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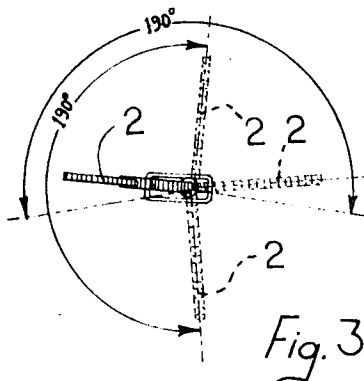
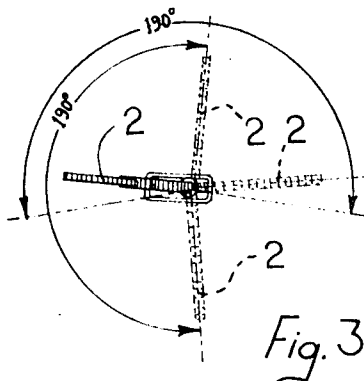
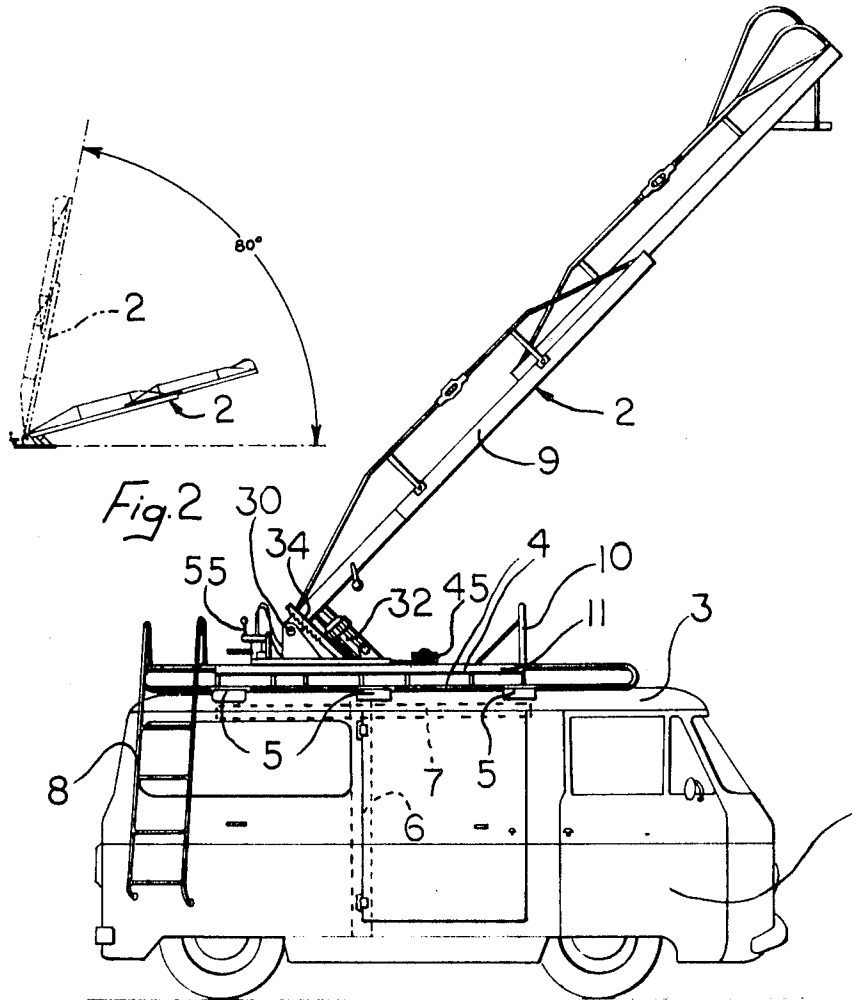
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3,605,943

AERIAL LADDER

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3 Sheets-Sheet 1



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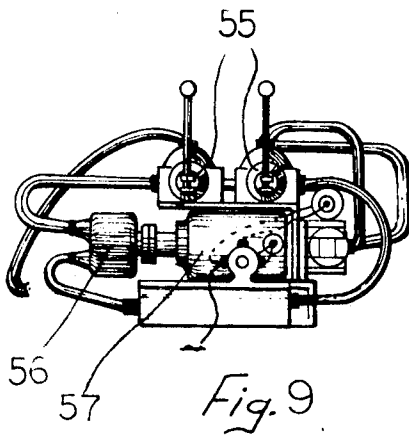
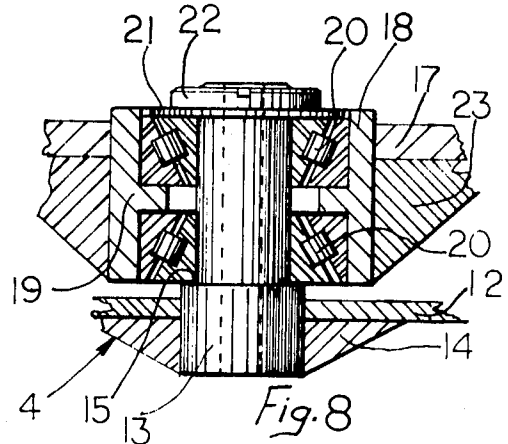
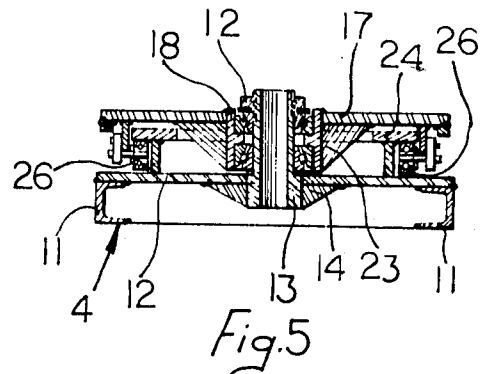
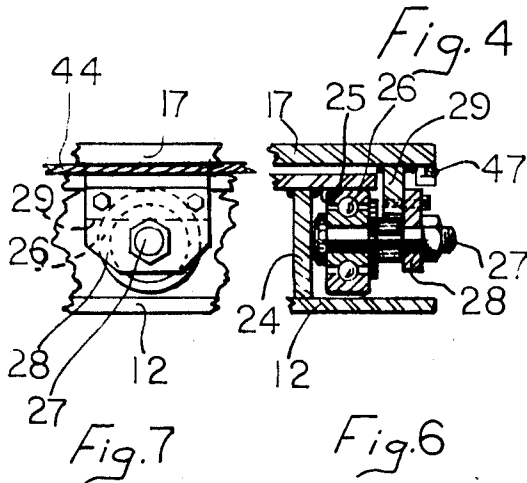
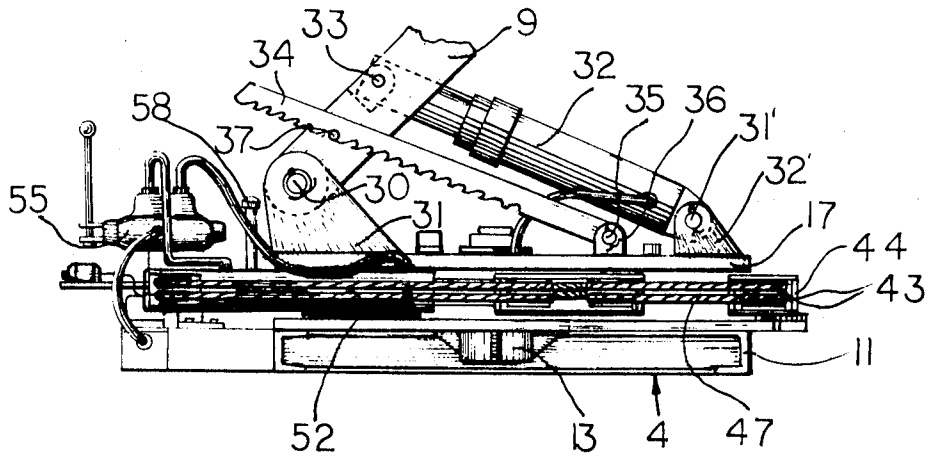
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AERIAL LADDER

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3 Sheets-Sheet 2



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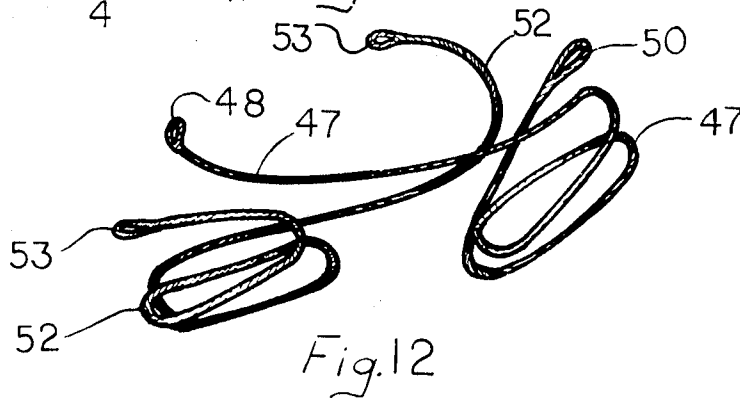
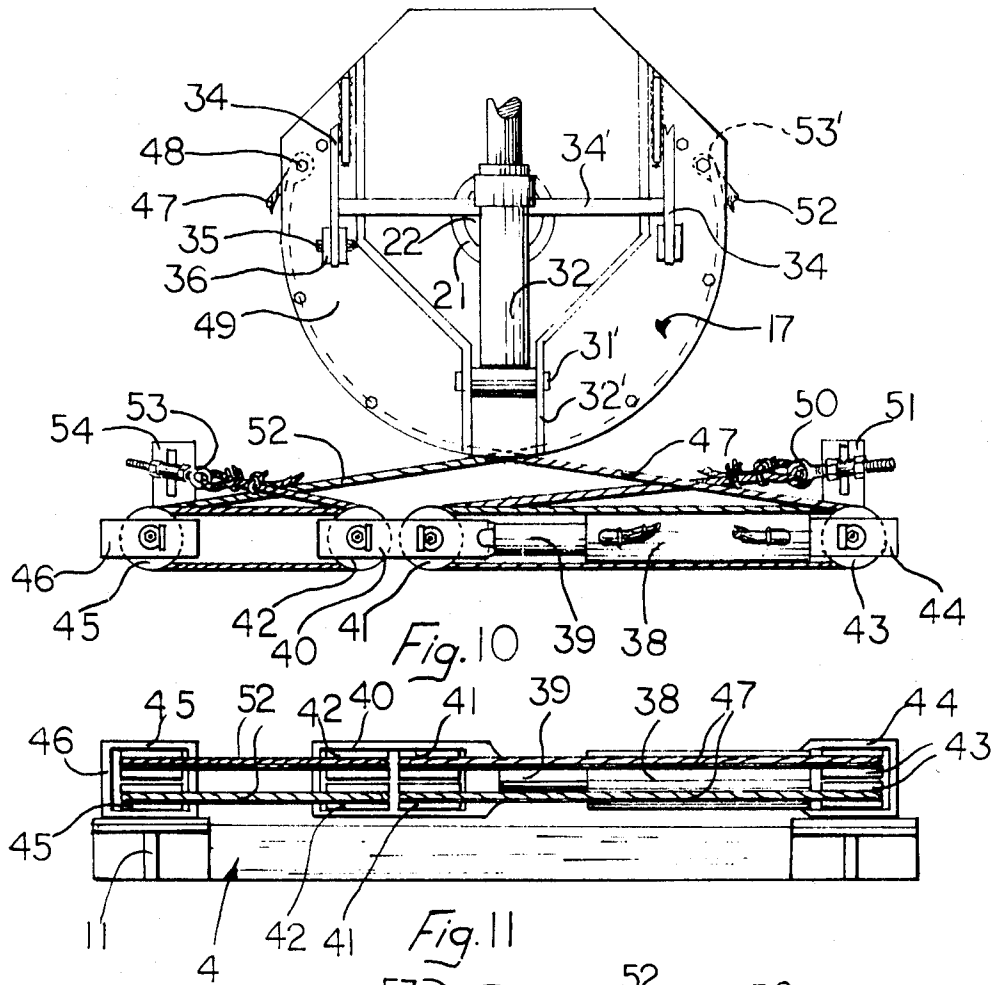
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3 Sheets-Sheet 3



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3,605,943

AERIAL LADDER

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9 Claims

ABSTRACT OF THE DISCLOSURE

An aerial ladder which is power operated for swinging and tilting movement with respect of a base mounting, said base mounting so designed as to have a minimum height and thus a very low center of gravity, such that the base mounting and ladder are especially adapted to be mounted on the roof of a small truck, whereby a person standing at the end of the extended ladder, with the ladder oriented transversely of the truck will not be able to overturn the truck even if the latter has no ground engaging stabilizers.

The present invention relates to an aerial ladder adapted to be mounted on a motor vehicle and which is power operated for swinging and tilting movement with respect to the vehicle, for obtaining access to overhead traffic lights, street lamps, telephone cables, television cables, and the like.

The general object of the invention resides in providing an aerial ladder of the character described in which the mechanism for operating the ladder and the base mounting for the ladder are built in such a manner as to have a minimum height whereby the ladder can be mounted on the roof of a small truck, while maintaining the center of gravity low enough such that the ladder when in an extended position and with an operator standing at the end of the same will not overturn the truck.

Another object of the invention resides in the provision of an aerial ladder of the character described, in combination with a small truck having a rigid roof covering the rear compartment of the truck, such that the said rear compartment forms an enclosed area for storing the tools and supplies necessary for the maintenance of telephonic and television cable lines, and the like.

Another object of the invention resides in a provision of an aerial ladder comprising a ladder pivotally mounted on a turntable and the latter rotatably mounted on a platform, there being provided means to prevent tilting of the turntable with respect to the platform in any position of the ladder.

Another object of the invention resides in the provision of a cable system and hydraulic power means for rotating the turntable and to lock the same in any desired horizontal position.

Another object of the invention resides in the provision of an aerial ladder of the character described of relatively simple and inexpensive construction, and which can be easily and rapidly operated to any vertical and horizontal angles.

The foregoing and other objects of the invention will become more apparent during the following disclosure and by referring to the drawings, in which:

FIG. 1 is a side elevation of a small roof covered truck combined with the aerial ladder;

FIG. 2 is a schematic side elevation of the hydraulic ladder showing its range of vertical tilting movement;

FIG. 3 is a schematic top plan view of the ladder showing its range of horizontal swinging movement;

FIG. 4 is a side elevation of the lower part of the ladder and showing the turntable rotated at 90° with respect to the platform;

FIG. 5 is a cross-section of the platform and turntable system;

FIG. 6 is a cross-section on an enlarged scale of a portion of FIG. 5, and showing a stabilizer roller arrangement for the turntable;

FIG. 7 is a partial side elevation taken at 90° to that of FIG. 6;

FIG. 8 is a cross-section on an enlarged scale of the central pivot for the turntable;

FIG. 9 is a side elevation of a part of the hydraulic system;

FIG. 10 is a top plan view of the turntable and of the cable and hydraulic cylinders system for rotating the same in a horizontal plan;

FIG. 11 is a side elevation of the cable system; and

FIG. 12 is a perspective view of the two cables showing how they are wound.

In the drawings, like reference characters indicate like elements throughout.

Referring to FIG. 1, the system of the invention comprises the combination of a small truck, generally indicated at 1, of the type having a metal roof over the rear compartment of the truck, said roof being generally an extension of the roof for the driver's cabin.

The ladder of the invention is generally indicated at 2, and is mounted on the roof 3 of the truck. Thus, the rear compartment of the truck is closed and can serve for storing supplies and tools.

The ladder 2 comprises a base mounting 4 constituted by a generally rectangular frame supported just over roof 3 by means of foot pads 5 curved and shaped to fit the curved sides of the roof 3 and bolted to the latter. Preferably, the roof 3 is reinforced by means of metal uprights 6 extending along the side walls of the truck rear compartment, bearing at their lower ends on the frame supported floor of the truck, and supporting at their upper ends transverse beam members 7 which extend underneath and are preferably bolted to the foot pads 5.

A fixed ladder is secured to the roof and extends along the side of the truck 1 to gain access to the ladder 2. The base 4 is fitted with an expanded metal trellis work extending across the same and serving as a platform for the operator. The ladder itself is shown at 9 and consists of two or more telescopic sections. The outer sections can be moved with respect to the base section by manually operated cable means in conventional manner.

The ladder 9 can pivot vertically between a horizontal position substantially parallel to the long axis of the truck, and in which the ladder rests on a support 10 secured to the front portion of base 4, and a nearly vertical position making an angle of approximately 90° with the horizontal position, as shown in FIG. 2.

Moreover, the ladder 9 can be swung horizontally with respect to base 4 through an angle of approximately 190° whereby the ladder can be directed towards the front or one or the other sides of the truck, as shown in FIG. 3. Obviously, the ladder can be arranged such that it will be directed towards the back and would be capable of being pivoted to one or the other side of the truck, as shown in dotted lines in FIG. 3.

The two channel shape longitudinal members 11 of the frame 4 support a metal plate 12 rigidly secured to said members 11. A tubular upright shaft 13 is secured to plate 12 and extends upwardly therefrom and is reinforced by triangular webs 14. Just above plate 12, shaft 13 has a shoulder 15. A turntable 17 is mounted for rotation in a horizontal plane on tubular shaft 13. The latter is disposed along the longitudinal center line of frame 4 and consequently of truck 1.

The turntable 17 is fitted with a centrally located

sleeve 18, inserted within a central hole of plate 17, and extending downwardly from said plate and surrounding and coaxial with tubular shaft 13. Sleeve 18 is provided at mid-length with a radially inwardly directed flange 19 serving as spacing and locating members for a pair of axial thrust conical roller bearings 20, the lower bearing resting on shoulder 15 and contacting flange 19, while the upper bearing rests on flange 19 and is in contact with a washer 21 surrounding the tubular shaft and tightened by means of a bolt 22 screwed within the tubular shaft 13.

The joint between sleeve 18 and turntable plate 17 is reinforced by triangular webs 23, terminating at a distance from the outer edge of turntable plate 17.

A ring 24 of inverted generally L-shaped cross-section, is secured to the top face of plate 12 and is coaxial with tubular shaft 13 and is located just on the outside of webs 23.

Ring 24 provides an underface 25 serving as a riding and guiding surface for the external race of each of at least three ball bearings 26 substantially equally angularly spaced around the turntable 17; each ball bearing 26 is mounted for free rotation on a stud shaft 27 bolted or otherwise screwed to an annular member 29 which is secured underneath turntable plate 17 adjacent its periphery; annular member 29 is disposed at the outside of ring 24.

Stud shafts 27 are radially directed with respect to sleeve 18 and shaft 13.

The arrangement of the ball bearings 26 engaging ring 24 positively prevents inclination of the turntable 17 under the action of the couple exerted on the turntable by the ladder mounted thereon, especially when an operator stands on the ladder. The system of thrust bearings 20 and roller bearings 26 allows frictionless rotation of the turntable about its tubular shaft 13.

It should be noted that with the system above described, the base mounting 4 and turntable 17 have a very small overall height which enables to mount the lower end of the ladder 9 at a very small distance from the roof 3 of the truck 1, in order to lower, as much as possible, the center of gravity of the connection system of the ladder to the turntable.

The lower end of the base section of the ladder 9, is pivoted at 30 to vertical ears 31 welded or otherwise rigidly secured to the turntable plate 17. A single action hydraulic cylinder 32 is pivoted at 31' to ears 32' secured to turntable plate 17. The pivots 30 and 31' are disposed on opposite sides of shaft 13 and are nearly equally spaced radially therefrom.

The piston of cylinder 32 is pivoted at 33 to the ladder lower base section upwardly from pivot 30. Cylinder 32 serves to tilt the ladder upwardly, the lowering vertical movement of the ladder being effected under gravity upon discharge of the fluid within cylinder 32.

As a safety precaution, in case of a leak in the fluid hydraulic system, a pair of toothed bars 34, joined by a transverse bar 34', are pivoted at their lower end at 35 to ears 36 secured to turntable plate 17 for vertical swinging movement, in such a manner that the teeth of the bars 34 can engage studs 37 secured on each side of the ladder lower section 9 to thereby automatically prevent lowering movement of the ladder under gravity, once its intended vertical angular position has been obtained by cylinder 32. In order to lower the ladder, it is therefore necessary to raise the safety bars 34.

The turntable 17 is rotated about shaft 13 by means of a cable system actuated by a hydraulic cylinder. This system comprises a double action hydraulic cylinder and piston unit 38, the cylinder of which is secured to base 4, transversely of the latter and of the truck and at the front of turntable 17.

The piston 39 of cylinder 38 carries a stirrup 40 horizontally arranged at about the center of base 4, and carrying two double pulleys 41 and 42 arranged for rotation about vertical axes. A double pulley 43 is mounted also for rotation about a vertical axis in a stirrup 44

secured to base 4 at the outer end of cylinder 38. Another double pulley 45 is mounted for free rotation about a vertical axis in a stirrup 46 secured to base 4 in alignment with piston 39 and on the opposite side of the base with respect to double pulley 43.

A first flexible cable 47 is secured at one end at 48 to the turntable 17 at a point slightly rearwardly of shaft 13 and freely engages a groove made at a periphery of the circular portion 49 of said turntable 17 and extends forwardly of the turntable and laterally therefrom in a direction opposite to the attachment point 48 to engage the upper sheave of the double pulley 43. Cable 47, then extends alongside cylinder 38 and is threaded on the upper sheave of the double pulley 41, the cable then makes another loop about the lower sheaves of pulleys 43 and 41 to finally be attached to an eye bolt 50 mounted for tightening adjustment of the cable on a bracket 51 secured to base 4 adjacent double pulley 43.

Thus, referring to FIG. 10, slight extension of the hydraulic cylinder and piston unit 38 and 39 will cause a relatively important rotation of turntable 17 in a counterclockwise direction.

A second flexible cable 52 is arranged in the same manner as cable 47, but in an inverted position. It is attached at 53' to the turntable 17 at a point opposite to the attachment point 48 of cable 47 and engages a peripheral groove in the circular portion 49 of turntable 17. It crosses cable 47 forwardly of the turntable, then makes two turns around double pulleys 45 and 42 to be finally attached to an adjustment eye bolt 53 carried by a bracket 54 secured to base 4. If desired, only one of the cables 47 and 52 can be adjustably secured to the brackets 51 and 54 respectively.

Retraction of cylinder unit 38 will cause displacement of stirrup 40 towards the right looking at FIG. 10, and therefore cable 52 will exert a pull on the turntable to rotate the same in clockwise direction.

With the system of the invention, when the piston 39 is blocked in a predetermined position, due to blocking of fluid circulation within the cylinder 38, the cables, which are sufficiently tightened, will maintain the turntable 17 in a predetermined angular position without any play. For added safety, one can provide a mechanical system for locking turntable 17 in a predetermined position, such as a vertically movable pin 58, shown in FIG. 4, carried by the turntable and adapted to engage any one of a plurality of holes made in plate 12.

It will be noted that the cable system for rotating the turntable has a minimum height.

The system of the invention enables to mount the ladder on top of a small truck provided with a roof over its storage rear compartment, with low enough center of gravity such that the truck or van will not overturn with an operator standing at the end of the ladder and with the same directed transversely of the truck.

Cylinders 32 and 38 are supplied with hydraulic fluid under pressure controlled by a conventional hydraulic circuit system including lever operated valves 55. The hydraulic fluid under pressure is supplied by a hydraulic pump 56 driven by an electric motor 57 supplied with electricity by the battery of the truck. The valve associated with cylinder 32 has three positions, namely, a hydraulic circuit blocking position to lock the piston of cylinder 32 in a predetermined position, a position opening the return circuit of the cylinder 32 to the fluid reservoir to allow lowering of the ladder, and a position connecting the pump with the cylinder 32 to raise the ladder.

The valve controlling the double action cylinder 38 has also three positions, namely, a hydraulic circuit closing position, a second position to cause clockwise rotation of the turntable, and a third position for causing anticlockwise rotation of the turntable.

What we claim is:

1. An aerial ladder adapted to be mounted on the roof of a small truck comprising a base mounting, foot pads

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secured to the sides of said base mounting and extending downwardly therefrom and adapted to fit and be secured to the sides of said truck roof to support said base mounting just over the said roof, said foot pads being disposed substantially at the corners of a rectangle, said base mounting having an upwardly directed substantially vertical shaft disposed along the longitudinal center line of said rectangle, a turntable mounted on said shaft for rotation in a substantially horizontal plane, a ladder pivoted at its lower end to said turntable for vertical pivotal movement, a hydraulic cylinder pivoted to said turntable and to said ladder at a point of the latter upwardly spaced from the pivotal connection of said ladder to said turntable for raising said ladder, means for rotating said turntable with respect to said base mounting and reaction means between the periphery of said turntable and said base mounting to prevent inclination of said turntable under the action of a couple exerted by said ladder on said turntable while allowing rotation of said turntable relative to said base mounting.

2. An aerial ladder as claimed in claim 1, wherein said reaction means include bearings mounted underneath the peripheral zone of said turntable and equally angularly spaced and disposed along a circle coaxial with said vertical shaft, a ring of inverted generally L-shaped cross-section secured to said base mounting and coaxial with said vertical shaft, said ring forming an annular rolling surface directed downwardly, said bearings in rolling contact with said rolling surface of said ring.

3. An aerial ladder as claimed in claim 1, wherein the pivotal attachment of said ladder and of said hydraulic cylinder to said turntable are horizontally spaced in opposite directions from said vertical shaft.

4. An aerial ladder as claimed in claim 1, wherein said means for rotating said turntable comprise a double acting hydraulic cylinder mounted on said base, a stirrup secured to the outer end of the piston of said cylinder, first and second idle pulleys carried by said stirrup, third and fourth idle pulleys carried on opposite sides of said base in alignment with said double acting cylinder and with said first and second pulleys, first and second flexible cables attached at one end to the periphery of said turntable on opposite sides of said vertical shaft, engaging grooves in a circular portion of said turntable, crossing each other when leaving said turntable, then threaded on said third and fourth pulleys respectively, and having their ends secured to said base mounting on opposite sides of said turntable, whereby displacement of said first and second pulleys under the action of said double acting cylinder cause rotation of said turntable by a pull exerted thereon by one or the other of said cables.

5. An aerial ladder as claimed in claim 4, wherein each of said first, second, third and fourth pulleys is a double pulley and each cable makes two loops around said pulleys in order to increase the rotation movement of said turntable relative to the extension and contraction movement of said double acting cylinder.

6. The combination of a small truck having a passenger compartment and a rear compartment with a substantially constant level roof extending over said two compartments,

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a base mounting, foot pads secured to the sides of said roof and supporting said base mounting just over said roof, said foot pads being disposed at substantially the four corners of a rectangle, said base mounting have a vertical shaft upstanding therefrom and disposed substantially along the longitudinal center line of said rectangle, a turntable mounted on said shaft for free rotation in a substantially horizontal plane, a ladder pivoted at one end to said turntable for raising and lowering movement in a vertical plane, a first hydraulic cylinder pivoted to said turntable and to said ladder for raising the latter, means for rotating said turntable in a horizontal plane with respect to said base mounting, means for preventing tilting of said turntable with respect to said base mounting under the action of the couple exerted by said ladder on said turntable, bracing means disposed within said truck rear compartment, said bracing means including posts disposed along the inside faces of the lateral walls of said truck in substantially the vertical plane of said foot pads, said posts supported by the truck chassis at their lower ends and carrying substantially horizontally disposed beam members at their upper ends, said beam members extending under said foot pads and under said roof on each side of said truck, and reinforcing said roof, said bracing means leaving said rear compartment practically free of any obstruction.

7. The combination as claimed in claim 6, wherein said turntable is spacedly disposed over said base mounting and further including bearings carried by said turntable under the periphery of the same and over said base mounting, and substantially equally angularly spaced and disposed on a circle coaxial with said vertical shaft, a ring secured to said base mounting and coaxial with said vertical shaft and providing a downwardly facing rolling surface for said bearings.

8. The combination as claimed in claim 6, wherein the pivotal attachment points of said ladder and of said first hydraulic cylinder to said turntable are horizontally spaced in opposite direction from said vertical shaft.

9. The combination as claimed in claim 7, wherein the pivotal attachment points of said ladder and of said first hydraulic cylinder to said turntable are horizontally spaced in the opposite direction from said vertical shaft.

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U.S. Cl. X.R.

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