April 27, 1926. 1,582,793

C. W. SMITH ET AL

POWER DRIVEN AND POWER ACTUATED EXTENSION LADDER FOR FIRE TRUCKS

Filed Sept. 27, 1924 2 Sheets-Sheet 1

Fig. 1.

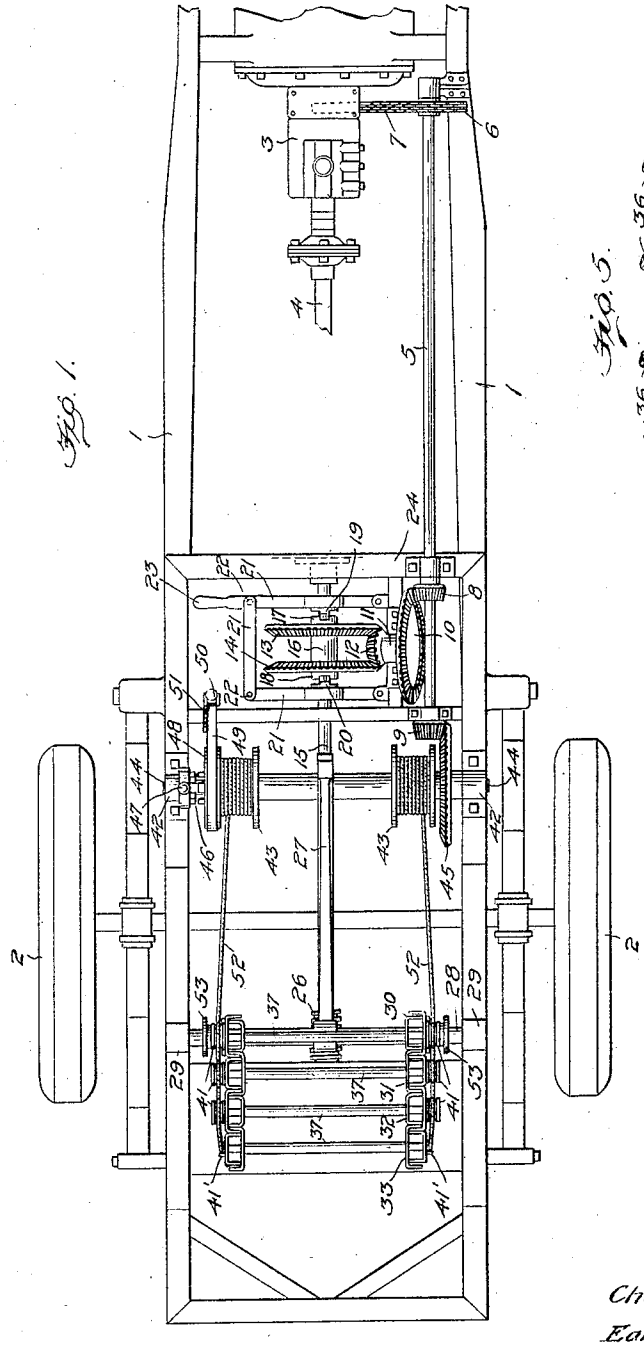


Fig. 5.

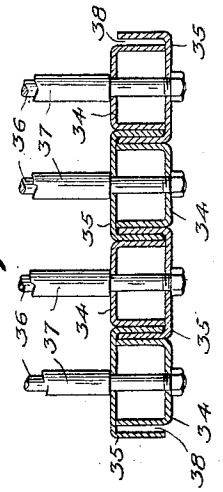
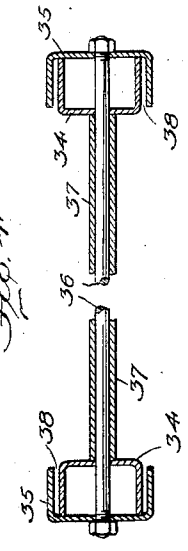


Fig. 11.



Witness
Edwin L. Bradford

Inventors
Charles W Smith, and
Earnest I. Thompson

By Wm. C. Dyer.
Attorney

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Fig. 2

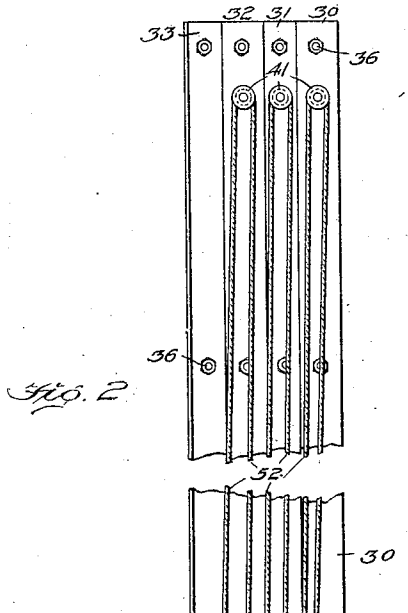
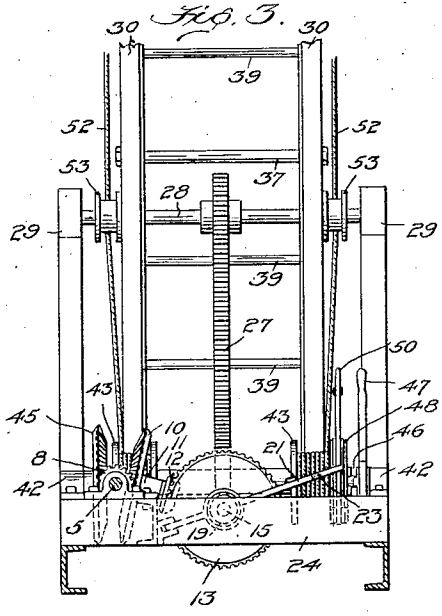
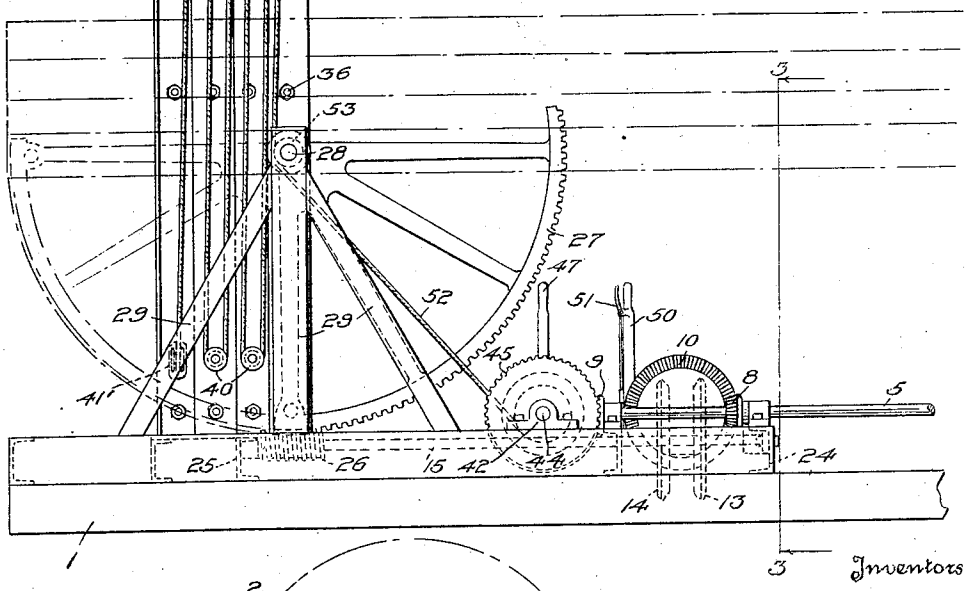


Fig. 3.





Witnesses

Edwin L. Bradford

Inventors

Charles W. Smith, and

Earnest L. Thompson

By Mc E. Dyer,

Attorney

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UNITED STATES PATENT OFFICE.

CHARLES W. SMITH AND EARNEST L. THOMPSON, OF BLUFFTON, INDIANA.

POWER-DRIVEN AND POWER-ACTUATED EXTENSION LADDER FOR FIRE TRUCKS.

Application filed September 27, 1924. Serial No. 740,236.

To all whom it may concern:

Be it known that we, CHARLES W. SMITH and EARNEST L. THOMPSON, citizens of the United States, residing at Bluffton, in the county of Wells and State of Indiana, have invented certain new and useful Improvements in Power-Driven and Power-Actuated Extension Ladders for Fire Trucks; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to power-driven fire-trucks, but more particularly to motor actuated ladders mounted upon such trucks, and to means whereby the main and extension ladder sections may be quickly and accurately elevated into operative position when desired or required.

An object of our invention is the production of fire-fighting apparatus of the character indicated, wherein is combined extreme simplicity of construction, durability and efficiency of the highest obtainable degree, the same power plant being employed for locomotion and for ladder manipulation with speed, accuracy and precision.

With the foregoing and other objects in view the present invention will be hereinafter particularly described and then pointed out by the claims following.

In the accompanying drawings which form part of this application for Letters-Patent, and whereon corresponding numerals indicate like parts in the several views:

Figure 1 is a top plan view of this invention showing the major part of the truck chassis, the ladder sections, and ladder operating mechanism;

Figure 2 is a fragmentary view showing in side elevation the ladder sections in a raised vertical position, but still nested or collapsed;

Figure 3 is also a fragmentary vertical sectional view taken on the line 3—3 of Figure 2, showing the lower end of the lowermost ladder section raised to a vertical position;

Figure 4 is a horizontal sectional view through one ladder section; and

Figure 5 is a fragmentary view also in horizontal section of one side of a series of ladders when nested or collapsed into the position indicated by Figure 2.

Reference being had to the drawings and numerals thereon, 1 indicates a truck chassis, which may be of any suitable construction or proportions, mounted upon wheels 2, only two of which are shown by the drawings, and provided with a suitable power and propulsion plant such as shown diagrammatically at 3. At one side of the main driving shaft 4 and bracketed to the truck frame 1 in suitable bearings is a power transmission shaft 5, driven from the engine 3 by agency of a sprocket 6 and chain 7, and provided at its other inner end with two fixed bevelled pinions 8 and 9. The former of these pinions 8 meshes constantly with a bevelled gear 10 carried by a short stub shaft mounted in a journal box 11, the said shaft having at its opposite end a fixed beveled pinion or spur wheel 12. This spur pinion 12 meshes constantly with two oppositely disposed driven gears 13 and 14 mounted loosely upon a worm-shaft 15, separated by the spacing sleeve 16, and provided upon their outer faces with clutch members 17 and 18 respectively, which rotate constantly in opposite directions with the said gears, the whole constituting a reversible clutch.

Splined upon the said worm-shaft 15, so as to permit of slight longitudinal movement, are the movable clutch members 19 and 20, arranged and adapted to be actuated by a rectangular frame or compound lever 21, pivoted as at 22, and provided with a handle 23 by which controlled, to move one or the other of the clutch members 19 or 20, into cooperating engagement with its particular clutch member 17 or 18 according to the requirements as will more clearly appear in connection with a description of operation to follow.

The shaft 15 rotatably journalled at its ends in transverse frame members 24, 25, is provided upon its innermost end with a worm 26 meshing with a segmental rack 27, the latter keyed to a shaft 28 which in turn is supported in uprights 29, 29, rising from the side sills of the truck chassis 1 as best shown by Figures 2 and 3. Rigidly secured to the said transverse shaft 28 also are the side rails of a main ladder section 30, which normally occupies the horizontal position indicated by dotted lines in Figure 2 of the drawings, but is capable of being rotated into vertical position as will later appear.

By preference the main ladder section 30, as also the co-acting fly ladders 31, 32 and 33, are made of sheet metal substantially as indicated by Figures 4 and 5 of the drawings. That is to say, their side rails are of tubular form made up of reversely arranged channels 34 and 35, the latter enclosing the former, and connected by through bolts 36 surrounded by tubular spacing members 37, as clearly shown by Figure 4. Between the inner sides of ladder members 35 and the outer surfaces of the members 34 of each ladder section, there is provided a continuous longitudinal clearance or space 38, into which is loosely and slidably fitted the member 35 of the adjacent ladder sections, and in this manner the several ladder sections 30, 31, 32 and 33 are interlinked as shown by Figure 5, in telescopic relation. At suitable intervals between the tie rods or bolts 36 the side rails of all ladder sections are also connected by ladder rungs 39, while near opposite ends of all ladder sections, upon their outer faces, are pivotally mounted inner and outer hoisting pulleys or sheaves 40 and 41 respectively, for purposes that will later appear. The uppermost of the fly ladders 33, has no upper sheaves 41, nor are there sheaves 40 at its opposite end, but in place of the latter at both sides of this ladder section 33, there are openings through the ladder sides and in these are journalled pulleys 41′ occupying positions at right angles to the sheaves 41.

Journalled in opposite sides of the truck chassis 1 as at 42, 42, is a double windlass or hoisting reel 43, 43, mounted loosely upon a transversely positioned driven shaft 44 having keyed upon one end a driven gear 45 constantly in mesh with the driving pinion 9 hereinbefore mentioned. At its opposite end the windlass or hoisting reel 43 is provided with a clutch 46, and a clutch lever 47, by which said reel can be temporarily locked to its constantly revolving shaft 44, or instantly released therefrom as occasion requires. Adjacent the reel clutch 46 and upon one side of reel 43 is a brake drum 48 over which runs a band brake 49, operated by a brake-lever 50 pivotally mounted upon the truck frame for retaining the ladder sections in a distended position or for lowering them back to their normal nested position, the brake lever 50 being fitted with an ordinary pawl and co-operating rack, indicated diagrammatically at 51 for holding the fly ladders in operative position after raising.

This being a description of our present invention in one form of embodiment, its use and operation in the form shown and described will now be briefly set forth as follows:

The truck having been driven to its point of service in the usual manner under the power of its engine, the brakes are applied, and the engine de-clutched or disconnected from its driving or propelling mechanism. Power now transmitted to the auxiliary shaft 5, by agency of such means as chain and sprocket 7, 6, drives the gears 13 and 14 in reverse directions by agency of pinions 8 and 12 and the intermediate gear 10. Normally the said gears 13 and 14 run idly upon the shaft 15, but when now the clutch members 18 and 20 are interlocked by a throw of handle 23 in a rearward direction, the said shaft 15 and its worm 26 operate to rock segment 27 on its center from the position indicated by dotted lines of Figure 2, to that indicated by full lines, thereby elevating the main and fire-ladder sections 30, 31, 32 and 33, still clustered, nested or withdrawn, to the vertical position shown by full lines in said Figure 2.

The fly ladders 31, 32 and 33 may now be quickly extended or shot upward from the main ladder 30, by agency of the ladder extension clutch 46, and its controlling lever 47. A throw of this lever 47 instantly couples the double hoisting reel 43, 43 to its supporting shaft 44, the latter constantly rotated by drive shaft 5 through pinion 9 and the gear 45.

This accomplished both ends of the continuous hoisting wire cable 52 are quickly coiled upon the power driven reels 43, 43, from which they pass over guide sheaves 53, adjacent the main ladder section 30, thence over oppositely disposed sheaves 41, 41, at the upper end of ladder 30, thence over sheaves 40, 40 and 41, 41, upon opposite ends of fly-ladder 31, over similar sheaves 40, 40 and 41, 41 upon opposite ends of ladder section 32, and finally over sheaves 41′, 41′ located in openings near the bottom and through the side rails of the outermost ladder section 33.

By this means the ladder sections are quickly extended, the side flanges of the channels 35, 35 of each ladder section being guided and running freely in the spaces or grooves 38, 38 provided in adjacent sections for their interconnection. Upon reaching the desired elevation or extension, clutch 46 is disconnected, and the band brake 48—49 being simultaneously set by a throw of the brake lever 50, is there retained by action of the pawl and ratchet mechanism 51, until manually released for the purpose of returning the ladder sections to normal positions.

When thus released the ladder sections are lowered or returned to a clustered vertical position by gravity under control of the brake lever 50, the operator preventing too rapid return by agency of the brake band 49 applied to the brake drum 48 with more or less pressure according to circumstances, and thus gradually paying out the hoisting cable from the reels 43, 43 as required.

Having reached the position indicated by Figure 2, the ladders are next returned to their normal horizontal position in the following manner:

A throw of the reversible clutch lever 23 in a forward direction now serves to interlock the clutch members 17 and 19 thereby rotating the worm-shaft 15 in the opposite or reverse direction from that hereinbefore described, at the same time rocking the segmental rack 27 from the position indicated by full lines, to that indicated by dotted lines, in Figure 2 of the drawings, thus lowering the ladder sections upon the transverse shaft 28 as a center into their normal horizontal position.

Having thus described our invention in one operative form of construction, what we now claim and desire to secure by Letters Patent is:

1. In a power driven and power actuated fire truck, the combination with a pivotally supported main ladder section having a segmental elevating gear secured to the lower end thereof, of a driving shaft power actuated in one direction only, a driven shaft having a worm connection with said segmental gear, a clutch interposed between said driving and driven shafts for rotating the latter in each direction selectively, and a gear train for transmitting power from said main driving shaft to the clutch aforesaid.

2. In a power driven and power actuated fire truck, the combination with a pivotally supported main ladder section having a segmental elevating gear secured to the lower end thereof, of a driving shaft power actuated in one direction only, a driven shaft having a worm connection with said segmental gear, a pair of gears loosely mounted upon said worm shaft, a spur gear engaging both of the last mentioned gears for rotating them in reverse directions, means for driving said spur gear from the main driving shaft, and means for manually connecting each of said loose gears to the worm shaft aforesaid.

3. In a power driven and power actuated fire truck, the combination with a pivotally supported main ladder section having a segmental elevating gear secured to the lower end thereof, of a driving shaft power actuated in one direction only, a driven shaft having a worm connection with said segmental gear, a pair of gears loosely mounted upon said worm shaft, a spur gear engaging both of the last mentioned gears for rotating them in reverse directions, a driven gear for transmitting power to the spur gear aforesaid, a driving gear upon the main driving shaft meshing with the said driven gear, and means for manually and selectively connecting each of the loose gears to the worm shaft aforesaid.

4. In a power driven and power actuated fire truck, the combination with a pivotally supported main ladder section having a segmental elevating gear secured to the lower end thereof, of a driving shaft power actuated in one direction only, a driven shaft having a worm connection with said segmental gear, a gear train interposed between said driving and driven shafts, a manually operated clutch for connecting and disconnecting the gear train aforesaid, a series of extension ladder sections slidably connected to the main ladder section, and means actuated from the same main driving shaft for projecting said extension ladder sections.

5. In a power driven and power actuated fire truck, the combination with a pivotally supported main ladder section having a segmental elevating gear secured to the lower end thereof, of a driving shaft power actuated in one direction only, a driven shaft having a worm connection with said segmental gear, clutch controlled gearing interposed between said driving and driven shafts for rotating the latter in each direction selectively, a ladder extending windlass mounted loosely upon a transversely arranged supporting shaft, a driven gear fixed to said supporting shaft, a driving pinion meshing with said driven gear and carried by the main driving shaft, a clutch for operatively connecting said windlass to its supporting shaft, a series of extension ladder sections slidably connected, and a cable having its ends secured to said windlass and having slidable connections with opposite ends of successively adjacent ladder sections for extending same.

6. In a power driven and power actuated fire truck the combination with pivotally supported and slidably extensible ladder sections, of means including a worm gear connection for elevating and lowering said sections collectively, in combination with a ladder-extending windlass mounted loosely upon a constantly rotating supporting shaft, a driven gear fixed to said supporting shaft, a driving pinion meshing with said driven gear, a power actuated constantly rotating driving shaft to which said pinion is affixed, a clutch for operatively connecting said windlass to its supporting shaft, and a ladder-extending cable having its ends secured to said windlass and having slidable connections with opposite ends of successively adjacent ladder sections.

In testimony whereof we affix our signatures.

CHARLES W. SMITH.
EARNEST L. THOMPSON.