March 23, 1937. P. PIRSCH 2,074,557

FIRE APPARATUS

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Fig. 4.

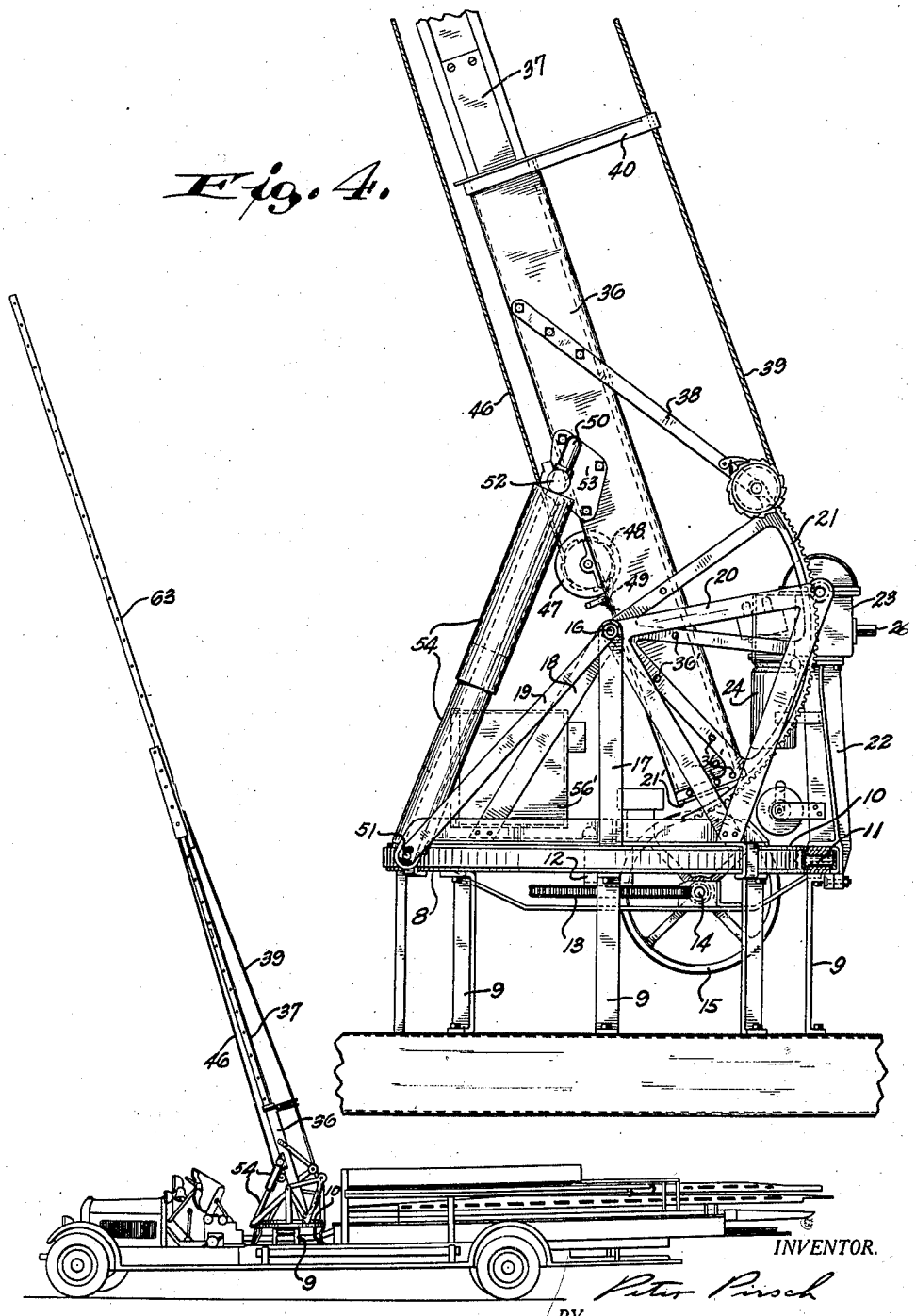

Fig. 1.

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FIRE APPARATUS

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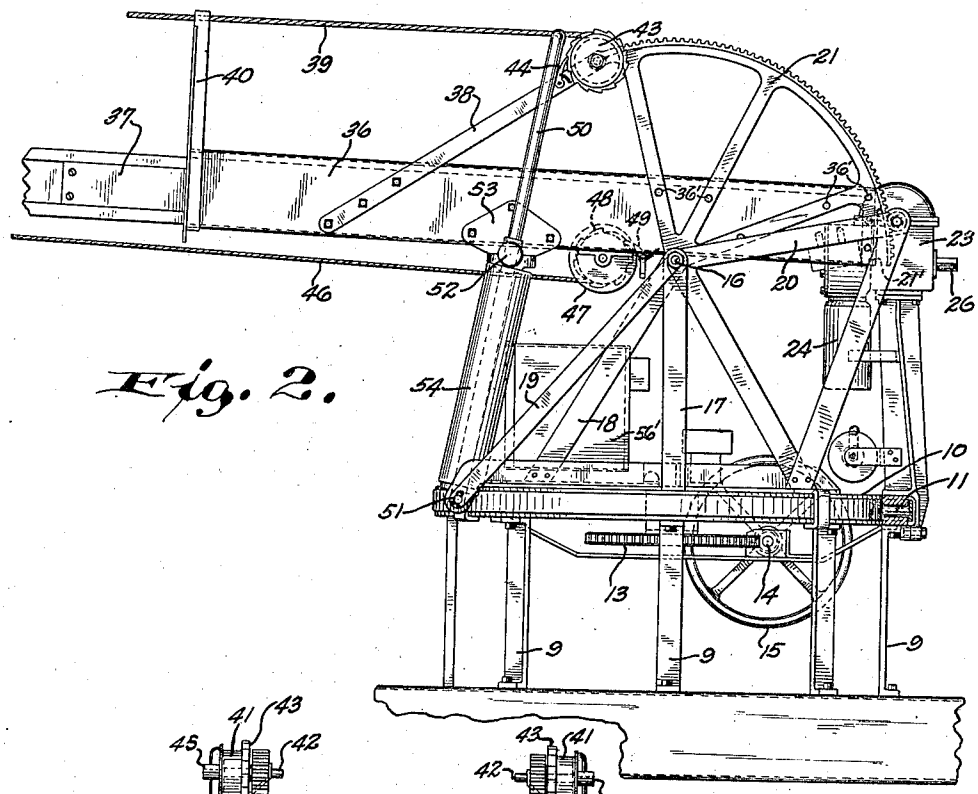

Fig. 2.

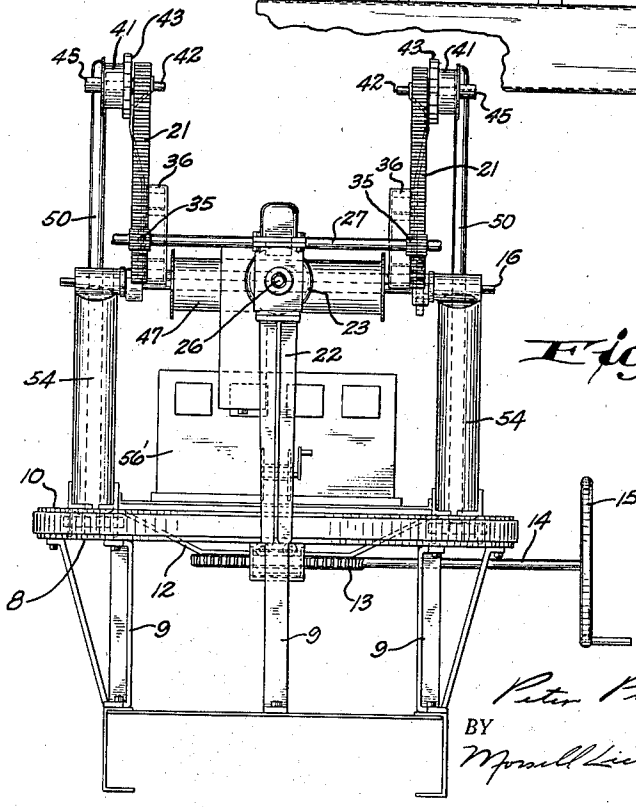

Fig. 3.

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FIRE APPARATUS

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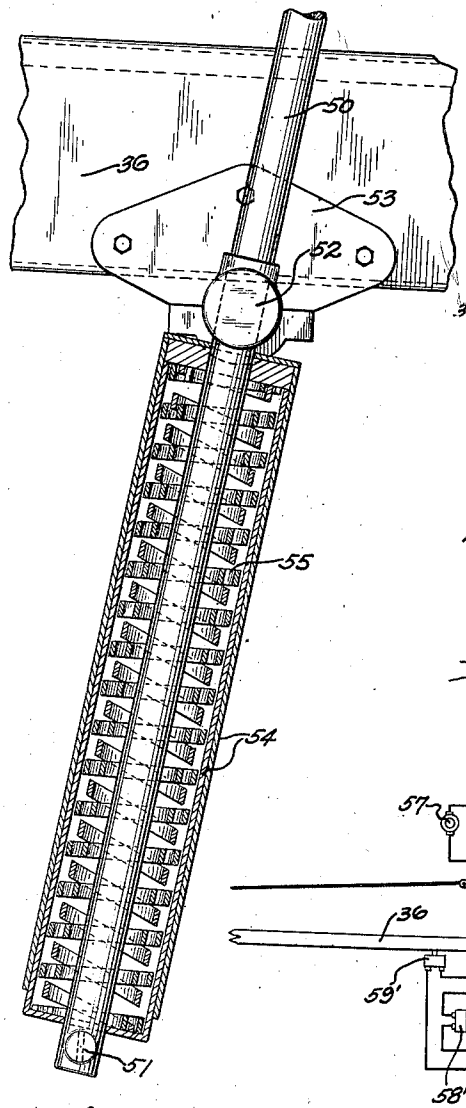

Fig. 5.

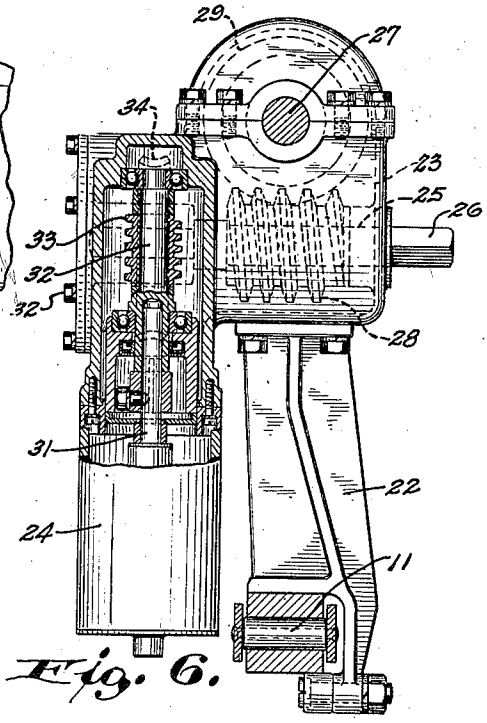

Fig. 6.

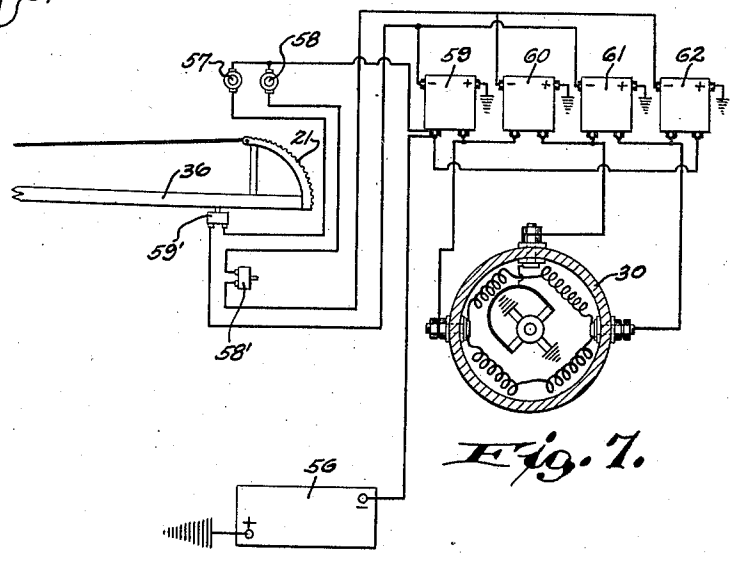

Fig. 7.

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Patented Mar. 23, 1937 2,074,557

UNITED STATES PATENT OFFICE

2,074,557

FIRE APPARATUS

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Application August 24, 1934, Serial No. 741,269

5 Claims. (Cl. 228—12)

This invention relates to improvements in fire apparatus and more particularly to aerial ladders.

Heretofore, aerial ladders have been available only on large size special aerial ladder trucks. This type of equipment, while highly desirable, is too expensive for the average smaller city or town. Most of these smaller municipalities, however, are able to afford service trucks and are already equipped with ground extension ladders, and it is therefore an object of the present invention to provide novel means for readily equipping standard size service trucks with aerial ladder elevating mechanism.

A further object of the invention is to provide improved aerial ladder elevating mechanism so constructed that it will readily removably receive a standard ground type of extension ladder to thereby convert the latter to an aerial ladder and increase its range of height.

The ordinary type of ground extension ladder requires six to eight men to raise, and it is an object of the present invention to provide aerial ladder mechanism which makes it possible for one man, after the ground ladder has been inserted in the elevating mechanism, to accomplish all maneuvers, such as raising and lowering the main beam, revolving the turntable and raising as well as lowering the fly ladder.

A further object of the invention is to provide improved aerial ladder mechanism which can be operated by a small storage battery driven electric motor.

A further object of the invention is to provide in an aerial ladder, common means for assisting in elevating the ladder and for cushioning it during its return to normal position.

A more specific object of the invention is to provide in an electrically driven aerial ladder elevating mechanism, means for automatically cutting off the current to the electric motor when the ladder has reached a fully elevated or a fully lowered position.

Other objects of the invention are to provide aerial ladder mechanism which is simple to install and operate, which can be installed either on a service truck now in use or be furnished as part of the equipment of a new service truck, which is relatively inexpensive to manufacture, and which is well adapted for the purpose described.

With the above and other objects in view, the invention consists of the improved aerial ladder and all its parts and combinations as set forth in the claims and all equivalents thereof.

In the accompanying drawings in which the same reference numerals designate the same parts in all of the views:

Fig. 1 is an elevational view of a service truck, showing the improved aerial ladder equipment in connection therewith, the ladder being shown in raised, extended, and swiveled position;

Fig. 2 is an enlarged side elevational view of the ladder elevating mechanism;

Fig. 3 is an end view thereof;

Fig. 4 is a view similar to Fig. 2, showing the movable frame in elevated position;

Fig. 5 is an enlarged detail view of the tubular telescopic members, showing the latter in longitudinal section, a fragment of the elevating frame being shown in connection therewith;

Fig. 6 is a detail view of the worm gear housing assembly, parts being broken away and shown in longitudinal section; and

Fig. 7 is a diagrammatic view illustrating the wiring arrangement for the electric motor.

Referring more particularly to the drawings, a base 8 may be supported on suitable legs 9 secured preferably to a portion of the service truck directly behind the driver's seat. Mounted on the base 8 is a turntable 10 which is rotatable on rollers 11, see Fig. 4. Depending from the bottom of the turntable is a substantially U-shaped bracket 12 which is secured to a worm wheel 13. The worm wheel 13 may be suitably propelled by a worm mounted on a shaft 14. The other end of the shaft 14 has secured thereto a hand wheel 15. Thus operation of the hand wheel will cause rotation of the wheel 13 and turntable 10.

A shaft 16 is suitably journaled in the upper ends of supports 17, 18, 19 and 20, said supports having their lower ends conected to the turntable. Rotatably mounted on the shaft 16 near each end thereof is a segmental gear 21. Supported on a bracket 22 extending upwardly from the turntable is a housing 23 having an extension housing 24 (see Fig. 6). Journaled transversely of the housing 23 in the lower portion thereof is a shaft 25 having a squared outer end portion 26 extending exteriorly of the casing, and journaled through the upper portion of the housing 23 at right angles to the shaft 25 is another shaft 27. The shaft 25 has rigidly mounted thereon a worm 28 which engages a worm wheel 29 rigidly mounted on the shaft 27.

In the extension housing 24 is an electric motor 30 adapted to drive a shaft 31. The latter shaft is connected by suitable clutch mechanism with another shaft 32 carrying a rigidly mounted worm 33. The latter engages a worm wheel 34 mounted rigidly on the shaft 25 to drive

the latter. It will thus be seen that operation of the electric motor will cause, through the worm 33, worm wheel 34, worm 28 and worm wheel 29, rotation of the shaft 27. The latter has both ends extending exteriorly of the housing 23 and provided with pinions 35 which are keyed thereon in such a position as to engage the teeth of the segmental gears 21. If it is not desired to utilize the electric motor, a hand wheel or crank may be attached to the squared end of the shaft 26 to permit manual operation of the segmental gears.

Bolted, as at 36', or otherwise secured to each segmental gear is a channel 36, the end of which abuts a shoulder 21' of the segmental gear, and said channels are adapted to slidably receive a ladder 37. The ladder may be of standard ground extension type. At the ends of the channels there may be suitable stops which the end of the ladder engages. In order to brace the channels 36, bars 38 may be connected at one end to the channels and at the other end to the outer portions of the segmental gears.

A guy wire 39 on each side of the ladder may have one end secured to the outer end of the main ladder and have its other end extending through a guide 40 and windable on a drum 41 mounted on a stud 42 (see Figs. 2 and 3), the latter being journaled in the outer end portion of the segmental gear. A ratchet wheel 43 is secured to one side of the drum and said ratchet is engaged by a pawl 44. One end of the stud 42 is squared as at 45 for attachment of a hand crank. By rotating the stud, any degree of tautness may be obtained on the guy wire.

The fly ladder may be operated in the usual manner by cables 46 windable on drums 47. Said drums have ratchets secured to one face thereof as at 48 cooperable with pawls 49. The drums may be rotated by a hand crank in the same manner as explained in connection with the drums 41, to thereby cause raising and lowering of the fly ladder with respect to the main ladder.

Each of a pair of guiding rods 50 has its lower end pivotally connected as at 51 to the turntable. The said rods extend slidably through bores in pivot members 52 and said pivot members are suitably mounted on brackets 53 in connection with the channels 36. Also mounted on each guide rod 50 is a pair of telescoping tubular members or cylinders 54. Within the innermost of said cylinders is a set of concentric coil springs 55, the springs being preferably three in number. When the ladder is being elevated from the position shown in Fig. 2 to the position shown in Fig. 4, the lower ends of the guide rods 50 pivot with respect to the turntable and the pivot members 52 in connection with the channels slide on the rods 50 while pivoting. At the same time, the cylinders 54 slide apart as shown in Fig. 4, and the coil springs, which are in a highly compressed condition when the ladder is down, act against the end of the outer cylinder to aid in elevating the frame and ladder. When the ladder is being lowered, the cylinders 54 telescope together and the coil springs are automatically compressed to store up energy for use in assisting in the next elevating operation.

The electric motor 30 may be driven by a storage battery 56 (see Fig. 7) and the circuit is controlled by a pair of push buttons 57 and 58. Magnetic switches 59, 60, 61, and 62, are so arranged and connected in the circuit as to provide for rotation of the motor in both directions. The storage battery and switches may be mounted in a suitable box 56' carried by the turntable. After the ladder has been lowered by the electric motor, a limit switch 59' is engaged by one of the channels 36 to automatically cut off the circuit to magnetic switches 60 and 62, which cut off the main flow of current to the electric motor. When the ladder has been fully elevated, a limit switch 58' is engaged, as is apparent from Fig. 7, to also cut off the flow of current.

From the above it is apparent that the device is of relatively simple construction and is propelled either by hand or by an auxiliary electric motor. Therefore it can be easily attached to a standard service truck now in use, without alteration or expensive hook-ups with the motor thereof, and it can also be furnished as part of standard equipment of new service trucks.

When it is desired to use the device, a ground extension ladder may be inserted in the channels 36, if it is not already in place, and the electric motor may be started by a momentary pressure on the control button 58. This sets the proper magnetic switch in action to start the electric motor in a raising direction. When the ladder has been fully elevated, the limit switch 58' will be engaged by the movable elevating frame as shown in Fig. 7 and heretofore explained, to cut off the flow of current to the electric motor. If desired, the equipment may be furnished without the electric motor and the before-described operation be accomplished by means of the hand wheel or crank attached to the squared end 26 of the shaft 25. After the ladder has been elevated the turntable may be operated by means of the hand wheel 15 to swing the ladder in a desired direction, such as the position shown in Fig. 1. Next, a hand crank is operated to cause rotation of the drum 47 and raising of the fly ladder 63 to the position shown in Fig. 1. To lower the fly ladder the dog 49 is released and the ladder is lowered under the control of a hand crank. Next, the turntable is manipulated to swing the equipment to the proper position for lowering, and next, if the electrical equipment is employed, the push button 57 is pressed to set the proper magnetic switch 59 and 61 in operation to cause the motor 30 to operate in a lowering direction. When the ladder has been fully lowered it will disengage the limit switch 59' in the manner shown in Fig. 7, to automatically shut off the flow of current to magnetic switches 59 and 61, which serve to cut off the main flow of current to the motor 30.

Heretofore aerial ladders have been of relatively expensive construction due to the fact that they were driven by hook-ups with the motor of the aerial ladder truck. With the present invention, however, by utilizing the novel spring construction illustrated in Fig. 5, a substantial amount of energy is stored up in said springs every time the ladder is lowered. Thus, to elevate the ladder requires only relatively small additional power, and therefore a storage battery driven electric motor can be employed, which motor would be otherwise entirely inadequate for a raising operation of this type. Furthermore, if the electric equipment is not utilized, the spring construction makes it possible for one man to readily accomplish the raising operation manually.

It will also be seen that the invention makes it possible for a standard type of ground extension ladder to be interchangeably used for ground purposes or as an aerial ladder. When used in the latter manner, the fact that it is mounted on

the service truck increases its available length materially.

Although only one form of the invention has been shown and described, it is obvious that various modifications may be made without departing from the spirit of the invention, and all of such changes and modifications are contemplated as may come within the scope of the claims.

What I claim is:

1. Fire apparatus comprising a supporting structure, a frame mounted on said supporting structure for movement from a substantially horizontal position to an inclined raised position, an aerial ladder carried by said frame, a tubular member connected to the supporting structure, a tubular member connected to the movable frame and telescopically associated with the first tubular member, spring means within said two tubular members compressible when said tubular members telescope together to cushion the lowering of the frame and ladder and to store energy to assist in the elevating thereof, a guide rod pivotally connected to the supporting structure and extending through said two tubular members and through said spring means, and means pivotally mounted on the frame for slidably receiving said guide rod.

2. Fire apparatus comprising a supporting structure, a frame mounted on said supporting structure for movement from a substantially horizontal position to an inclined raised position, spaced channels on said frame, a ladder slidably received by said channels, brackets extending upwardly from said channels, bracing cables secured to the outer end of the ladder and having slidable connection with said brackets, and means on the frame for tightening said cables, to maintain the ladder firmly in position in the channels.

3. Fire apparatus comprising a supporting structure, a frame mounted on said supporting structure for movement from a substantially horizontally position to an inclined raised position, an aerial ladder carried by said frame, segmental gears secured to opposite sides of said frame and having their major actuating portion extending above the inner end of the frame, a bracket extending upwardly from said supporting structure, a motor supported on said bracket, a horizontal shaft journalled in an upper portion of said bracket, pinions rigidly carried by said shaft and engageable with said segmental gears, worm and worm wheel transmission mechanism between said motor and horizontal shaft, and yielding means between said supporting structure and ladder carrying frame for cushioning said frame and ladder in downward movement and for assisting in the elevation thereof.

4. Fire apparatus comprising a supporting structure, a frame mounted on said supporting structure for movement from a substantially horizontal position to an inclined raised position, said frame being formed with a pair of channels with the open sides of the channels facing one another, each channel being of a size to snugly receive the side bar of a standard ground ladder, and the channels being so spaced apart as to accommodate said standard ground ladder and permit the extension part thereof to slide between the channels.

5. Fire apparatus comprising a vehicle having a rotatable supporting structure thereon, a frame mounted on said supporting structure for movement form a substantial horizontal position to an inclined raised position, said frame being formed with a pair of channels with the open sides of the channels facing one another, each channel being of a size to removably receive between the flanges thereof the side bar of the lower section of a standard multi-section ground ladder to convert the same to an aerial ladder, said channels being of substantially less length than the lower section of the ground ladder, and means for removably anchoring said lower section of the ground ladder in said channels so that the projecting portion of said lower section is firmly supported and braced during movement and during raising of the upper sections of the ladder.

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