conjunction with a platform which is adapted to be elevated, comprising a housing having a shaft fixedly mounted therein, a reel rotatably mounted on said shaft, resilient means interconnecting said reel and shaft, adjustable ladder base guide means slidable relative to said housing and a one-way flexible ladder having one of its ends secured to said reel and extending around said guide means and having its other end adapted to be secured to said platform whereby when said platform is raised the ladder will be unwound from the reel and positioned so as to permit access to said platform and when said platform is lowered the ladder will automatically be rewound upon said reel.

2. A self-winding, reel-type ladder usable in conjunction with a platform which is adapted to be raised and lowered to varying heights, comprising a housing having a shaft fixedly mounted therein, a reel rotatably mounted on said shaft, spring means interconnecting said reel and shaft, a one-way flexible ladder having one of its ends secured to said reel and having its other end adapted to be secured to said platform whereby when said platform is raised the ladder will be unwound from the reel and positioned so as to permit access to said platform and when said platform is lowered the ladder will automatically be rewound upon said reel, and ladder base guide means co-operating with said ladder between its ends and slidable relative to said housing whereby the vertical inclination of the ladder may be adjusted to compensate for various elevations to which the platform is raised.

3. A self-winding, reel-type ladder assembly usable in conjunction with a platform which is adapted to be raised and lowered to varying heights, comprising a housing having a reel rotatably mounted therein, resilient rewind means for said reel, ladder base guide means movable relative to said housing and a one-way flexible ladder having one of its ends secured to said reel and extending through said guide means and having its other end adapted to be secured to said platform whereby when said platform is raised the ladder will be unwound from the reel and positioned so as to permit access to said platform and when said platform is lowered the ladder will automatically be rewound upon said reel.

4. A self-winding, reel-type ladder assembly usable in conjunction with a platform which is adapted to be

raised and lowered to varying heights, comprising a rotatably mounted reel, adjustable ladder base guide means movable relative to said reel and a one-way flexible ladder having one of its ends secured to said reel and extending through said guide means and having its other end adapted to be secured to said platform whereby when said platform is raised the ladder will be unwound from the reel and positioned so as to permit access to said platform and reel rewind means whereby when said platform is lowered the ladder will automatically be rewound upon said reel.

5. A collapsible ladder assembly comprising a rotatably mounted ladder storage means, a one-way flexible ladder having one of its ends secured to said storage means and provided at its other end with means adapted to be secured to a vertically movable platform, automatic rewind means connected to said storage means and ladder base guide means co-operating with said ladder between its ends and laterally movable relative to said storage means.

6. A collapsible ladder assembly usable in conjunction with a platform which is adapted to be raised and lowered to varying heights, comprising a rotatably mounted ladder storage means, a one-way flexible ladder having one of its ends secured to said storage means and having its other end adapted to be secured to said platform whereby when said platform is raised the ladder will be unwound from said storage means and positioned so as to permit access to said platform, rewind means for said storage means whereby when said platform is lowered the ladder will automatically be rewound upon said reel, and ladder base guide means co-operating with said ladder between its ends and laterally movable relative to said storage means whereby the vertical inclination of the ladder may be adjusted to compensate for various elevations to which the platform is raised.

7. A flexible ladder assembly comprising, in combination, an elevatable member having a normal lowered position, a drum disposed below said member and being mounted for rotation about a fixed axis, a flexible ladder wound on said drum and extending to and being connected at its upper end to an edge of said member, whereby the ladder is unwound from said drum responsively to elevation of the member, spring means operatively connected to and biasing said drum against rotation in ladder-unwinding direction, whereby the ladder is rewound on the drum responsively to lowering of said member, means for causing the portion of the ladder between drum and member to extend first outwardly from the drum and thence upwardly to said member, and means for inclining the upwardly extending portion of the ladder toward said member, wherein said ladder inclining means is effective to incline the ladder to a selected one of a plurality of predetermined inclinations.

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