April 12, 1938. H. M. HAVENS 2,114,262

LADDER TRUCK

Filed April 23, 1935 4 Sheets-Sheet 1

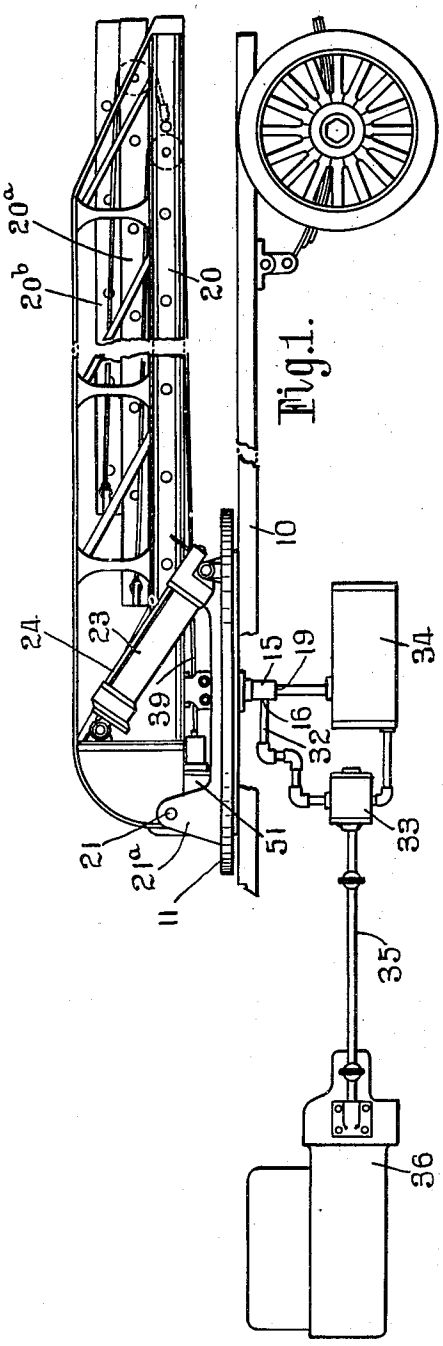

Fig.1.

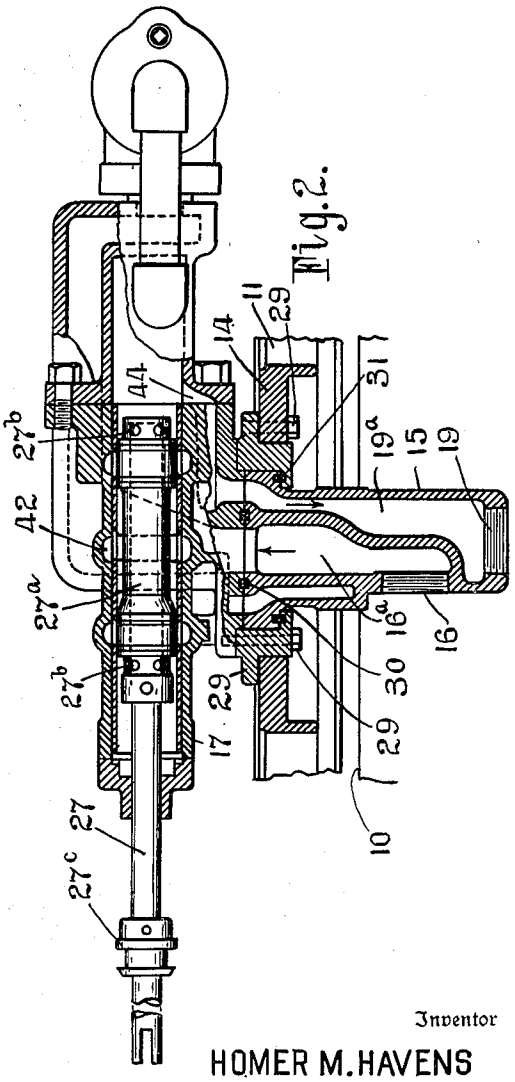

Fig.2.

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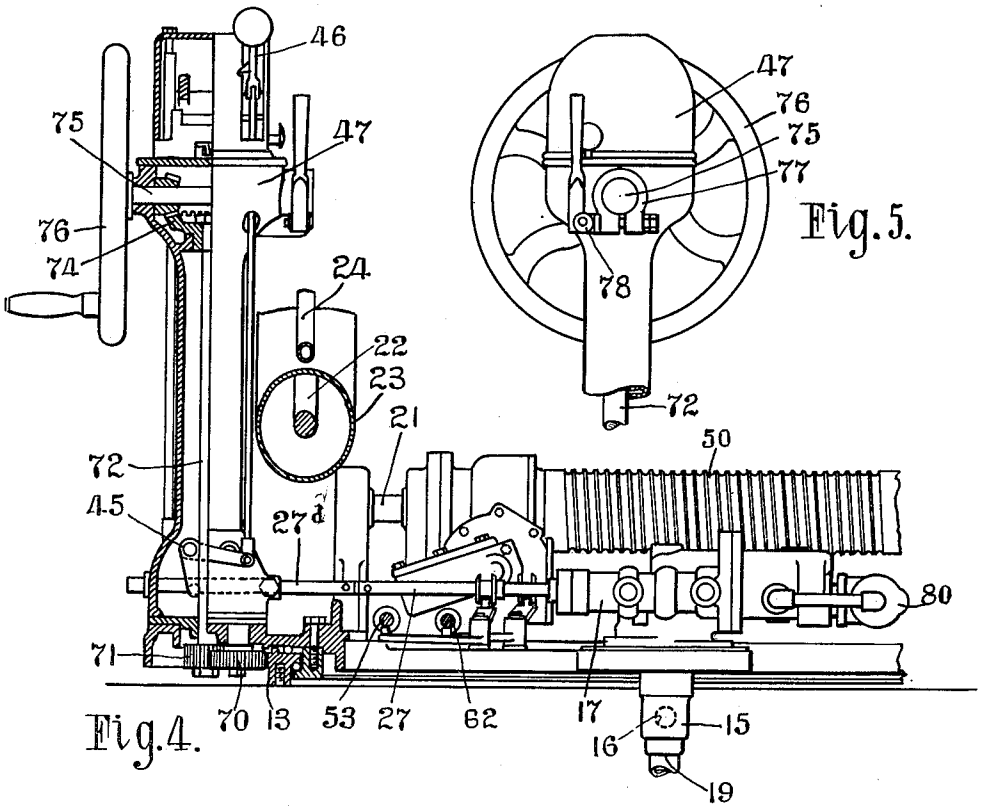

Fig.4.

Fig.5.

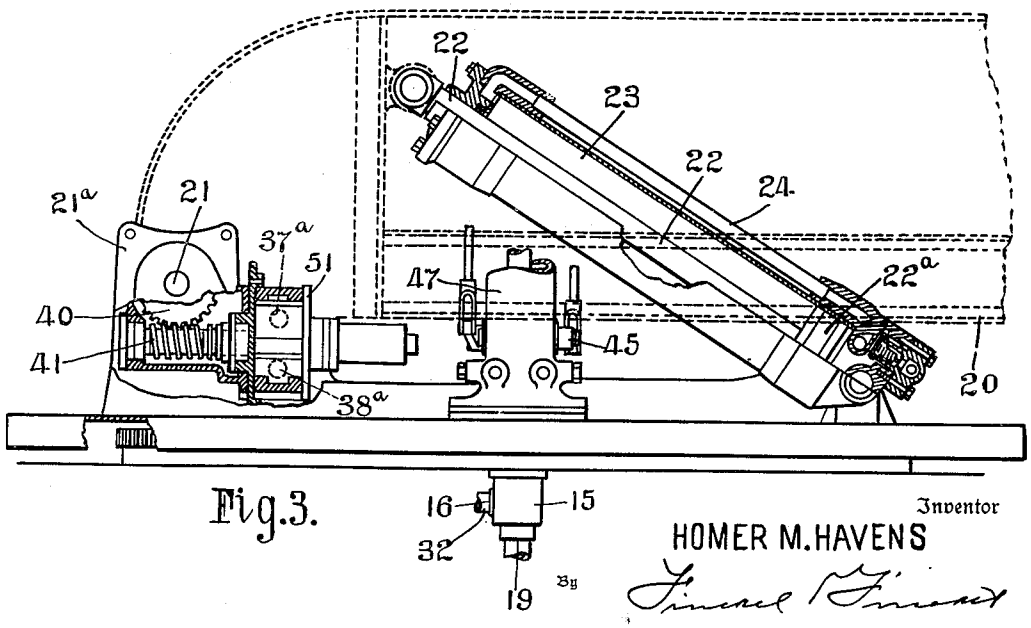

Fig.3.

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LADDER TRUCK

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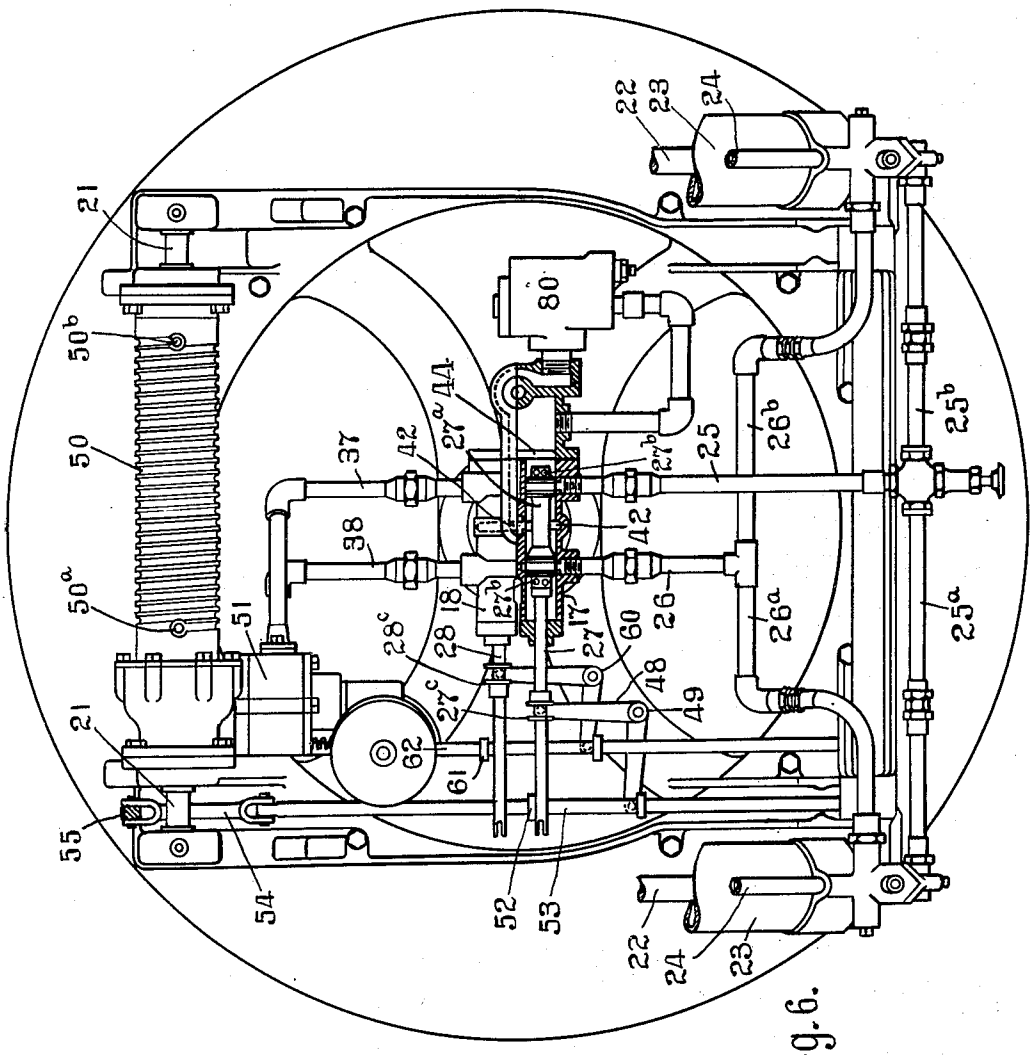

Fig. 6.

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LADDER TRUCK

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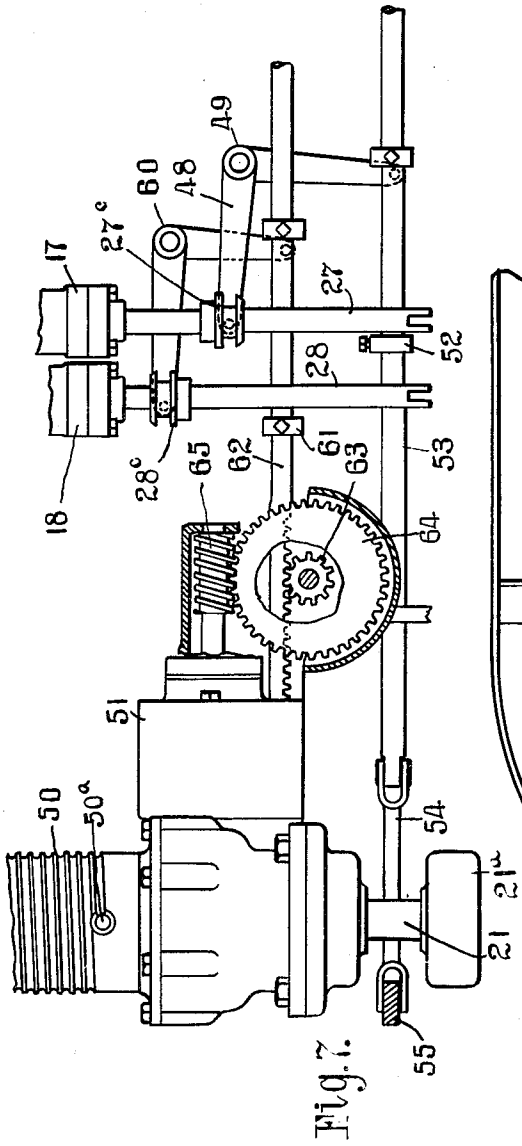

Fig. 7.

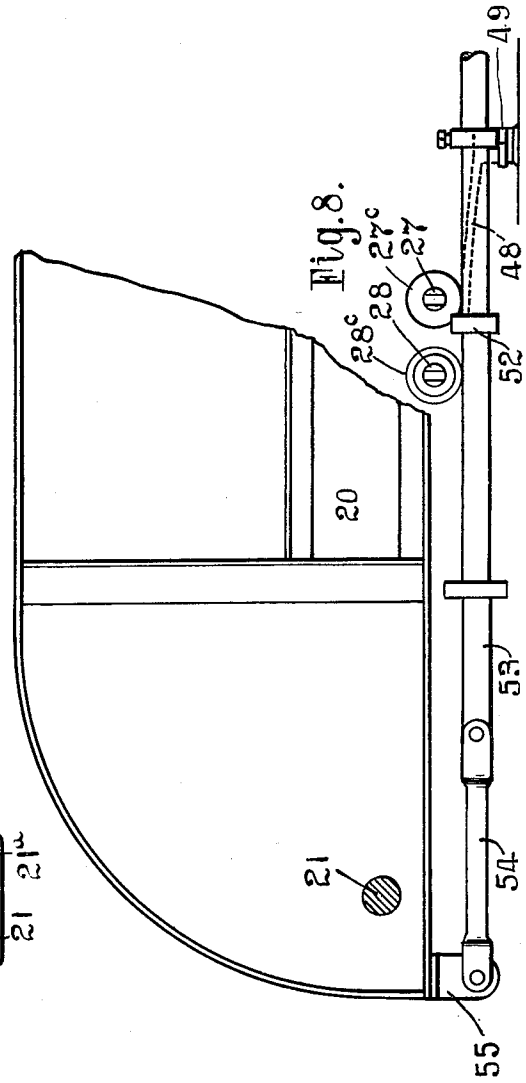

Fig. 8.

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Patented Apr. 12, 1938 2,114,262

UNITED STATES PATENT OFFICE

2,114,262

LADDER TRUCK

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Application April 23, 1935, Serial No. 17,835

8 Claims. (Cl. 228—14)

This invention relates to aerial ladders such as used by the fire departments of municipalities to aid in extinguishing fires and rescuing persons and property from burning buildings.

Such ladders are now commonly transported by engine driven trucks.

Because such ladders and the essential parts thereof are necessarily heavy and bulky and therefore difficult to quickly move, the primary object of the invention is to provide improvements in details of construction whereby their operations are facilitated and speeded by the application of the power used to transport the ladder and thereby relieve the ladder men of the physical exertion heretofore necessary in the handling of such parts. The particular object of the invention is to provide improved means whereby flexible hose for conducting pressures is dispensed with so that the turn table in such structure may be rotated in either direction as much as desired. Other objects will appear from the disclosure herein.

In the accompanying drawings showing one exemplification of the invention—

Figure 1 is a general view in side elevation and partly diagrammatic on a relatively small scale illustrating a fraction of a truck with a turn-table thereon supporting the ladder and the power applying means whereby the ladder is raised and lowered.

Fig. 2 is a detail on a larger scale partly in section and elevation illustrating the mounting and connection of the parts for applying power to raise and lower the ladder.

Fig. 3 is a detail partly in section and showing further details of the means for raising the ladder and a fluid motor co-operating with said means to operate the ladder extensions.

Fig. 4 is a detail view partly in elevation and partly in section of the means for rotating the turn-table and for hoisting the ladder extensions.

Fig. 5 is a detail view in rear elevation of means for locking the turn-table in the position to which it may be rotated.

Fig. 6 is a plan view with parts in section of the means for controlling the operation of the ladder.

Fig. 7 is a detail plan and sectional view of the operating and controlling means for the hoisting of the ladder extensions.

Fig. 8 is detail view of the base of the ladder to show portions of the means for limiting the raising of the ladder.

In the views 10 designates the truck bed of the chassis and 11 the turn-table which is supported centrally to be rotated on said truck bed. The turn-table 11 is engaged and supported at its rim on the truck bed by a suitable track 13 with ball bearings; and at the center of the turn-table is secured a double valve structure supported on a ring 14 in which latter is supported a non-rotatable casing 15. Said non-rotatable casing is provided with a threaded intake 16 having an upward passage 16a, the upper end of which communicates with the two valve casings 17 and 18 for the purpose of supplying oil under pressure to raise and lower the ladder and also to turn a winding drum to raise and lower the ladder extensions. The casing 15 is provided with a distinct discharge downward passage 19a surrounding said upward passage and leading to a threaded opening 19 for the return of the oil to the tank.

20 designates the main ladder, it being pivoted at its base on the opposite ends of a shaft 21 journaled in brackets 21a rising from the turn-table. The main ladder carries extensions 20a and 20b.

At each of its opposite sides the ladder is connected with the turn-table by a piston rod 22 having piston 22a working in a cylinder 23, said piston rod being pivoted to the ladder and said cylinder pivoted to the turn-table so that when liquid (preferably oil) is forced into the cylinder at the lower side of the piston the ladder is raised on the shaft ends 21, and when liquid is forced into the cylinder through a by-pass 24 to the upper side of the piston the ladder is lowered.

Each of the two valve casings 17 and 18 contains a double slide valve, one to control the flow of oil in pipes 25 and 26. The pipe 25 and its two branches 25a and 25b conduct the oil to the cylinder 23 for raising the ladder and pipe 26 and its two branches 26a and 26b conduct oil to the by-pass 24 for lowering the ladder. The two heads of each of said valves are mounted on the opposite ends of a tube as at 27a carried by the stem of the valve, said tube being closed between the heads, but perforated as shown at 27b at its opposite projecting ends to permit the flow of oil through the tube between the chamber portions of the casing beyond the valve heads.

The stems of valves 27 and 28 are each shifted by manual operation at the housing 47 to open and close the ports to said pipes 25 and 26, but means are provided as hereinafter described for automatically closing them upon predetermined operation.

The valve casings 17 and 18 and ring bearing

29 are joined and fixed by bolts 29a to the turntable to rotate with said table, but the casing 15 is stationary at the center of the table and the junction is provided with suitable circular packing rings 30 and 31 to prevent leakage of the oil either between the passages or to the ground.

The intake 16 of the casing 15 has a pipe 32 connecting it with the discharge of a pump 33 and the discharge 19 of the casing 15 communicates with a storage tank 34 that in turn is connected with the intake of the pump 33. The pump 33 is of the usual rotating type and is operated by the power take off shaft 35 from the engine 36 that propels the truck carrying the ladder to the site of a fire. The engine of the truck referred to and the power take off are not shown in detail because they are of ordinary and well known construction. In the pressure delivering operation the same liquid (the oil) is repeatedly used to raise the ladder or project the ladder extensions because after removing the oil from the tank 34 to perform these operations it is returned to said tank through the discharge 19 of the stationary casing 15.

The valve casing 18 has connected communicatingly with it pipes 37 and 38 for the purpose of conducting oil under pressure to a fluid motor for raising or lowering the ladder-extensions 20a and 20b, said extensions being connected in the usual manner for their concurrent movement. Said extensions are operated by means of two cables (one shown at 39) connected to opposite ends of the drum 50 to wind in opposite directions, one of said cables to draw up the extensions and the other to pull down said extensions according to the direction of rotation of the drum.

The pipe 38 leads the oil under pressure from the control valve casing 18 to a port 38a (shown in broken lines Fig. 3) of a fluid motor 51, and after operating said motor to the extent desired the oil is returned to said valve casing 18 by means of the pipe 37 connected with the port 37a of said motor 51. Said operation occurs only when the pressure intake and exhaust of the casing 18 are utilized.

Connected with the shaft 21 of the cable winding drum 50 is a worm gear 40 driven by a worm 41 on the shaft of the motor 51. By reason of this construction said motor 51 can be driven to rotate the cable in the proper direction to cause the extending or drawing down of the ladder extensions. Change of rotation of the motor and winding drum is accomplished by shifting the valve of the casing 18 to cause the oil under pressure to flow through the pipe 37 or 38 according to the direction of rotation necessary to achieve the operation desired. The two points for attaching the cables to simultaneously wind and unwind them are indicated at 50a and 50b.

The two valve casings 17 and 18 have between them at 42 an intake common to them for the pumped oil, said intake being connected by passages with the intake 16 of the casing 15.

When oil is being pumped to raise the ladder the residual oil in the cylinder 23 above the piston therein is returned or exhausted to the tank 33 through the tube 27a connecting the valve heads of the valve casing 17 through outlet 19 and down passage 19a and outlet 19 in the casing 15. And when the piston is shifted to cause the pressure to pass through the by pass 16 in lowering the ladder the oil below the piston in the cylinder exhausts directly through the outlet 44 and through the down passages in the casing 15 to the tank 34. The operation is the same when raising and lowering the ladder extensions but is controlled by the valve of similar construction in casing 18. By reason of this construction the actuating medium is saved for repeated use, and at the same time provides a construction whereby the turn table can be turned unrestrictedly in either direction at will.

The stems 27 and 28 for the valves in the casings 17 and 18 are forked at their outer ends to receive a link 27d with one of two crank arms on a shaft 45 operated by a handle 46 at the top of housing 47 containing the controlling means whereby said valves can be shifted to initially direct the flow of the oil pressure for the operation of raising the ladder and its extensions, but it is desirable that said rising movement be automatically limited. For this purpose, and in the case of the ladder raising, the stem 27 is provided with a collar 27c engaged by one arm 48 of a bell-crank lever 49 pivoted on the turntable, the other arm of said lever being actuated by a collar 52 on a rod 53 connected with one end of a link 54 having its other end connected with an ear 55 on the base of the ladder so that when the ladder has been raised to the predetermined limit the oil pressure is cut off provided the valve stem has not been earlier manually shifted. And likewise in the case of the ladder-extension-raising-means the valve stem 28 is provided with a collar 28c engaged by one end of a bell-crank lever 60 pivoted on the turntable, the other arm of said lever being actuated by a collar 61 on a rack rod 62 riding on a pinion 63 on the shaft of a large worm gear 64 driven by a worm 65 on the shaft of the motor that turns the ladder-extension hoisting drum 50, so that when the ladder extensions have been extended to the predetermined limit provided the valve in the casing 18 has not been earlier manually shifted to cut off the flow of the oil pressure. It will be observed that the flow of pressure in the valve casing 17 or 18 can be arrested by moving the valves therein to neutral position and the ladder or extensions thereof supported in any position to which moved by reason of the fluid entrapped in the cylinders or motor.

The means for rotating the turn-table includes the following:—The supporting track 13 having its rim provided with gear teeth engaged by an intermediate gear wheel 70 so that in turn it is engaged by a pinion 71 secured on the lower end of a vertical shaft 72 extended upward in the housing 47 secured on a base on the turn-table. The upper end of said shaft 72 has secured to it a bevel gear 74 that is engaged by a pinion secured on a shaft 75 turned by a hand wheel 76 so that by turning said wheel 76 in one direction or the other the turn-table can be turned to the position desired and suitable for pointing the ladder and its extensions in the direction desired notwithstanding the position of the truck carrying the apparatus. When the ladder has been pointed, as desired, the shaft of the hand wheel 76 can be locked to prevent any movement of the table by means of a clevis 77 on said shaft drawn tightly around said shaft by a cam 78 connected with a bolt and a handle operating on the clevis to draw the free ends thereof together into pinching engagement with said shaft.

At 80 is an ordinary relief chamber to take care of excess pressure in the oil system in case the ladder meets an obstruction either in raising

or extending, or when the oil is interrupted by means of the control valves.

The forms of the parts can be changed without departing from the gist of the invention as claimed.

What I claim is:

1. In a truck ladder, a turn-table mounted on the truck, a ladder pivoted on the turn-table, fluid pressure actuated means for raising and lowering the ladder, a valve casing supported on the turn-table to rotate therewith and communicating with said means for raising and lowering the ladder, said valve casing having an intake and a discharge passage and containing a valve to control the application of fluid pressure to said means for raising and lowering the ladder, a pressure fluid conducting casing supported stationarily on the truck coaxially with the axis of rotation of said turn table, said stationary casing having a fluid pressure intake and discharge passage distinct from each other communicating in all positions of the turn-table with corresponding passages in said control valve casing, a tank into which the outlet of said stationary casing discharges, and a pump for creating fluid pressure through the intake of said stationary casing to the said valve casing and ladder raising and lowering means.

2. In a truck ladder, a turn-table mounted on the truck, a ladder pivoted on the turn-table, fluid pressure actuated means for raising and lowering the ladder, a valve casing supported on the turn-table to rotate therewith and communicating with said means for raising and lowering the ladder, said valve casing having an intake and a discharge passage and containing a valve to control the application of fluid pressure to said means for raising and lowering the ladder, a pressure fluid conducting casing supported stationarily on the truck coaxially with the axis of rotation of said turn-table, said stationary casing having a fluid pressure intake and discharge passage distinct from each other communicating in all positions of the turn-table with corresponding passages in said control valve casing, a tank into which the outlet of said stationary casing discharges, a pump for creating pressure through the intake of said stationary casing, and a conductor for feeding the pressure medium from said tank to said pump.

3. In a ladder truck, a turn-table mounted on the truck and supporting the main ladder and an extension thereon, a fluid pressure conducting casing supported stationarily on the truck below said turn-table, said casing having an inlet and an outlet passage distinct from each other in respect to a pressure supply means, two valve casings supported upon said turn-table to rotate therewith, said valve casings having concentric communication in all positions of the turn table with the inlet and outlet passages of said stationary casing, fluid pressure actuated means communicatingly connected with said valve casings for raising and lowering the main ladder, and independently operable fluid pressure means communicatingly connected with said valve casings to extend or retract the ladder extension, and valve means in said valve casings for controlling at will the application of fluid pressure to said main ladder and its extension.

4. In a ladder truck, a turn-table mounted on the truck and supporting the main ladder and an extension thereon, a fluid pressure conducting casing supported stationarily on the truck below said turn-table, said casing having an inlet and an outlet passage in respect to a pressure supply means distinct from each other, two valve casings supported upon said turn-table, said valve casings swiveled to said stationary pressure conducting casing and having concentric communication with the inlet and outlet passages thereof, fluid pressure actuated means communicatingly connected with said valve casings for raising and lowering the main ladder, and independently operable fluid pressure means communicatingly connected with said valve casings to extend or retract the ladder extension, and valve means in said valve casings for controlling at will the application of fluid pressure to said main ladder and its extension.

5. In a ladder truck, a turn-table mounted on the truck and supporting the main ladder and an extension thereon, fluid pressure supplying and actuated means for said ladder and extension including a fluid pressure conducting casing supported stationarily on the truck below said turn-table, said casing having an inlet and an outlet passage distinct from each other in respect to a pressure supply means, two valve casings supported upon said turn-table, said valve casings swiveled to said stationary pressure conducting casing and having concentric communication with the inlet and outlet passages thereof, means for automatically limiting the application of pressure to said fluid pressure actuated means communicatingly connected with said valve casings for raising and lowering the main ladder, and independently operable fluid pressure applying means communicatingly connected with said valve casings to extend or retract the ladder extension at will.

6. In a ladder truck, a turn-table mounted on the truck and supporting the main ladder and an extension thereon, a fluid pressure conducting casing supported stationarily on the truck below said turn-table, said casing having an inlet and an outlet passage distinct from each other in respect to a pressure supply means, two valve casings supported upon said turn-table, said valve casings swiveled to said stationary pressure-conducting casing and having concentric communication with the inlet and outlet passages thereof, packing means at the swiveling junction of said valve casings and pressure conducting casing for preventing leakage of pressure fluid to the atmosphere and from one passage to the other, fluid pressure actuated means communicatingly connected with one of said valve casings for raising and lowering the main ladder, and independently operable fluid pressure means communicatingly connected with the other of said valve casings to extend or retract the ladder extension, and valve means in said valve casings for controlling at will the application of fluid pressure to said main ladder and its extension.

7. In a ladder truck, a turn-table mounted on the truck and supporting the main ladder and an extension thereon, fluid pressure actuatable means for raising and lowering the main ladder and independently operable fluid pressure actuatable means including a fluid motor and gearing means actuated thereby for extending and retracting the ladder extension, two valve casings and means therein and connected therewith for controlling at will the application of fluid pressure to each of said fluid pressure actuatable means, a fluid pressure conducting casing supported stationarily on the truck, said casings having fluid pressure inlet and outlet passages dis-

tinct from each other, said casing swiveled to said stationary conducting casing and having their said passages coaxial with the inlet and outlet passages, respectively, of the stationary casing.

8. In a ladder truck, a turn-table mounted on the truck and supporting the main ladder and an extension ladder thereon, fluid pressure supplying and actuating means for said ladder including a fluid pressure conducting casing supported stationarily on the truck below said turn-table, said casing having an inlet and an outlet passage distinct from each other in respect to a pressure supply means, two valve casings supported upon the turn-table, said valve casings swiveled to said stationary pressure conducting casing and having coaxial communication with the inlet and outlet passages thereof, means for controlling the application of pressure to said main and extension ladder, and means for automatically limiting the application of pressure to the extension ladder.

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