United States Patent

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[54] **DEVICE FOR PREVENTING FALLING DOWN OF LIFTER OF FIRE FIGHTING LADDER-EQUIPPED VEHICLE**

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[52] **U.S. Cl.**.....**182/102,** 182/145

[51] **Int. Cl.**.....**E06c 7/16**

[58] **Field of Search**.....182/103, 102, 101, 66, 67, 182/68, 145; 187/73, 81, 82

[56] **References Cited**

UNITED STATES PATENTS

202,876	4/1878	Rutan	182/103
287,042	10/1883	Milliken	182/103
837,006	11/1906	Spaull	182/103
3,220,509	11/1965	Fisher	182/142

FOREIGN PATENTS OR APPLICATIONS

359,942	10/1931	Great Britain	182/103

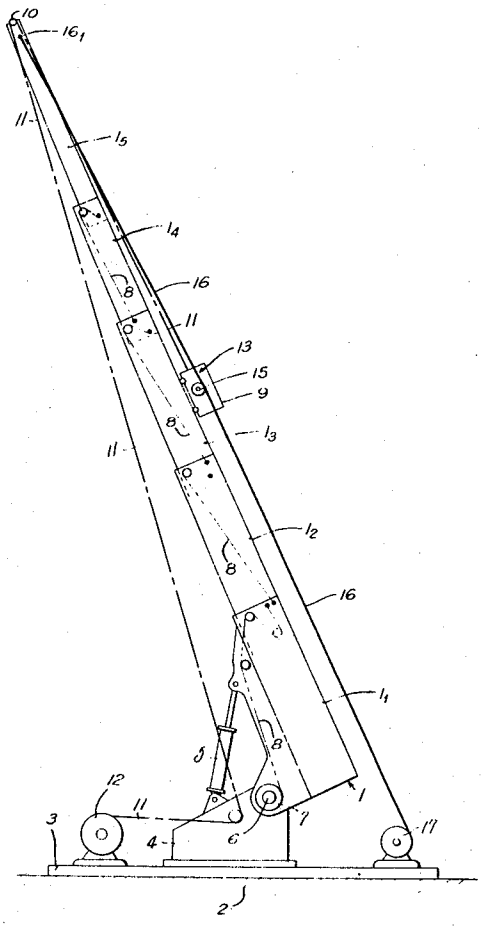
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[57] **ABSTRACT**

A falling down-preventive cable is provided in addition to a lifting cable, with the intermediate portion of said falling down-preventive cable being wrapped a plurality of turns around a drum or pulley provided in a lifter, and brake means for said drum or pulley is held inactive during normal operation by the weight of the lifter, thereby permitting the up and down movements of the lifter. Upon breakage of the lifting cable, the brake means is actuated to control the rotation of the drum or pulley and henceforth said falling down-preventive cable prevents the lifter from falling down. Other advantages and details of the construction will be made clear.

6 Claims, 5 Drawing Figures



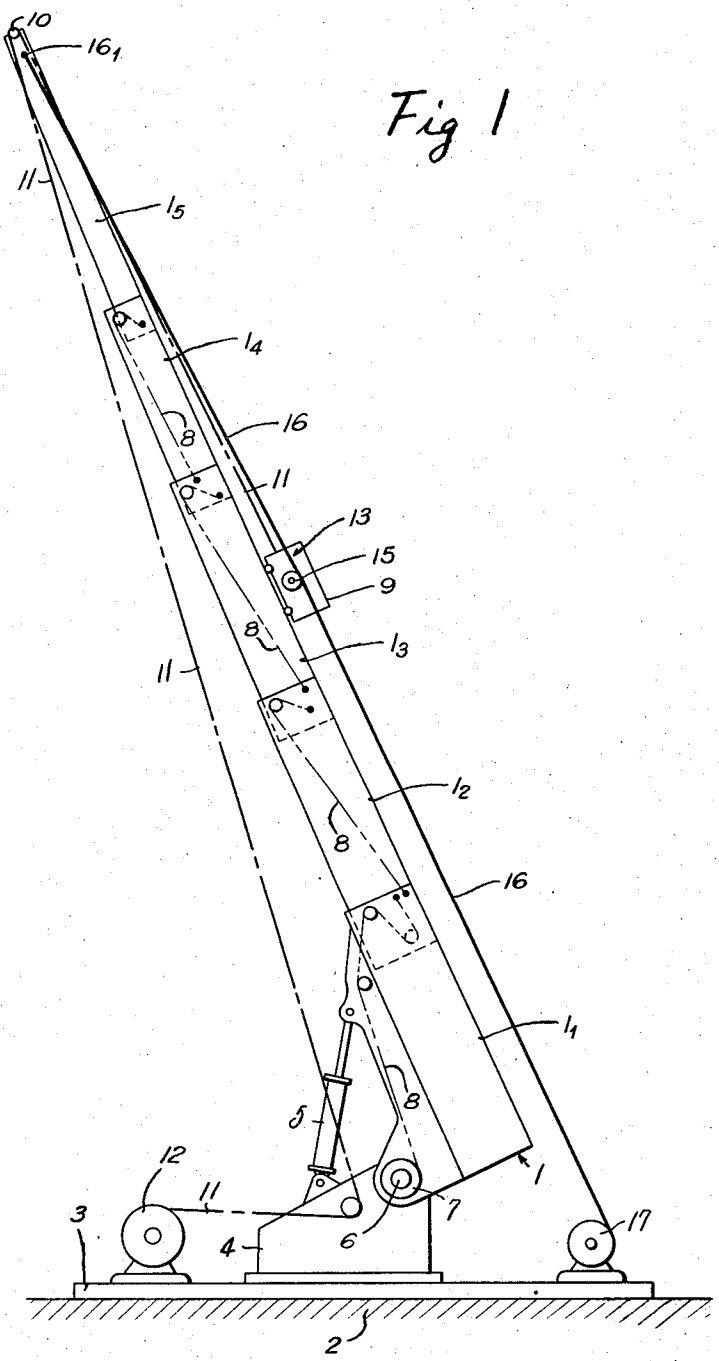


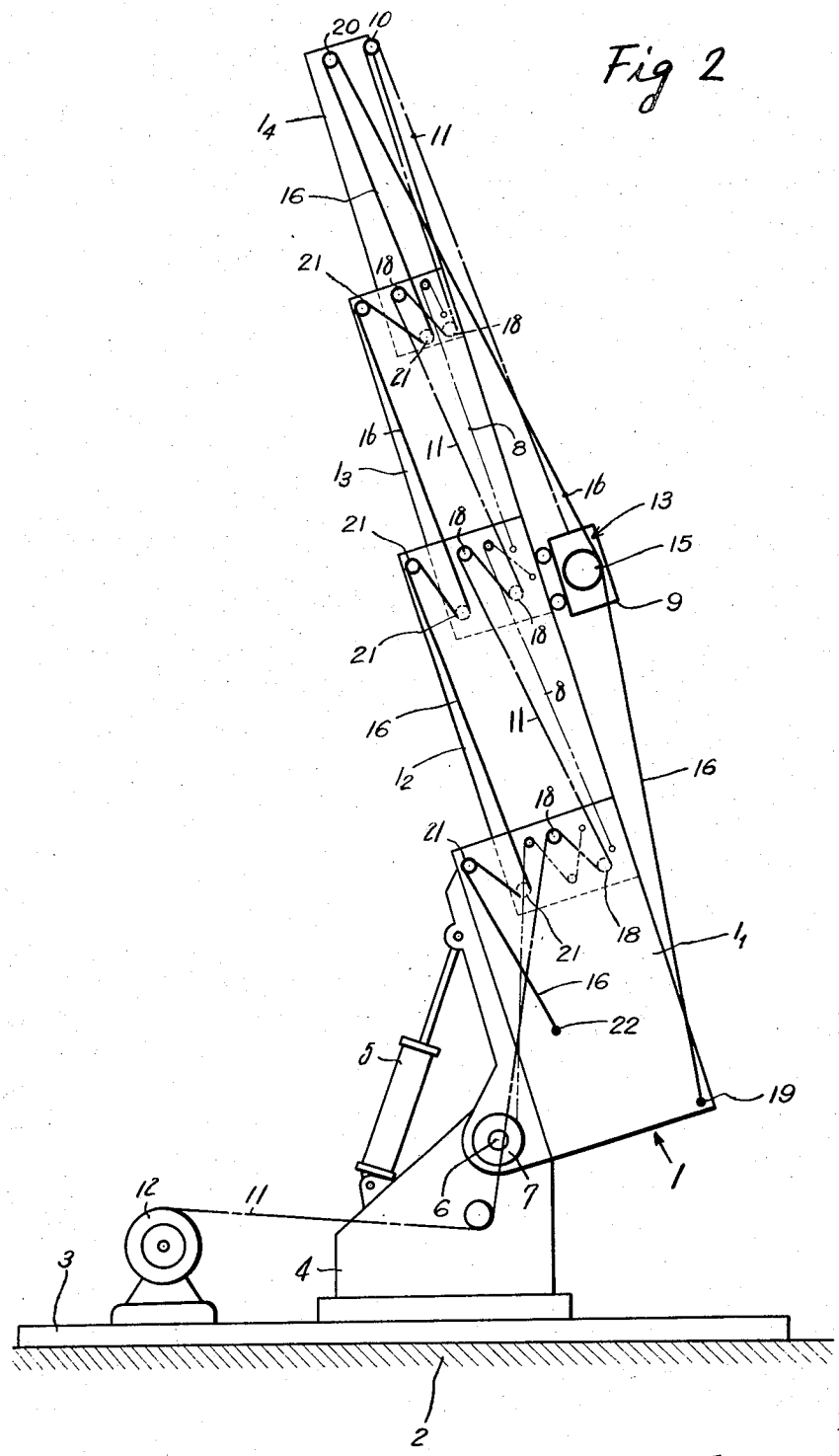
Fig 1

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Fig 2



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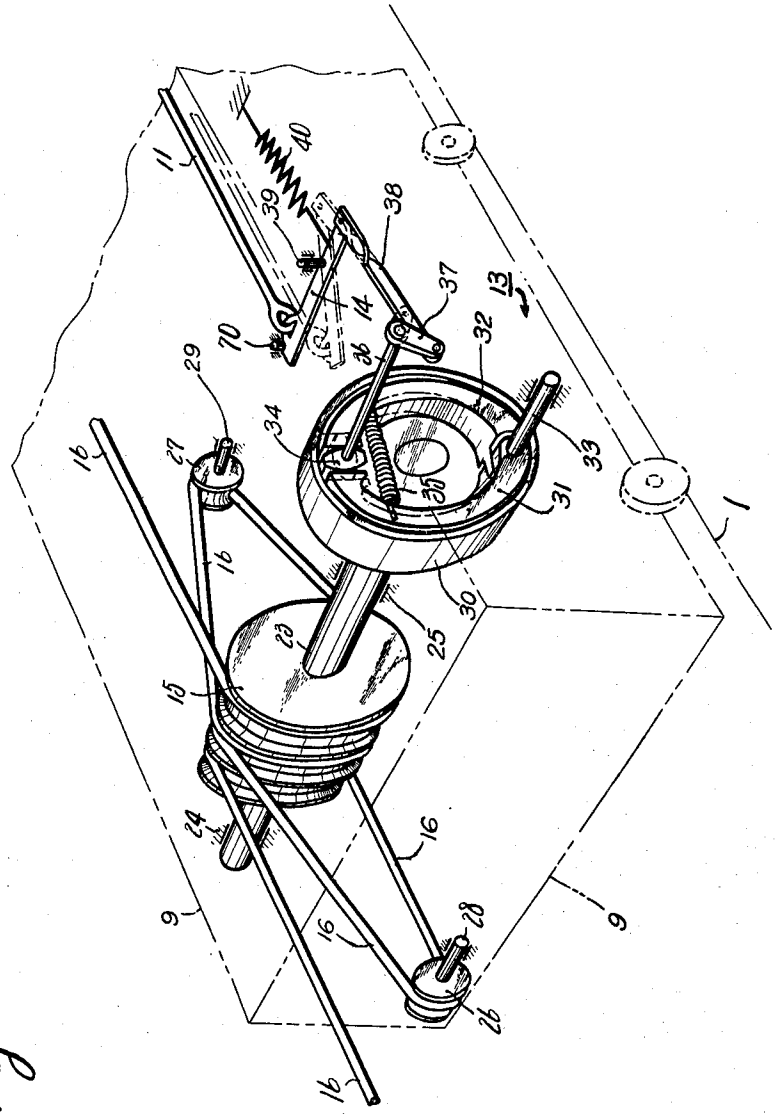


Fig 3

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Fig 5

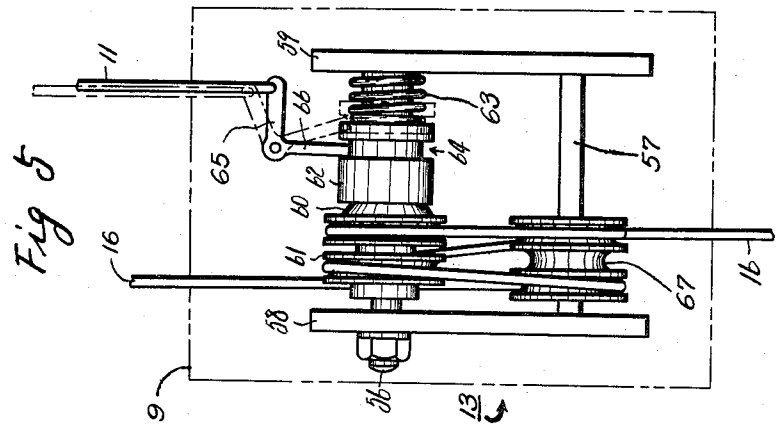
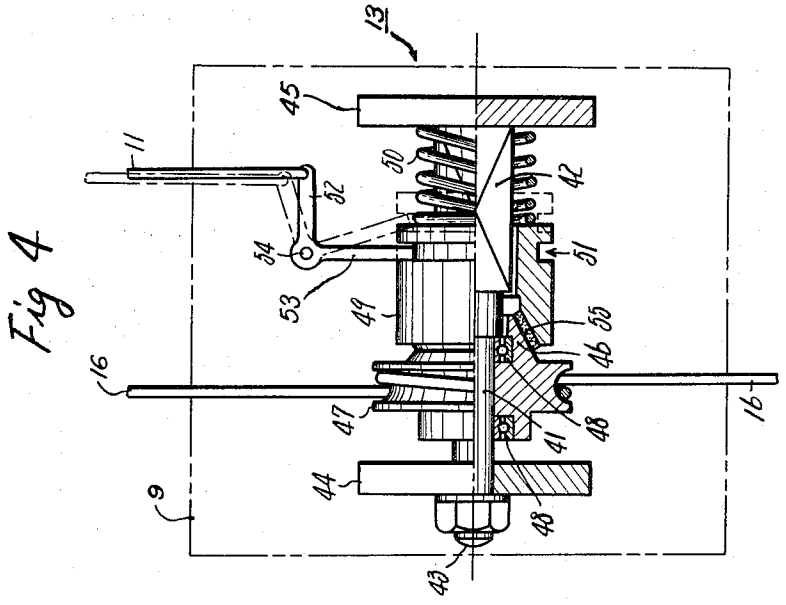


Fig 4



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DEVICE FOR PREVENTING FALLING DOWN OF LIFTER OF FIRE FIGHTING LADDER-EQUIPPED VEHICLE

BACKGROUND OF THE INVENTION

The present invention relates to a device for preventing the falling down of the lifter of a fire fighting ladder-equipped vehicle upon breakage of the lifting cable thereof.

FIELD OF THE PRIOR ART

A lifter which moves up and down along an extended ladder is operated by winding and unwinding a cable.

Therefore, it becomes necessary to provide a device for preventing falling down upon breakage of the cable. At present, the known devices for preventing the falling down of the lifter include a type which comprises cable clamp means provided at a suitable place on a lifter moving up and down along an extended ladder, a lifting cable for the lifter fastened to the operative lever of the cable camp means, said cable clamp means being kept inactive by the weight of the lifter except when the cable breaks, a second cable for preventing the falling down of the lifter stretched along an extended ladder and extending between the cable clamp bodies of the cable clamp means, said cable clamp means being adapted to be actuated as a result of breakage of the lifting cable to clamp the lifting cable so that henceforth the lifter is prevented from falling down. However, such a lifter weighs more than **100**kg, and it is too much for a device of the type described to reliably brake such a heavy lifter simultaneously with breakage of the cable. Thus, the prior art braking device is not so suitable as to fully meet the requirements.

OUTLINE OF THE INVENTION

The present invention provides an improved device for preventing the falling down of the lifter located in juxtaposed relation to the aerial ladder of a fire fighting ladder-equipped vehicle, characterized in that said device comprises a capstan means, i.e. drum or pulley means, mounted for forward and reverse rotations in the lifter, said drum or pulley means being provided with brake means, a lifting cable secured to the lifter through said brake means, said brake means being adapted to be kept inactive by the weight of the lifter except when the lifting cable breaks, a lifter falling down-preventive second cable provided separately from said lifting cable and having the intermediate portion thereof wrapped a plurality of half turns around said drum or pulley, said brake means being adapted to be actuated by brake control means upon breakage of the lifting cable to brake the drum or pulley so that henceforth the falling down of the lifter is prevented by frictional force acting at the place of wrapping where the falling down-preventive cable is wrapped around the drum or pulley.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings showing the preferred embodiments of the invention:

FIG. **1** is a side view of the ladder portion of a fire fighting ladder-equipped vehicle constructed in accordance with the invention;

FIG. **2** is a side view of the ladder portion of a fire fighting ladder-equipped vehicle having another construction according to the invention;

FIG. **3** is a perspective view of brake means constructed in accordance with the invention; and

FIGS. **4** and **5** show other embodiments of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

An aerial ladder **1** shown in FIG. **1** consists of five ladders 1_1 – 1_5 fitted together for expansion and contraction, the base ladder 1_1 being tiltably pivoted to a ladder support **4** on a turntable **3** provided on a vehicle body **2**. The tilting motion of the ladder 1_1 is effected by a hydraulic cylinder **5**. Further, the expanding and contracting motions of the aerial ladder **1** are effected by winding and unwinding a ladder expanding and contracting cable **8** by means of a winder **7** provided on a pivot shaft **6**. Since the entraining system for the expanding and contracting cable **8** is a known one, description thereof is omitted.

A lifter **9** is so mounted that it can be moved along the extended aerial ladder **1**. The lifter is suspended by raising and lowering means comprising a hoisting or lifting cable **11** entrained around a sheave **10** on the front end of the ladder, the other end of said cable **11** being wrapped around a winder **12** on the turntable **3**, so that the raising and lowering of the lifter are effected by winding and unwinding the cable **11**. In addition, the lifting cable **11** is not directly fastened to the lifter. It is fastened to the operative lever **14** of brake means **13** which is provided in the lifter for controlling a drum of pulley **15** mounted for forward and reverse rotations in the lifter **9**. The intermediate portion of a lifter falling down-preventive cable **16** is wrapped **2–3** turns around said drum or pulley **15**. The lifter falling down-preventive cable extends along the entire length of the extended ladder **1**. In the case shown in FIG. **1**, the cable **16** has its front end 16_1 fastened to the front end of the ladder **1** and the lower end wrapped around a winder **17** of the turntable **3**. In view of this arrangement, it becomes necessary to wind and unwind the falling down-preventive cable **16** by said winder **17** in accordance with the expansion and contraction of the aerial ladder **1**.

FIG. **2** shows another embodiment wherein the lifting cable **11** and falling down-preventive cable **16** are entrained by a different system. The other arrangements, however, are the same as those shown in FIG. **1** and the common members are indicated by the same reference characters as those used in FIG. **1**. Thus, in FIG. **2**, the lifting cable **11** has its front end fastened to the operative lever **14** of the brake means **13** of the lifter **9** and is entrained around the pulley **10** provided on the front end of the uppermost ladder 1_4 and is then entrained in zigzags under tension around successive pulleys **18** provided at the front and rear ends of the ladders 1_1, 1_2, 1_3, 1_4 and is finally led to the winder **12**.

Further, the falling down-preventive cable **16** has one end thereof fastened at **19** to the lower end of the lowermost ladder 1_1 and is wrapped **2–3** turns around the drum of pulley **15** in the lifter **9**, entrained in bights or zigzags under tension seriatim around successive pulleys **21** provided at the front and rear i.e. upper and lower ends of the ladders 1_4, 1_3, 1_2, 1_1 and is finally fastened at **22** to the lowermost ladder 1_1 thus making it fast over the member **21** near the top thereof.

With the above-mentioned arrangement, even if the aerial ladder is expanded and contracted, the lifting cable **11** and falling down-preventive cable **16** remain permanently under tension, so that there is no need to wind or unwind these cables **11** and **16** in accordance with the expansion and contraction of the aerial ladder.

The above-mentioned brake means **13** is secured to the lifter **9**, embodiments of the brake means being shown of FIGS. **3** and **5**.

Thus, in FIG. **3**, the lifter carries a rotatable shaft **23** journaled in bearings **24** and **25**. The rotatable shaft **23** extends transversely of the direction of up and down motions of the lifter **9**. The drum or pulley **15** is fixed at the central portion of the rotatable shaft **23**. The drum or pulley has three annular grooves. These annular grooves may be formed in the outer peripheral surface of the drum or pulley or they may be formed by joining three pulleys together. In FIG. **3**, the numerals **26** and **27** denote guide pulleys secured to shafts **28** and **29** journaled before and behind the rotary shaft **23** and extending parallelly to the latter. The falling down-preventive cable **16** has its intermediate portion wrapped successively around the groove at one end of the drum or pulley **15**, around one guide pulley **26**, then one turn around the middle groove of the drum or pulley **15**, then around the other guide pulley and finally around the other guide pulley. This arrangement prevents the drum or pulley **15** from being displaced to either side by the falling down-preventive cable **16**. A brake drum **30** is secured to one end of the rotatable shaft **23**. Two semicircular brake shoes **31**, **32** are inserted in the brake drum **30**. The brake shoes **31**, **32** are pivoted on a pin **33** at one of their respective ends and a cam **34** is interposed between the free ends thereof. The free ends of the brake shoes **31**, **32** clamp the cam **34** by means of a spring **35**. The cam **34** has a support shaft **36** integral therewith. The support shaft **36** and pin **33** for the brake shoes **31**, **32** are journaled by the frame of the lifter **9** laterally of the open end of the brake drum **30**. An arm **37** is secured to the end of the support shaft **36** of cam **34**, the free end of said arm being connected to the operative lever **14** by a link **38**. The operative lever **14** is pivotally connected to the frame of the lifter **9** by a pin **39**. The operative lever **14** is acted on permanently by a spring **40**, serving to spread the brake shoes **31** and **32** through the cam **34**. The lifting cable **11** is fastened to the operative lever **14**. The wright of the lifter **9** serves to normally pull the operative lever **14** against the power storing action of the spring **40** until it bears against a stop **70** projecting from the frame of the lifter, i.e. lies in its brake releasing position as shown in solid lines in FIG. **3**. Thus, if the lifting cable **11** breaks, the stored power means **40** moves the lever **14** to its brake applying position, and the brake is applied to the rotatable shaft **23** as shown in chain lines in FIG. **3** to stop the lifter **9**. While FIG. **3** shows the brake means embodied in the form of an internal spread type, an external band type brake may be used.

FIG. **4** shows another embodiment of the brake means, wherein a shaft **43** having a round shaft portion **41** and a square shaft portion **42** is fixedly supported in the lifter **9** through brackets **44** and **45**. A pulley **47** having a conical projecting sleeve **46** on one lateral surface thereof is rotatably mounted on the round shaft portion **41** of the fixed shaft **43** through ball bearings **48**. The intermediate portion of the falling down-preventive cable **16** is wrapped one turn around the pulley **47**. A slidable sleeve **49** adapted to be intimately fitted on the conical projecting sleeve **46** of the pulley **47** at a certain time is mounted on the square shaft portion **42** of the fixed shaft **43** and a spring **50** acts permanently on the slidable sleeve **49** to urge the latter toward the conical projecting sleeve **46**. The outer peripheral surface of the slidable sleeve **49** is provided with a groove **51** in which a shifter rod **53** at the other end of the operative lever **52** engages. The lifting cable **11** is fastened to the operative lever **52**. Thus, when the lifting cable **11** is tensioned under the weight of the lifter, the operative lever **52** has been pulled upwardly as it turns counterclockwise around a pivot **54**, with the slidable sleeve **49** being displaced toward the right as viewed in the drawing as shown in chain lines, compressing the spring **50**. Therefore, the pulley **47** is in its free state. Thus, upon breakage of the lifting cable **11**, the spring **50** brings the slidable sleeve **49** into intimate engagement with the conical projecting sleeve **46** of the pulley **47** to brake the pulley **47**, thereby positively preventing the falling down of the lifter **9** by means of the falling down-preventive cable **16**. In FIG. **4**, the numeral **55** denotes a rubber lining secured to the slidable sleeve **49**.

FIG. **5** shows a modification of the brake means shown in FIG. **4**. In this modified embodiment, the falling down-preventive cable **16** is entrained around a plurality of pulleys in two rows. In this case, increased frictional resistance is exerted between the falling down-preventive cable **16** and pulleys so that the falling down of the lifter **9** can be prevented more reliably. In FIG. **4**, the numerals **56** and **57** denote fixed shafts fixed to brackets **58** and **59**. One fixed shaft **56** is of the same construction as the fixed shaft **43** shown FIG. **4**. A pulley **61** having a conical projecting sleeve **60** on one lateral surface thereof is rotatably mounted on the fixed shaft **56**, and there is also mounted thereon a slidable sleeve **62** adapted to be intimately fitted on said conical projecting sleeve at a certain time. A spring **63** permanently urges the slidable sleeve **62** toward the conical projecting sleeve **60** of the pulley **61**. The outer peripheral surface is provided with a groove **64** in which a shifter rod **66** at the other end of the operative lever **65** engages, and the lifting cable **11** is fastened to the operative lever **65**, as in the case of FIG. **4**. Further, a pulley **67** is rotatably mounted on the other fixed shaft **57**, and the falling down-preventive cable is entrained around this pulley **67** and around the pulley **61** on the fixed shaft **56**. The operation of the brake means shown in FIG. **5** is the same as that of the brake means shown in FIG. **4**.

While the respective brake means shown in FIGS. **3** to **5** are automatically actuated to brake the lifter **9** in conjunction with breakage of the lifting cable **11**, it is also possible to manually operate the operative lever.

It will be seen from the foregoing that the present invention provides an arrangement comprising a lifter falling down-preventive cable provided separately from a lifting cable for a lifter and extending along an extended aerial ladder, the intermediate portion of said falling down preventive cable being wrapped a plurality of turns around a drum or pulley means provided on

the lifter, said drum or pulley means being provided with brake means and being adapted to be maintained free to turn during normal operation to permit the raising and lowering of the lifter, said brake means being adapted to be manually or automatical actuated to control the rotation or the drum or pulley upon breakage of the lifting cable, so that henceforth the falling down of the lifter is prevented by frictional force exerted between the falling down-preventive cable and the drum or pulley. With this arrangement, it is possible to reliably prevent the falling down of the lifter.

While there have been described herein what are at present considered preferred embodiments of the several features of the invention, it will be obvious to these skilled in the art that modifications and changes may be made without departing from the essence of the invention. It is therefore to be understood that the exemplary embodiments thereof are illustrative and not restrictive of the invention, the scope of which is defined in the appended claims and that all modifications that come within the meaning and range of equivalency of the claims are intended to be included therein.

I claim:

1. The combination, in a fire fighting vehicle, of
   a. an aerial ladder,
   b. a lifter located in juxtaposed relation to said ladder and raisable and lowerable in said relation,
   c. means for raising and lowering said lifter comprising a sheave carried by said ladder above said lifter and a hoisting cable connected to said lifter and passing over said sheave,
   d. capstan means mounted on said lifter,
   e. a second cable extending along the path of lifting and lowering of said lifter, and wrapped about said capstan means,
   f. braking means connected to said capstan means for controlling rotation thereof to control movement of said lifter along said second cable, and
   g. brake control means connected to said braking means for operating the same to permit free turning of said capstan means during normal operation of said hoisting cable.

2. A combination as claimed in claim 1, wherein:
   h. said aerial ladder is of the plural section extensible and contractible type,
   i. each of said plural ladder sections except the lowest has upper and lower take-up sheaves near its top and bottom respectively,
   j. the portion of said second cable extending downwardly from said lifter is fastened to the lower portion of the lowest of said ladder sections, and
   k. the portion of said second cable extending upwardly from said lifter is entrained in bights passing under tension seriatim about the upper and lower take-up sheaves of each of said ladder sections except said lowest ladder section and then made fast near the top of said lowest ladder section,

whereby there is no substantial change in tension of said second cable on extension and contraction of said ladder.

3. A combination as claimed in claim 1, in which said second cable has a plurality of half-turns engaged with said capstan means.

4. A combination as claimed in claim 3, in which said capstan means comprises a plurality of pulleys in two rows with each of which said second cable has a half-turn engagement.

5. A combination as claimed in claim 1, wherein:
   h. said braking means comprising power storage means for actuating the same to restrain rotation of said capstan means, and
   i. means responsive to a tensioned condition of said hoisting cable for preventing actuation of said braking means by said power storing means.

6. A combination as claimed in claim 5, wherein said last named means comprises a lever carried by said lifter having a brake applying and a brake releasing position, said hoisting cable being connected to said lever for normally holding the same in its brake releasing position but allowing the same to move to its brake applying position on breakage of said hoisting cable.

* * * * *