Dec. 16, 1958 H. J. TROCHE 2,864,543

VEHICLE LADDER APPARATUS

Filed Sept. 13, 1954 3 Sheets-Sheet 1

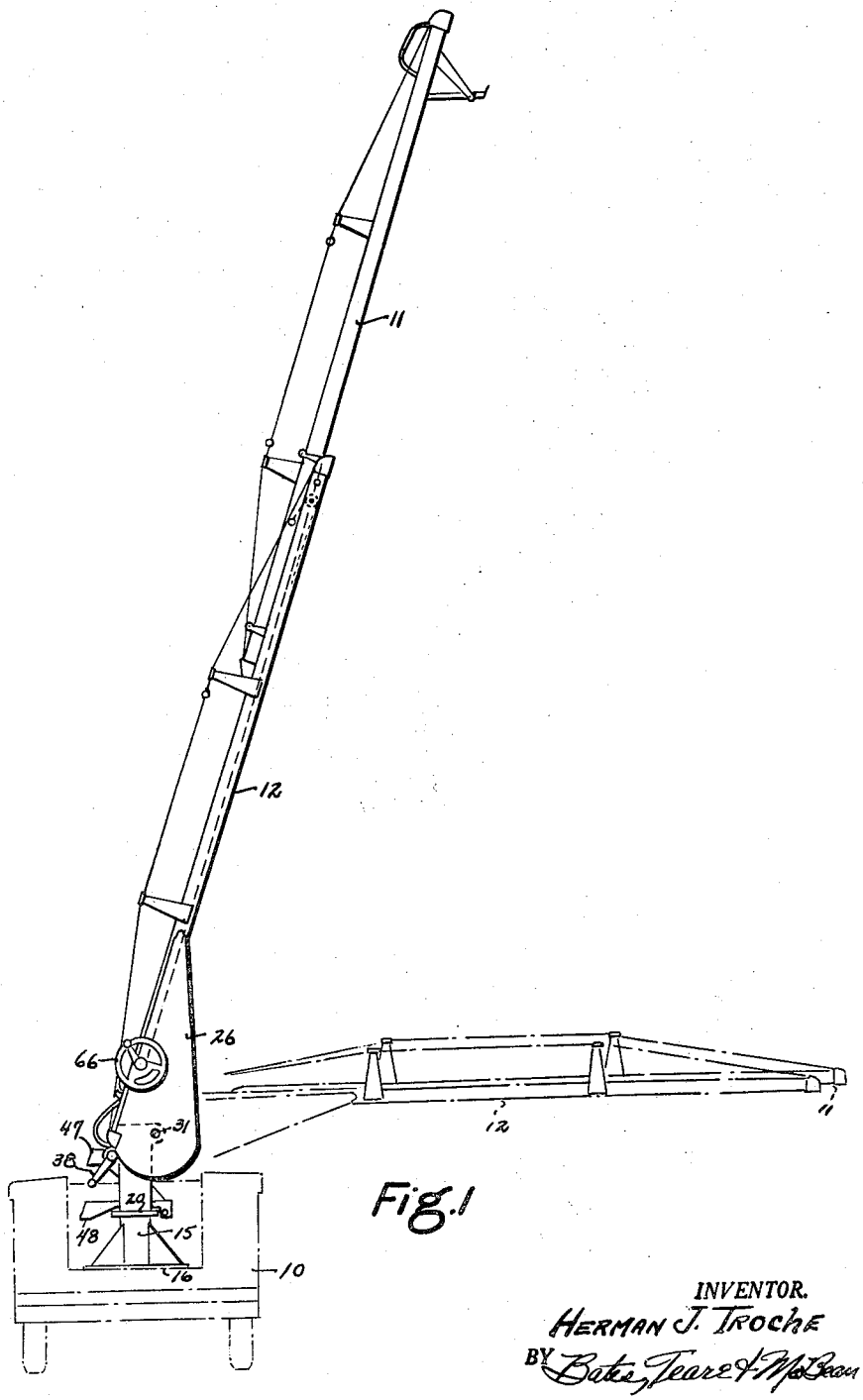

Fig. 1

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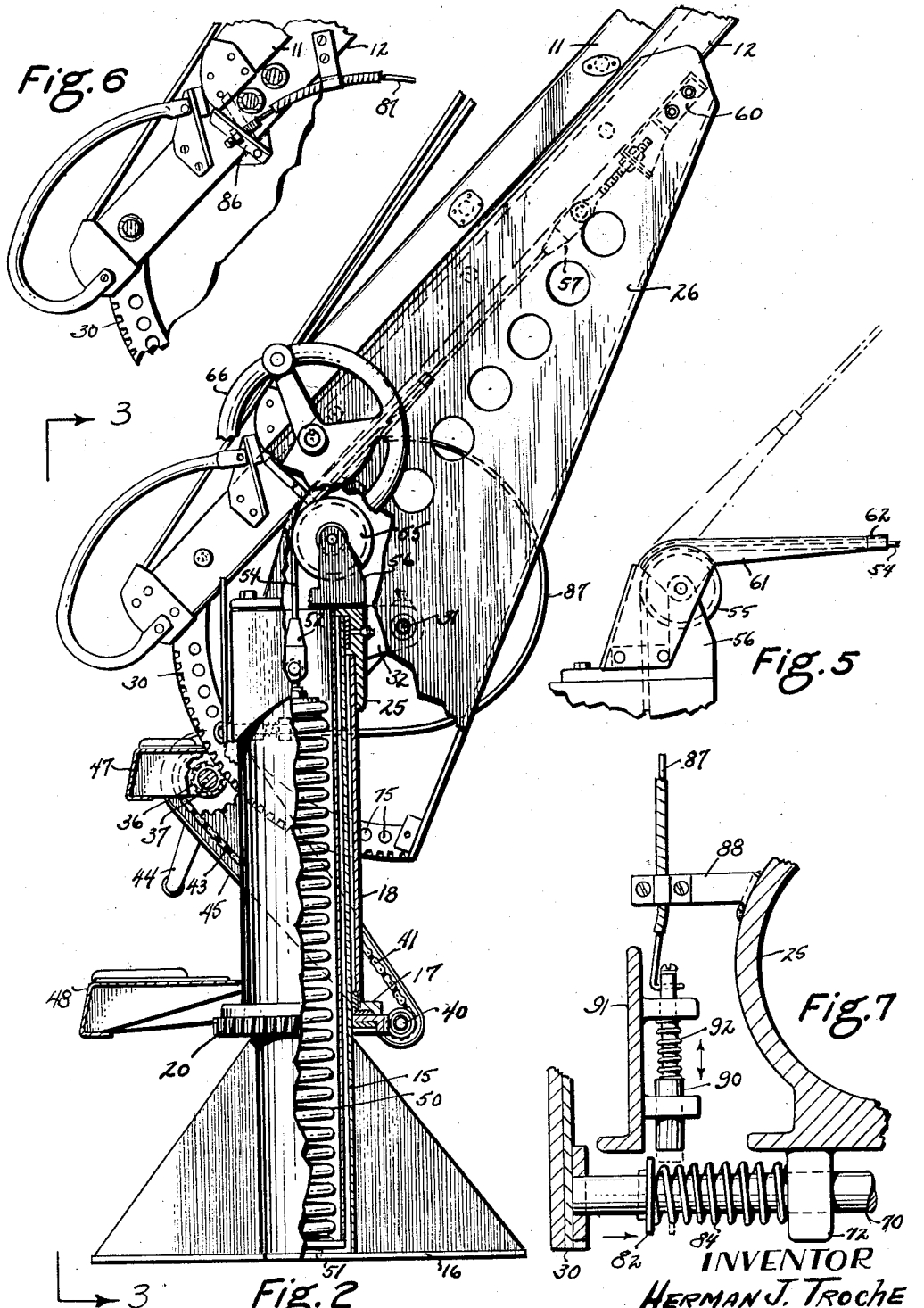

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VEHICLE LADDER APPARATUS

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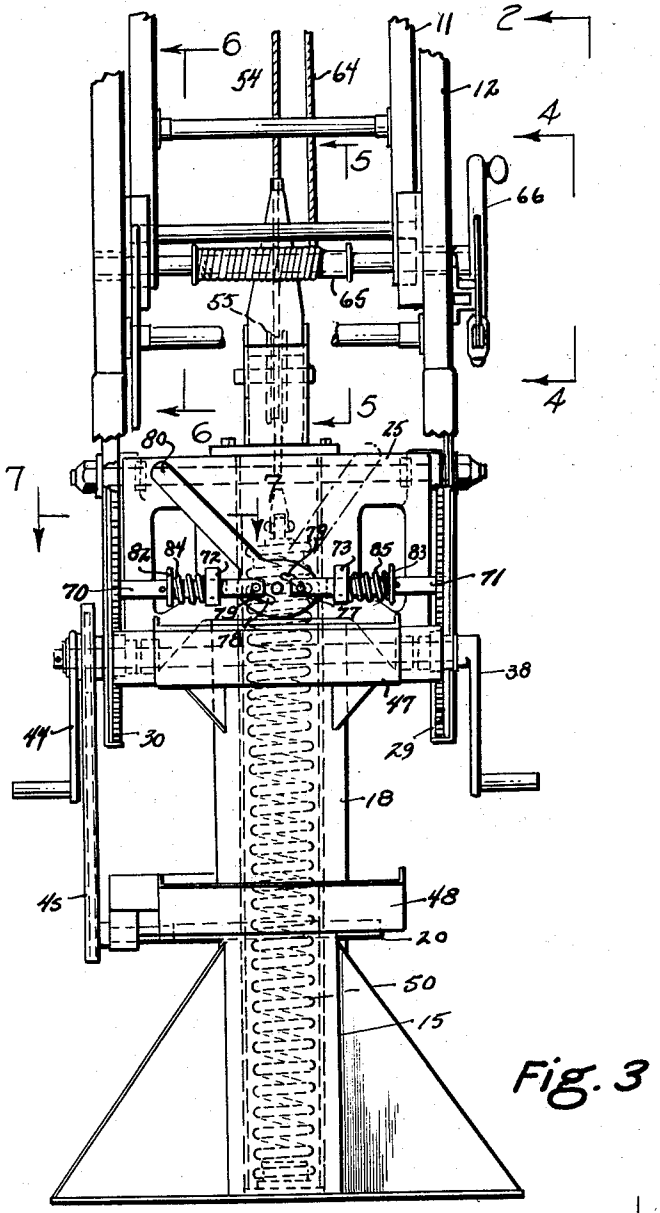

Fig. 3

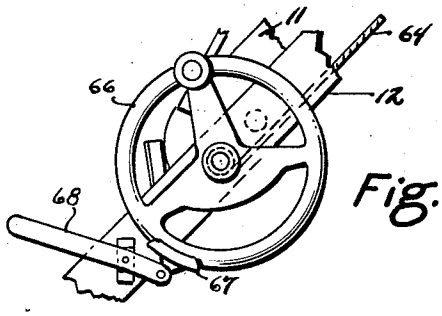

Fig. 4

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VEHICLE LADDER APPARATUS

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7 Claims. (Cl. 228—6)

This invention relates to a utility vehicle having an extensible ladder that is swingable and tiltable in transverse planes relative to the vehicle and more particularly relates to an improved tilting and counter-balancing arrangement for such a ladder assembly.

One of the difficulties in the operation of a vehicle ladder assembly of the type indicated is the ability to counter-balance or otherwise secure the ladder assembly in any position throughout its operating range. The ladder is usually of the extensible type and, although suitable arrangements can be made for balancing the weight of the ladder in the retracted position, the same arrangement cannot be conveniently utilized to counter-balance the overhanging mass of the ladder when extended. Nevertheless, it is important to balance or otherwise secure the ladder in any retracted or extended position in order to avoid a break-down and injury to an operator.

Accordingly, it is a principal object of this invention to provide a vehicle mounted extensible ladder assembly that may be optimumly counter-balanced in any tilted position when retracted and secured in any tilted position when extended until otherwise released by the operator.

A more particular object of the invention relates to the provision of a self-contained counter-balancing mechanism which coacts with the ladder mounting throughout the tilting range to balance the extensible ladder assembly when retracted.

Another more particular object of the invention is the provision of an arrangement for locking the ladder assembly in any tilted position when extended until released by the operator.

Other objects and advantages of the invention, including various safety features and controls for effectively balancing the ladder assembly throughout the tilting range, will become more apparent from the following description, reference being had to the accompanying drawings which illustrate preferred embodiments of the invention.

Briefly, the invention contemplates pivotally mounting an extensible ladder assembly on a hollow vertical mast carried by the vehicle and providing hand-operated tilting and extending mechanisms. A preloaded coiled spring is disposed within the hollow mast and operates to counter-balance the retracted ladder assembly throughout the tilting range. A suitable locking device releasable by the operator coacts with the tilting mechanism to secure the extended ladder assembly in multiple positions throughout its tilting range. The invention also contemplates that the entire ladder assembly and tilting mechanism will be rotatably supported on the mast with hand operated means for effecting the rotation in a horizontal plane about the vertical axis of the mast. The locking device includes a safety latch which renders the device active while the ladder is extended but which operates to automatically release the device upon retraction to again condition the assembly for tilting operation.

In the drawings;

Fig. 1 is a rear view of a vehicle having a ladder

embodying this invention and illustrating the ladder in various positions;

Fig. 2 is an enlarged view showing the ladder assembly and mounting with portions thereof in partial section and cut away to better illustrate the operative elements;

Fig. 3 is a view taken along the lines 3—3 in Fig. 2 illustrating an endwise disposition of the ladder assembly and mounting;

Fig. 4 is a view taken along the lines 4—4 in Fig. 3 to illustrate the ladder extending winch mechanism;

Fig. 5 is a fragmentary view taken along the lines 5—5 in Fig. 3 to particularly illustrate the hinged counter-balance cable guide and guard;

Fig. 6 is a fragmentary view taken along the lines 6—6 in Fig. 3 to illustrate the operation of the safety latch; and

Fig. 7 is a fragmentary sectional view taken along the lines 7—7 in Fig. 3 to illustrate the coaction between the safety latch and ladder tilt locking device.

Referring now more particularly to Fig. 1 of the drawings, the ladder assembly is shown as being mounted upon the floor of a vehicle indicated in general at **10** and is of the extensible type, there being an upper section **11** and a lower section **12** mounted telescopically with respect to each other in the customary manner, the upper section **11** being extendable as shown in full lines in Fig. 1 or retractable as shown in dotted lines. The entire ladder assembly is supported on the vehicle body for swinging movement to any desired angle in the vertical plane within its operating range.

To accomplish the foregoing the supporting structure for the ladder assembly, as more particularly illustrated in Figs. 2 and 3 of the drawings, preferably includes a vertical mast **15** in the form of a cylinder projecting upwardly from the floor of the vehicle and secured thereto through a reinforced base **16**. The mast **15** carries a fixed worm gear **20** and supports for rotation about its vertical axis a sleeve **18** which extends downwardly around the cylindrical mast and carries at its lower extremity a flange **17** which rotates on the worm gear **20** by operation of a hand crank in a manner to be hereinafter more fully described.

The revolvable sleeve **18** carries at its upper extremity a mast head **25** which supports the ladder assembly as well as certain portions of the tilting and counter-balancing mechanisms. As best shown in Figs. 2 and 3 of the drawings, the lower ladder section **12** carries a pair of side plates **26** and **27** on each side rail and each side plate carries an enlarged gear segment **29** and **30** at the extremity adjacent the supporting mast **15**. The side plates **26** and **27** are intermediately connected to a pivot shaft **31** which is journaled in a pair of forwardly extending lugs **32** and **33** on the mast head **25**. Tilting of the ladder assembly is accomplished by driving the gear sectors **29** and **30** carried by the respective side plates on the side rails of the lower ladder section from a pair of pinions **35** and **36** each of which are fixedly journaled on a shaft **37** rotatably carried by the mast head **25**. The shaft **37** carries adjacent one extremity an elevating crank arm **38**, Fig. 3, which is intended to be rotated in either direction by an operator to elevate or lower the ladder assembly.

The sleeve **18** and mast head **25** are rotated as a unit about the axis of the supporting mast **15** through the driving engagement of a sprocket driven worm **40** with the worm gear **20** fixed on the mast **15**. The worm **40** is rotated by a sprocket chain **41** driven by a sprocket wheel **43** supported for free rotation on the pinion shaft at the extremity opposite the elevating crank arm **38**. The sprocket wheel **43** is provided with a suitable crank arm **44** that extends external to a sprocket guard **45** for access by an operator standing on the floor of the vehicle

body. In addition to the foregoing, suitable access steps are carried by the rotatable sleeve 18; the upper step 47 serving to protect and house the pinion shaft 37 and the lower step 48 serving to protect and house the rearward portion of the worm gear 40.

The ladder assembly is suitably counter-balanced when the upper section 11 is retracted by means of a coiled spring 50 which is disposed within the cylindrical mast 15 with its lower end secured to the base plate at 51 and its upper end coupled through a suitable link 52 to a cable 54. The cable 54 extends about a free-running pully 55 which is rotatably journaled in a bracket 56 on top of the mast head 25 and has its other extremity connected through another link 57 to a bracket 60 carried by the lower ladder section 12, as best shown in Fig. 2 of the drawings. The coiled spring 50 is preloaded to an extent sufficient to counter-balance the retracted ladder assembly in the horizontal position in which it is normally transported and also throughout the tilting range of the ladder to an angle of approximately 70° as determined by the limit of the elevating gear sectors. The counter-balance connecting cable 54 and pully assembly 55 are protected by a hinged cable guard 61 shown in dotted lines in Fig. 2 and also shown in Figs. 3 and 5 of the drawings. The guard 61 is hinged at the pully axis and preferably encircles the cable 54 at its extremity 62 so that it will be raised and lowered in a vertical plane accordingly as the ladder assembly is tilted up and down.

The foregoing counter-balancing arrangement is designed to be operably active to balance the ladder assembly only when the ladder sections are in their retracted position; the overhanging mass of the ladder assembly in the extended position shown in full lines in Fig. 1 being too great to be effectively counter-balanced by the coiled spring 50 in the present arrangement. The upper fly ladder section 11 may be extended by pulling it along the lower section 12 in the customary manner, as by means of a rope or cable 64 which is wound on a hand operated winch 65 carried by the lower ladder section. The winch 65 is best shown in Figs. 2 and 3 of the drawings as including as externally accessable hand wheel 66 which may be manipulated by an operator standing on the floor of the vehicle and as further including the added feature shown in the fragmentary view of Fig. 4 of a hand operated brake shoe 67 which can be positioned by means of the lever 68 to engage and lock the winch hand wheel 66 against movement in any direction. The overhanging mass of the extended ladder assembly is accommodated by providing an interlocking arrangement which releasably engages the elevating gear sectors 29 and 30 carried by the lower ladder section 12 in a multiplicity of selected tilted positions and secures them against further tilting movement in any direction.

Reference may be had particularly to Fig. 3 of the drawings, wherein oppositely directed locking pins 70 and 71 are slidably supported in corresponding lugs 72 and 73 projecting from the mast head 25 for axial movement towards and away from engagement with a plurality of mating apertures 75, Fig. 2, extending along the inner surface of each elevating gear sector adjacent the correspinging locking pin so that when the pins are engaged in the apertures, the elevating gear sectors are fixed against rotation and the ladder assembly is secured against tilting movement. The inner extremities of each locking pin respectively carry transverse pins 76 and 77 which slidably engage corresponding cam slots 78 and 79 in an eccentric lever 80 so designed that when the lever 80 is positioned in the full line position of Fig. 3, the locking pins 70 and 71 are each slidably positioned outwardly in engagement with the aligned aperture in the corresponding gear sector. Each of the locking pins 70 and 71 carries a washer 82 and 83 which serves as one fixed abutment on each pin against which the biasing springs 84 and 85 coact to normally urge the corresponding locking pin in an outward locking direction. The dotted line position of the eccentric hand lever 80 shown in Fig. 3 represents the released or unlocked position of the pins 70 and 71 to permit tilting movement of the ladder assembly.

In normal operation, it is intended that the eccentric hand lever 80 will not be positioned to unlock the ladder assembly for tilting movement except when the ladder sections are in their retracted position. In order to insure against accidental operation of the hand lever 80 or release of the locking pins 70 and 71 when the ladder assembly is extended and tilted, there is provided a safety latch best shown in the fragmentary views of Figs. 6 and 7 of the drawings. This latch is duplicated on each side of the lower ladder section 12 and takes the form of a bracket 86 pivoted to the lower ladder section and having its free extremity intersecting the retraction path of the base of the upper ladder section side rail so that it will be engaged thereby and rotated about its pivot. This bracket 86 adjustably carries one end of a sheathed cable 87, as best shown in Fig. 6, the other end of which, as shown in Fig. 7, slidably extends through a support 88 carried by the mast head 25 and engages the adjacent extremity of a latching pin 90. The pin 90 is slidably supported in another portion 91 of the mast head 25 for axial movement in a plane transverse to the axis of the locking pins 70 and 71 for intersection with the path of the corresponding washer carried by one of the locking pins to prevent it from being retracted further from the aligned aperture in the corresponding elevating gear sector. As best shown in Fig. 7 of the drawings, the latch pin 90 is also biased with a spring 92 in a locking direction requiring a positive axial movement of the cable 87 to withdraw it from interlocking engagement behind the corresponding washer on one of the locking pins. This is accomplished by so mounting the pivotal bracket 86 on the lower ladder section 12 that the latch pin 90 is retracted and the locking pin freed for engagement with the aligned aperture in the corresponding elevating gear sector when the upper ladder section 11 is moved to its retracted position where it engages the bracket 86. However, as soon as the ladder assembly is tilted to a desired vertical position and extended with the eccentric hand lever 80 positioned to permit the locking pins 70 and 71 to engage the corresponding aligned aperture in the elevating gear sectors, the bracket 86 is released and the biasing spring 92 urges the latch pin 90 into interlocking engagement behind the washer on the corresponding locking pin, thereby insuring that the extended ladder assembly will not accidentally be released from its tilted position.

Thus, there has been provided a hand operated extensible ladder assembly which may be tilted vertically and rotated horizontally about a mast on the floor of a vehicle body. The ladder mounting includes a self-contained mechanism for counter-balancing the retracted ladder assembly. There is also provided a locking arrangement for automatically securing the extended ladder assembly in a plurality of vertical tilted positions throughout its operating range. The locking arrangement includes a hand operated releasing lever and also includes a safety latch which automatically prevents release of the lock while the ladder sections are extended. The rotating and elevating handwheels as well as the extending winch handwheel and the lock lever are all operably located in distinct proximity to each other on the supporting mast so that an operator may stand at the foot of the ladder or on the floor of the vehicle body and quickly position the ladder assembly to and from any desired operating position.

I have shown and described what I consider to be the preferred embodiment of my invention along with similar modified forms and suggestions, and it will be obvious to those skilled in the art that other changes and modifica-

tions may be made without departing from the scope of my invention as described by the appended claims.

I claim:

1. In a tiltable and extensible ladder assembly having a ladder pivotally connected at one end to a vertical support for tilting movement in a vertical plane the combination of, an arcuately formed member carried by the pivoted end of the ladder with the pivotal connection as its center, said member having a plurality of apertures spaced along its arcuate periphery, a releasable mechanism including a pin slidably carried by the ladder support for axial movement towards and away from engagement with an aligned aperture in said arcuate member to secure the member and ladder against further tilting movement, releasable locking means for maintaining the pin in engagement with a selective aperture when the ladder is extended, and means for automatically releasing said locking means in response to retraction of said extensible ladder.

2. The combination of claim 1 wherein said slidable pin includes means for biasing the pin in an aperture engaging direction and also includes an eccentric lever pivotally connected on the ladder support and leaving a slidable cam slot connection therewith for coaction in response to operation of the lever to retract the pin from engagement with the aligned aperture to release the arcuate member and ladder for tilting movement.

3. In a tiltable and extensible ladder assembly a mechanism for selectively rotating the ladder about a pivotal connection to a support comprising in combination, an arcuately formed gear sector carried by said ladder with the pivotal connection as its center, an operator-controlled pinion shaft operably carried by the support for driving engagement with the gear sector to tilt the ladder, said gear sector having a plurality of apertures spaced along its arcuate periphery, and a releasable locking device including a pin slidably carried by the support for axial movement towards and away from engagement with an aligned aperture to releasably secure the gear sector and ladder against rotation, said slidable pin having means biasing the pin in an aperture engaging direction and including an operator-controlled lever on the support for retracting the pin from the aligned aperture to selectively release the gear sector and ladder for rotation, and means for automatically locking said pins in engagement with a selective aperture when the ladder is extended.

4. In a vehicle supported ladder assembly having one end pivotally supported on a vertically disposed sleeve for tilting movement in a vertical plane, the combination therewith of a hollow vertical mast having its lower end fixed on the vehicle and rotatably supporting said sleeve in concentric telescoping relation on its upper end, a coiled spring rotatably disposed within said hollow mast for following movement with said sleeve and having its lower end anchored adjacent the lower end of the mast, a pulley on the mast head and a flexible connection extending about the pulley between the upper end of said spring and the ladder, said spring being preloaded in tension and being further tensioned by said flexible connection, upon downward pivotal movement of said ladder with respect to said sleeve to effectively counterbalance the ladder throughout its tilting range.

5. A vehicle supported ladder assembly comprising in combination, a vertical mast rotatably supported on the vehicle body, an extensible ladder including a pair of telescoping sections having the lower end of one section pivotally coupled to the mast, means for selectively tilting the extensible ladder in a vertical plane, other means for selectively extending the ladder sections, a releasable latch for securing the ladder in a plurality of tilted positions, and means automatically responsive to extension of the ladder from a retracted position to prevent release of said latch, thereby maintaining the tilted position of the ladder fixed while the ladder is extended.

6. A vehicle supported ladder assembly comprising in combination, a vertical mast rotatably supported on the vehicle body, an extensible ladder including a pair of telescoping sections having the lower end of one section pivotally coupled to the mast, means for selectively tilting the extensible ladder in a vertical plane, said means including an arcuately formed elevating gear sector carried by the lower end of the pivoted ladder section and an operator-controlled pinion shaft operatively supported by the mast for driving engagement with the elevating gear sector to tilt the ladder, said gear sector including a plurality of apertures spaced along its arcuate periphery, a releasable latch for securing the ladder in a plurality of tilted positions, said latch including a pin slidably supported on the mast for axial movement towards and away from engagement with an aligned aperture to secure the gear sector against further rotation, said slidable pin having means normally biasing the pin in a direction to engage a gear sector aperture and including an eccentric lever having a slidable cam slot connection therewith for coaction in response to manual operation of the lever to retract the pin from the aligned aperture and thereby release the gear sector for tilting movement, and means automatically responsive to extension of the ladder from a retracted position to prevent release of said latch thereby maintaining the tilted position of the ladder fixed while the ladder is extended.

7. The ladder assembly to claim 6 wherein said latch locking means includes a movable stop member on the mast adjacent the slidable pin adapted in one position to engage and prevent retraction of the pin from a gear sector aperture, means normally biasing said stop member in said pin engaging position, an operating member having one end pivoted on the lower end of the pivoted ladder section and having its other end intersecting the path of the extensible ladder section and adapted to be engaged thereby, means interconnecting the operating and stop members and coacting therebetween to retract the stop member when the operating member is engaged and rotated about its pivot by the lower end of the extensible ladder section in the retracted position.

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