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Garnett

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[54] **EXTENSIBLE LADDER ASSEMBLY AND AERIAL BASKET THEREFOR**

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[73] Assignee: **SSP Truck Equipment, Inc.,** Paramount, Calif.

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[52] **U.S. Cl.** **182/2,** 182/67

[51] **Int. Cl.** **B66f 11/04**

[58] **Field of Search** 182/2, 64–68, 182/141, 148

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Attorney—Herbert A. Huebner et al.

[57] **ABSTRACT**

An extensible ladder is mounted on a vehicle to be pivotal upward and downward by piston mechanism positioned to the side of the pivotal path of ladder travel. An aerial basket is pivotally mounted on the ladder which has its motion damped to prevent sudden changes in basket attitude. Included are arrangements for automatically storing the basket on ladder retraction and for supporting the ladder in a rest position over the vehicle roof. The ladder rest arrangement may be positioned to permit depression of the ladder to the vehicle roof.

13 Claims, 9 Drawing Figures

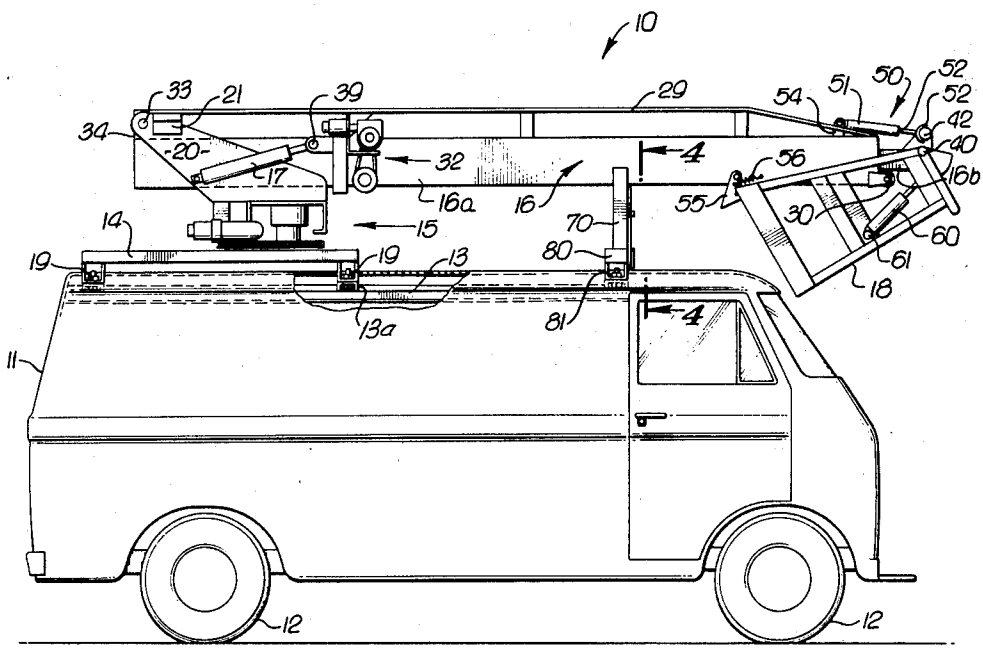
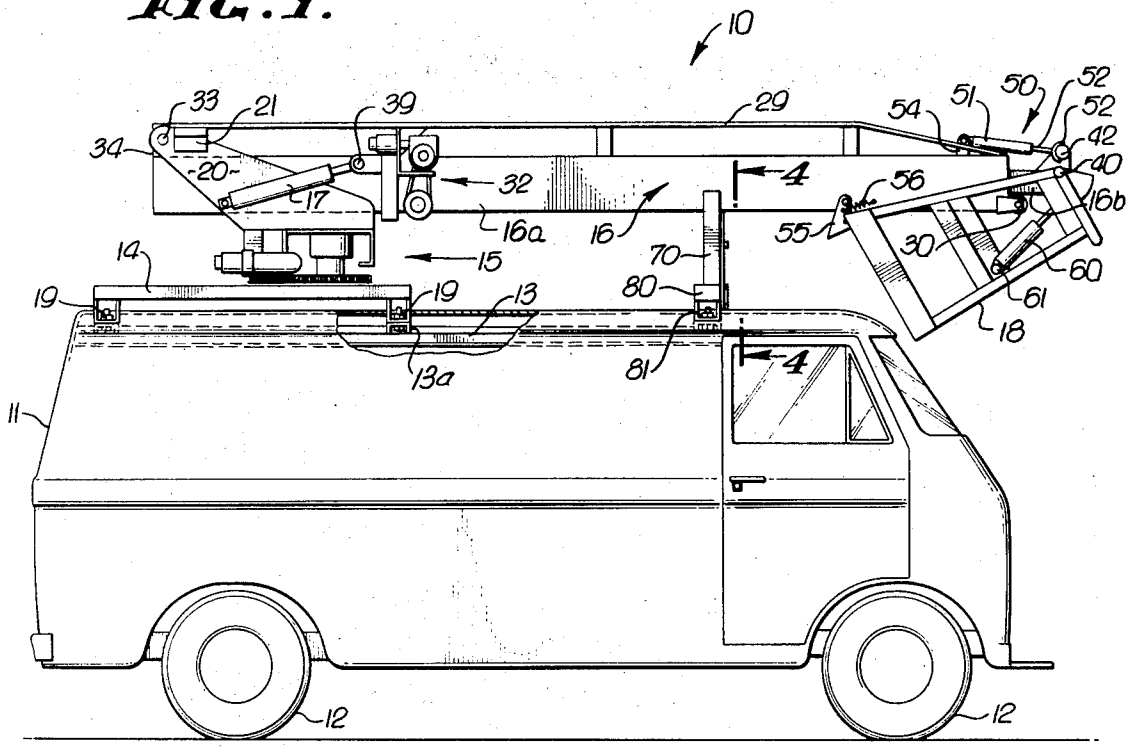


FIG. 1.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16b
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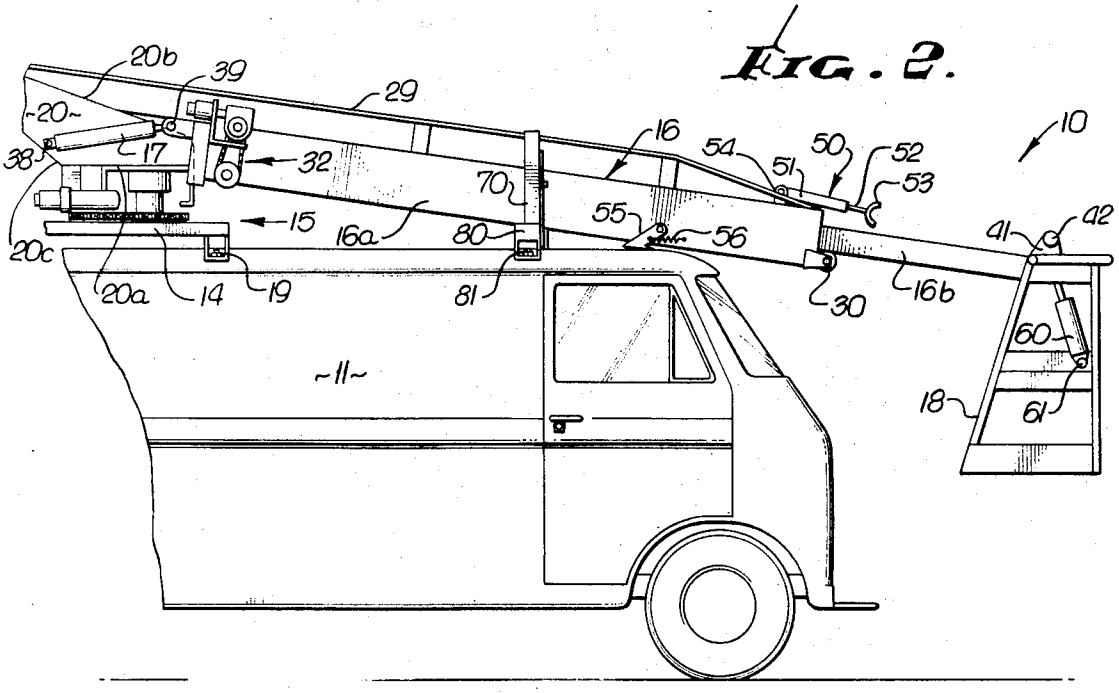
FIG. 2.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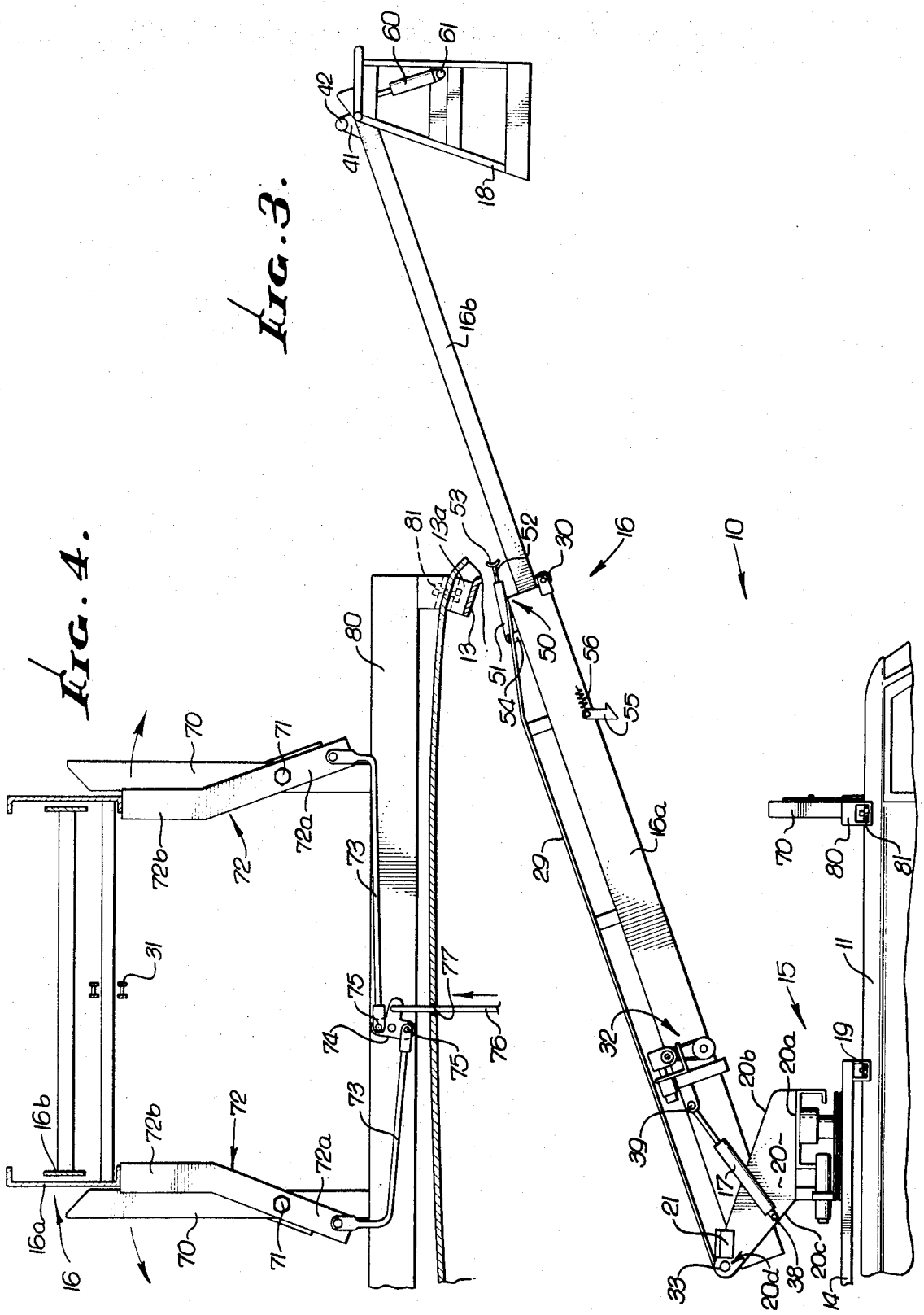
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72a
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20a
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20d
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20c
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FIG. 3.

FIG. 4.

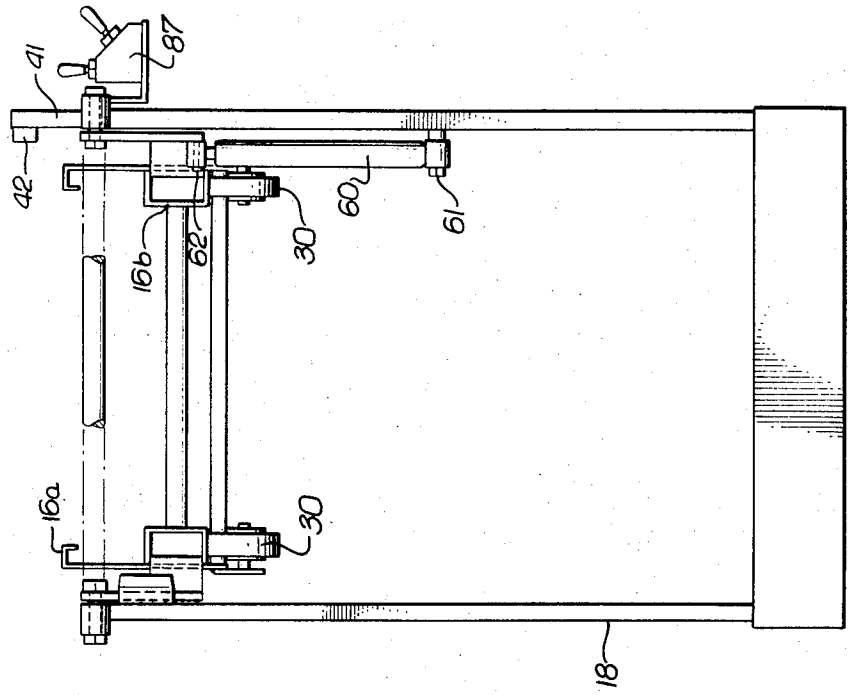
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FIG. 6.

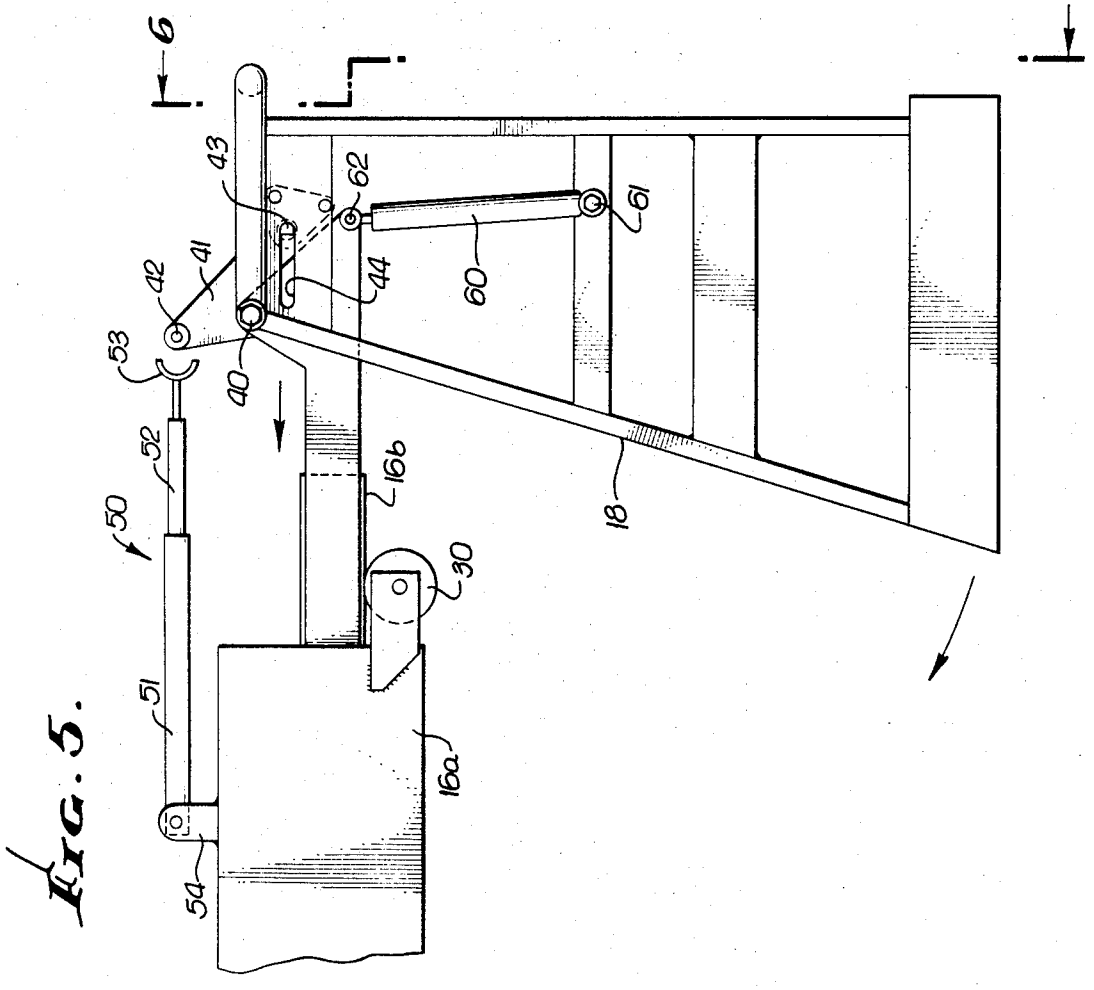
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FIG. 5.

FIG. 8.

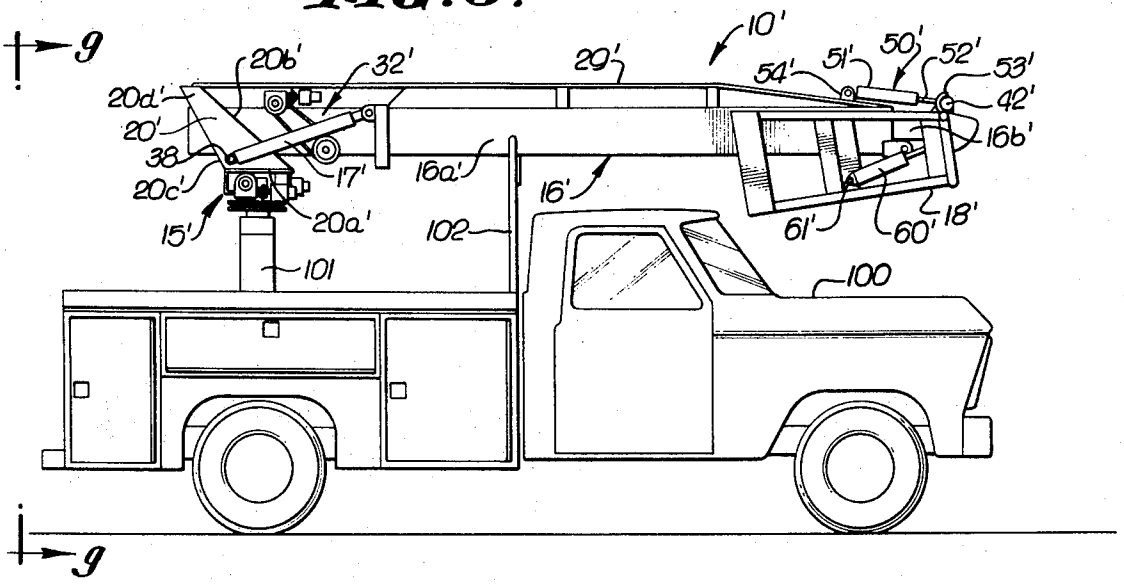


FIG. 7.

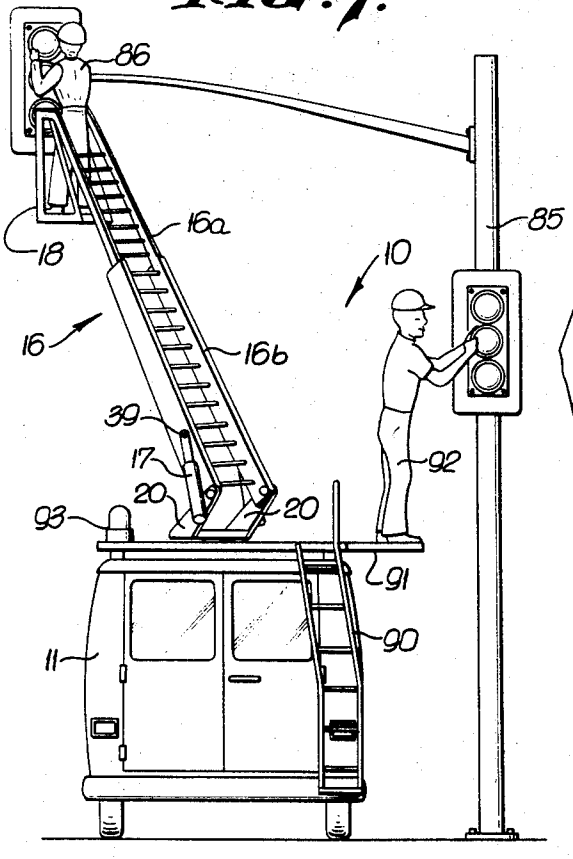
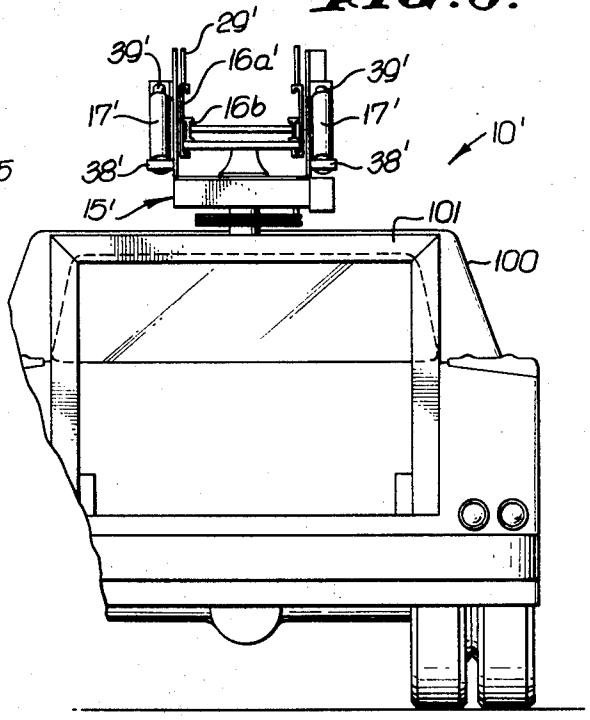


FIG. 9.



EXTENSIBLE LADDER ASSEMBLY AND AERIAL BASKET THEREFOR

BACKGROUND OF THE INVENTION

The present invention relates to ladders and more particularly to an improved type of extensible ladder assembly suitable for mounting on a vehicle or other type of mobile platform. Further, the present invention relates to an improved type of aerial basket arrangement suitable for mounting on the extensible ladder assembly.

Such vehicle mounted aerial ladder assemblies and baskets are used to support workmen in elevated locations for power line work, tree trimming, street and signal light replacement and similar operations.

Ideally, these ladder assemblies should be power operated and satisfy certain basic safety requirements. One such safety requirement is that the ladder assembly must be so mounted on the vehicle that it may be fully extended with a workman positioned in the aerial basket without running the risk of tipping over the vehicle upon which it is mounted. For this reason it is desirable that the extensible ladder assembly be designed to have its center of gravity as low as possible. Unfortunately, due to the arrangements heretofore used to selectively elevate the ladder assemblies, these assemblies generally had relatively high centers of gravity.

Another basic requirement is that the aerial baskets included in these ladder assemblies should at all times provide a stable work platform when positioned in their work positions. This is important since any sudden changes in the basket attitude could throw a workman or his tools therefrom. Further, the aerial basket should be automatically self-leveling so that a substantially level work platform is at all times provided. Heretofore, arrangements have been provided for maintaining aerial baskets level. Generally, however, these arrangements have been unduly complicated including rigid members connected in parallelograms, cables, sprockets, chains, mechanisms for locking the baskets in place, etc.

An additional basic requirement is that the basket should be storable in a safe traveling position whereat it will not interfere with the operation of the vehicle upon which the ladder assembly is mounted.

SUMMARY OF THE INVENTION

It is, accordingly, an object of the present invention to provide an improved extensible ladder assembly for mounting on a mobile platform which has a relatively low center of gravity.

It is further an object of the present invention to provide an improved arrangement on an extensible ladder which is operable to automatically position an aerial basket mounted thereon in a storage position whenever the ladder is retracted.

It is also an object of the present invention to provide an improved aerial basket arrangement on a ladder which is self-leveling and operable to prevent sudden changes in the basket attitude.

It is additionally an object of the present invention to provide an improved extensible ladder assembly mounted on a mobile platform which has a relatively low center of gravity, includes an improved self-leveling aerial basket the motion of which is damped to prevent sudden changes in attitude of the basket, includes an improved arrangement operable to automatically position the basket in a safe storage position whenever the ladder is fully retracted, and includes ladder rest mechanism.

In accomplishing these and other objects, there is provided in accordance with the present invention a vehicle having an improved extensible ladder assembly mounted thereon which includes an extensible ladder and an aerial basket. The ladder is mounted at one end in pivot structure and piston mechanism is connected outside of the ladder for pivoting the ladder upward or downward, thereby to raise or lower the ladder. By mounting the piston means to the side of the pivotal path of ladder travel, the ladder may be mounted at a lower point on the vehicle so as to lower the center of gravity of the ladder assembly and thereby increase stability.

The aerial basket is pivotally mounted on a section of the ladder which may be selectively extended and a store means or arrangement is provided for engaging the basket when the ladder is retracted to pivot the basket into a safe storage or travel position. The basket, when the ladder is extended, automatically assumes an upright work position due to its pivotal mounting and an arrangement is provided for damping the movement of the basket. Thereby, the basket in its work position is not susceptible to sudden changes in attitude so that it provides in its work position a platform which is at all times substantially stable and level.

A two position ladder rest mechanism is also provided for holding the ladder when stored in a substantially horizontal rest position over the vehicle roof. The rest mechanism may be selectively moved to its second position where the ladder may be depressed to rest on support structure on the vehicle roof. By extending the ladder so that the basket drops into its work position and lowering the ladder so that it rests on the vehicle roof, the basket is positioned and stably supported in a relatively low position whereat a workman on the ground may climb into the basket.

Additional objects of the present invention reside in the specific construction of the exemplary embodiments of extensible ladder assembly hereinafter particularly described in the specification and shown in the several drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation view of a van type vehicle having an extensible ladder assembly according to the present invention mounted thereon illustrating the ladder and aerial basket of the assembly in storage position.

FIG. 2 is a view as in FIG. 1 illustrating the ladder partially extended and depressed to rest on the van roof and the aerial basket in its work position.

FIG. 3 is a side elevation view of the extensible ladder assembly of FIG. 1 in an extended and elevated position.

FIG. 4 is a view taken along the line 4—4 of FIG. 1.

FIG. 5 is an enlarged view of the aerial basket portion of the ladder assembly of FIG. 1.

FIG. 6 is a view taken along the line 6—6 of FIG. 5.

FIG. 7 is a rear end view of a van of the type shown in FIG. 1 which has been modified to include a foldable work platform and which has its ladder assembly extended and elevated with a traffic signal workman positioned in the aerial basket.

FIG. 8 is a side elevation view of a pickup truck having another embodiment of extensible ladder assembly according to the present invention mounted thereon.

FIG. 9 is a view taken along the line 9—9 of FIG. 8.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings in more detail, there is shown in FIGS. 1–6, an extensible ladder assembly generally identified by the numeral 10. The ladder assembly 10 is mounted on a van type vehicle 11 having wheels 12. The roof of the vehicle 11 is reinforced by a longitudingal header 13 having support extensions 13*a*. The header 13 is welded to the inside of the van, and is of such a unitary interfitted construction, that upon removal of the ladder assembly 10 for resale of the van, the van's interior appearance is not objectionable.

The ladder assembly 10 includes a platform 14, a turret mechanism 15, an extensible ladder 16, elevating pistons 17 and an aerial basket 18. The platform 14 is preferably rectangular and is secured by bolts 19 through the rear roof portion of the van 11 to support extensions 13a. The platform 14 provides a mounting platform for the turret mechanism 15. The turret mechanism 15 may be any conventional arrangement and is preferably an electrically operated chain drive mechanism which may be selectively rotated 360°.

Mounted on the rotatable portion of the turret mechanism 15 is structure for pivotally mounting the ladder 16 on the turret 15. This mounting structure is preferably made up of a pair of spaced apart, mutually parallel, vertically extending plate-like support members 20. The support members 20 preferably are shaped substantially in the form of identical obtuse-angled triangles, each having a base side 20*a*, an hypotenuse 20*b* and an upward extending third side 20*c*. The hypotenuse 20*b* and the third side 20*c* intersect to form the triangle vertex 20*d*.

The support members 20 have their base sides 20*a* secured to the rotatable portion of the turret 15, preferably by being welded thereto. These support members 20 which function as pivot mounts are positioned on the turret 15 symmetrically to each side of the axis of rotation of the turret so that the vertices 20*d* are offset a predetermined distance from the axis of rotation and are positioned side by side a predetermined distance apart. Thereby, pivot points are defined by the vertices 20*d* which are offset vertically above the turret 15 and horizontally from the turret's axis of rotation. A control box 21 is provided for controlling the operation of the turret 15 and ladder assembly 10, and the control box 21 may be mounted on the outer side of one of the pivot mounts 20, as shown in FIGS. 1 and 3.

The extensible ladder 16 may be of any conventional type. The ladder 16 shown has a first fixed ladder section 16*a* with hand rails 29 thereon into which fits a second movable ladder section 16*b*. The movable ladder section 16*b* may be selectively extended from one end of the ladder section 16*a*, as shown in FIG. 3, or retracted, as shown in FIG. 1. The ladder section 16*b* rolls on rollers 30 mounted on the fixed ladder section 16*a* and an endless roller chain 31, shown in FIG. 4, is mounted on the ladder section 16a and connected to the ladder section 16*b*. The endless chain 31 is driven by a conventional motor-chain drive mechanism 32 and the motor 32 may be selectively operated to drive the endless chain 31 either in a forward or reverse direction, thereby to extend or retract the ladder section 16*b*, respectively. The motor-chain drive mechanism 32 may be mounted, as shown in the drawings, on the outer side of the fixed ladder section 16*a*.

The other end of the ladder section 16a is positioned between the pivot mounts 20 and is pivotally mounted on a transversely extending shaft 33 which extends therebetween. The shaft 33 extends between the pivot points defined on the support members 20 by the vertices 20*d*. Preferably, the shaft 33 extends through upward projecting extensions 34 on the sides of the ladder section 16a so that the heaviest portion of the ladder structure is positioned relatively closely to the turret 15 and the roof of the van 11. Thereby, the ladder assembly 11 has a relatively low center of gravity. It is noted that the lower corner portion of the extension 34 is shown in FIG. 1 while the remainder of the extension 34 is hidden behind the pivot mount 20.

One of the elevating pistons 17 is preferably mounted on each side of the ladder section 16*a*. Each of these piston mechanisms 17 preferably has its cylinder portion pivotally connected at a point 38 along the side 20*c* of the pivot mount 20 and its rod end pivotally connected at point 39 to the outer side of the extensible ladder 16. The piston mechanism 17 may be of any conventional type, such as hydraulic, and other suitable ladder elevating mechanism could be connected outside of the ladder path of travel for selectively elevating and lowering the ladder 16. By mounting the piston mechanism 17 or other suitable ladder elevating mechanism to the side of the pivotal path of ladder travel, the ladder 16 may be mounted at a lower point on the vehicle so as to lower the center of gravity of the ladder assembly 10 and thereby increase stability.

The movable ladder section 16b has mounted on its outer end the aerial basket 18. The basket 18 is pivotally mounted on a transversely extending shaft 40 which extends between the sides of the ladder section 16*b*. Secured on the upper end of the basket 18 is an upwardly extending rigid member 41 which has a transversely extending boss 42 formed thereon. The member 41 is secured to the basket 18 by being pivotally mounted on the shaft 40 and having a pin 43 formed thereon which interfits in a groove 44 formed in a side of the basket 18. The pin 43 — groove 44 arrangement rigidly connects the member 41 to the basket 18 while allowing the pin 43 to move longitudinally in the groove 44 to accommodate changes in basket attitude. The rigid member 41 is preferably substantially triangular in shape, having the shaft 40 pinned through one of its corners and the boss 42 and pin 43 formed on its other corners.

Mechanism is mounted on the ladder section 16*a* for engaging the boss 42 whenever the ladder section 16*b* is fully retracted, thereby to pivot the basket 18 under the extensible ladder 16. This mechanism preferably is a telescoping plunger mechanism 50 which is resiliently biased in an extended position. The plunger 50 is shown in detail in FIG. 5.

The plunger 50 includes an outer cylindrical portion 51 and a telescoping inner portion 52. The end of the inner plunger portion 52 adjacent the basket 18 has a semicircular rigid collar 53 secured thereon for engaging and bearing against the boss 42. The other end of the plunger 50 has its outer casing anchored in brackets 54 on the upper side of the ladder section 16*a*. The

inner and outer sections of the plunger **50** are resiliently biased, such as by a compression spring, so that the plunger **50** is normally extended and functions to pivot the basket **18** into a storage position, as shown in FIG. **1**. Once the basket **18** is pivoted to its storage position, the telescoping inner portion **52** is forced into its outer casing **51** to accommodate any further retraction of the ladder section **16b** into the section **16a**.

The plunger mechanism **50** operates to pivot the basket **18** into the storage position shown in FIG. **1** when the ladder **16** is retracted by pushing against the boss **42** on the rigid member **41**. Thereby, the rigid member **41** is rotated on the transverse shaft **40** and the pin **43** pushes against the side of the slot **44** to pivot the basket **18** under the ladder **16**. A latch **55**, preferably in the form of a hook, may be mounted on the side of the ladder section **16*a*** to lock the basket **18** in its storage or travel position. The latch **55** is preferably resiliently biased by a spring **56** so that it automatically engages the basket **18** when the basket **18** is pivoted into the storage position.

The aerial basket **18** drops into a work position as shown in FIGS. **2, 3** and **5** when the ladder section **16*b*** is extended. The basket **18** drops into this work position since the extension of the ladder **16** slidably disengaged or releases the bottom of the basket **18** from the latch **55** and moves the boss **42** on the member **41** out of contact with the plunger mechanism **50**.

The basket **18** in its work position is self-leveling since it is pivotally mounted on the shaft **40**, the force of gravity being operable to cause the basket **18** to assume a vertical work position. A shock absorber **60** is pivotally connected between a point **61** on the forward portion of the basket **18** and a point **62** on the end of the ladder section **16*b***. The shock absorber **60** functions as damping means and damps the movement of the basket **18** so that the attitude of the basket **18** changes gradually rather than suddenly. Thereby, the basket **18** in its work position provides a safe substantially stable platform.

The ladder assembly **10** shown in FIGS. **1–6** includes a two position ladder rest mechanism made up of a pair of uprights **70** which are laterally spaced apart on the front portion of the roof of the vehicle **11**. The uprights **70** are spaced apart so that the ladder **16** may be lowered therebetween. Pivotally mounted at pivot points **71** on each of the uprights **70** are ladder supports **72**. Each of the supports **72** are preferably made of two straight sections **72*a*** and **72*b*** which are joined together to bow inwardly, thereby to project slightly outward, and the pivot points **71** are located centrally on the support sections **72*a***.

Tie rods **73** are pivotally connected between the bottoms of the ladder support sections **72*a*** and a rotatably mounted member **74**. The tie rods **73** are pivotally connected to diametrically opposite eccentric points **75** on the member **74**, and a control rod **76** is connected to the member **74** for rotating it. The tie rods **73** are appropriately dimensioned to hold the ladder support sections **72*b*** within the uprights **70** substantially parallel to each other whenever the rod **76** is in its lower position, as shown in FIG. **4**. Thereby, the ladder **16** is held by the supports **72** in a substantially horizontal storage or travel position. By pushing on the rod **76** which projects through the hole **77** in the van roof, the member **14** is rotated to pull each tie rod **73** inwardly. Thereby, the upper ends **72*b*** of the ladder supports **72** are pivoted outward, as indicated by the arrows in FIG. **4**, so that the ladder **16** may be depressed between the uprights **70** without contacting the supports **72** to an inclined position below the horizontal rest position.

The ladder **16** is shown lowered between the uprights **70** to rest upon the support member **80** which is bolted through the van to support extensions **13*a*** by bolts **81**. The support member **80** which is part of the ladder rest mechanism extends transversely on the van roof and provides the supporting base for the uprights **70**. With the ladder **16** depressed, as shown in FIG. **2**, and its section **16b** extended so that the basket **18** is dropped into its work position, the basket **18** is positioned in a relatively low stable position whereat a workman may enter the basket from ground level.

In operation of the exemplary ladder assembly **10**, the van **11** is driven into position near a signal light **85**, such as into the position shown in FIG. **7**. A signal light workman **86** is then positioned in the aerial basket **18**, for example, by extending and depressing the basket **18** to the position shown in FIG. **2**. The ladder **16** is then elevated, rotated and extended to position the workman in the basket **18** adjacent the overhanging portion of the signal light **85**. It is noted that control mechanism **87** is mounted at the basket **18**, as shown in FIG. **6**, so that the workman **86** can control the elevation, rotation and extension of the ladder **16**. Further, the controls **87** may be arranged to be operable to selectively deactivate the controls **21** located at the base of the ladder **16**. After the workman **86** has completed his work on the signal light **85**, the basket **18** is lowered to the position shown in FIG. **2** where the workman may descend therefrom and the basket **18** and ladder **16** are stored in the travel position shown in FIG. **1**. To store the ladder **16** in its storage position, the ladder **16** is elevated, the ladder supports **72** are pivoted to the position shown in FIG. **4** by pulling on the rod **76**, and the ladder **16** is lowered to rest on the ladder supports **72**. As before-described, the basket **18** is automatically pivoted to its storage position by the plunger mechanism **50** by retracting the extensible ladder **16**.

It is noted that the van **11** shown in FIG. **7** includes a ladder **90** mounted on its rear for climbing to the top of the van **11**, a platform **91** which forms part of the platform **14** and may be folded out to support a workman **92** as shown, and a light **93** which may be illuminated to warn drivers that the van **11** is stopped.

A modified form of ladder assembly **10′** is shown in FIGS. **8** and **9**. The parts of the ladder assembly **10′** corresponding to the parts of the ladder assembly **10** are identically numbered with a prime added. The ladder assembly **10′** is mounted on the bed of a pickup truck **100** a U-shaped support member **101**. The member **101** is constructed in a U-shaped form so that the rear view of a driver of the truck **100** is not obstructed. A U-shaped ladder support **102** is also mounted on the truck **100** near the truck cab to support the extensible ladder **16′** in a substantially horizontal storage position. The ladder assembly **10′** operates in substantially the same manner as the hereinbefore described ladder assembly **10**. It is noted that the storage position of the basket **18′** is slightly higher than that of the basket **18** to insure that the front visibility of a driver of the truck **100** is not blocked.

Thus, there has been provided an improved extensible ladder assembly mounted on a mobile platform which has a relatively low center of gravity, includes an

improved self-leveling aerial basket the motion of which is damped to prevent sudden changes in basket attitude, includes an improved arrangement for automatically storing the basket and includes improved ladder rest mechanism.

Although I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of my invention.

I claim:

1. An extensible ladder assembly for mounting on a mobile platform, comprising:

extensible ladder means, said ladder means including at least first and second ladder sections, said first ladder section having first and second ends and said second ladder section having an outer end, said ladder means being operable to selectively extend and retract said second ladder section from and into, respectively, the second end of said first ladder section;

structure pivotally mounting the first end of said first ladder section for upward and downward pivotal movement;

piston means connected to said first ladder section for selectively pivoting said ladder means upward or downward whereby to raise or lower said ladder means;

an aerial basket pivotally mounted on the outer end of said second ladder section so as to be self-leveling; and

a two position ladder rest mechanism, said ladder rest mechanism being operable in one position to support said ladder means in a substantially horizontal at rest position and being operable in its second position to support said ladder means in an inclined position below said horizontal rest position.

2. The invention defined in claim 1, wherein said ladder rest mechanism comprises a pair of spaced apart uprights interconnected at their bottoms by a transverse support member, a pair of inwardly bowed ladder supports pivotally mounted on said uprights, and tie rod means for pivoting said ladder supports between an inner position for supporting said ladder means in its horizontal rest position and an outer position whereat said ladder supports are pivoted out of the way of said ladder means so that said ladder means may be depressed to rest on said transverse support member.

3. The invention defined in claim 2, wherein said piston means connected to said first ladder section are positioned to one side of the pivotal path of ladder travel.

4. The invention defined in claim 1, wherein said piston means connected to said first ladder section are positioned to one side of the pivotal path of ladder travel.

5. The invention defined in claim 1, including means connected to said basket for damping the movement of said basket to prevent sudden changes in the attitude of said basket.

6. An extensible ladder assembly for mounting on a mobile platform, comprising:

extensible ladder means, said ladder means including at least first and second ladder sections, said first ladder section having first and second ends and said second ladder section having an outer end, said ladder means being operable to selectively extend and retract said second ladder section from and into, respectively, the second end of said first ladder section;

structure pivotally mounting the first end of said first ladder section for upward and downward pivotal movement;

piston means connected to said first ladder section and positioned to one side of the pivotal path of ladder travel for selectively pivoting said ladder means upward or downward whereby to raise or lower said ladder means;

an aerial basket pivotally mounted on the outer end of said second ladder section so as to be self-leveling;

store means mounted on said ladder means for automatically pivoting said basket into a storage position whenever said second ladder section is fully retracted into said first ladder section;

means connected to said basket for damping the movement of said basket to prevent sudden changes in the attitude of said basket; and

a two position ladder rest mechanism, said ladder rest mechanism being operable in one position to support said ladder means in a substantially horizontal at rest position and being operable in its second position to support said ladder means in an inclined position below said horizontal rest position.

7. The invention defined in claim 6, wherein said store means comprises:

first structure connected to said basket for pivoting said basket; and

second structure mounted on said first ladder section for engaging said first structure whenever said second ladder section is fully retracted whereby to pivot said basket into said storage position.

8. The invention recited in claim 7, wherein:

said second structure is a telescoping plunger mechanism resiliently biased in its extended position which is operable to accommodate any additional movement of said second ladder section into said first ladder section after said basket has been pivoted by said plunger mechanism into its storage position; and

said damping means is a shock absorber connected between said aerial basket and said second ladder section.

9. The invention recited in claim 8, wherein said ladder rest mechanism comprises a pair of spaced apart uprights interconnected at their bottoms by a transverse support member, a pair of inwardly bowed ladder supports pivotally mounted on said uprights, and tie rod means for pivoting both said ladder supports between an inner position for supporting said ladder means in its horizontal rest position and an outer position whereat said ladder supports are pivoted out of the way of said ladder means so that said ladder means may be depressed to rest on said transverse support member; said piston means includes a piston mechanism connected to each side of said first ladder section; and including latch means for holding said basket in said storage position when said second ladder section is fully retracted, said latch means being operable to release said basket when said second ladder section is extended.

10. In an extensible ladder assembly for mounting on a mobile platform wherein the extensible ladder of said assembly includes first and second ladder sections, said second ladder section being extendable from and re-

tractable into said first ladder section, the improvement comprising:

an aerial basket pivotally mounted on the outer end of said second ladder section so as to be self-leveling; and

store means mounted on said ladder for automatically pivoting said basket into a storage position whenever said second ladder section is fully retracted into said first ladder section, said store means comprising first structure connected to said basket for pivoting said basket and second structure mounted on said first ladder section for engaging said first structure whenever said second ladder section is fully retracted whereby to pivot said basket into said storage position, said second structure being a telescoping plunger mechanism resiliently biased in its extended position which is operable to accommodate any additional movement of said second ladder section into said first ladder section after said basket has been pivoted by said plunger mechanism into its storage position.

11. The invention defined in claim **10,** including latch means for holding said basket in said storage position when said second ladder section is fully retracted, said latch means being operable to release said basket when said second ladder section is extended.

12. The invention defined in claim **10,** including means connected to said basket for damping the movement of said basket to prevent sudden changes in the attitude of said basket.

13. The invention defined in claim **12,** wherein said damping means is a shock absorber connected between said basket and said second ladder section.

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