No. 835,153. PATENTED NOV. 6, 1906.

W. J. COOPER.

LADDER.

APPLICATION FILED APR. 8, 1905.

3 SHEETS—SHEET 1.

Fig. 1.

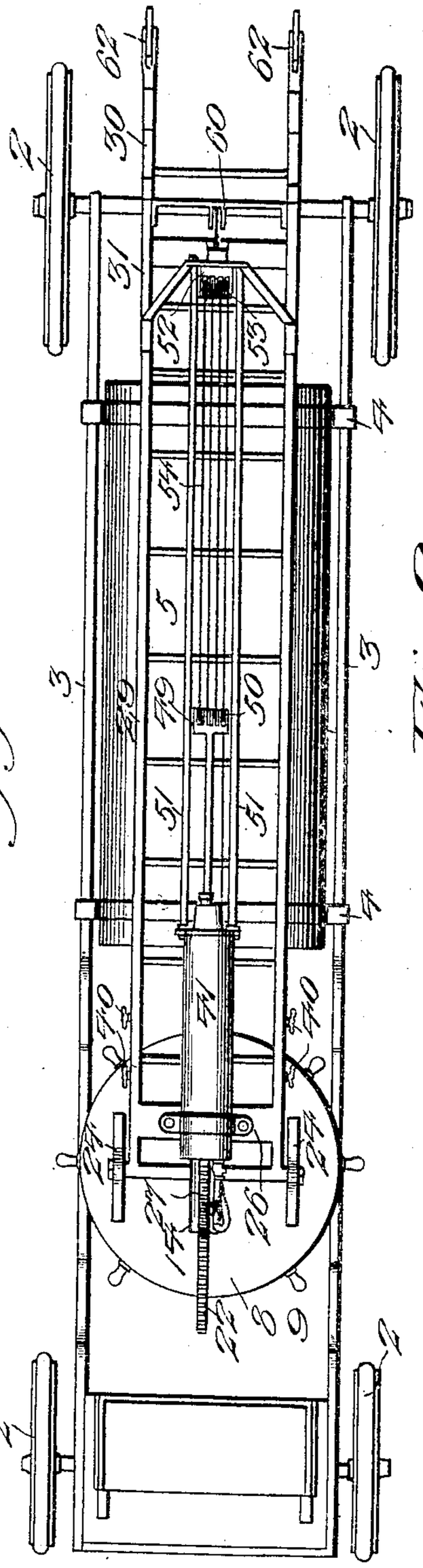
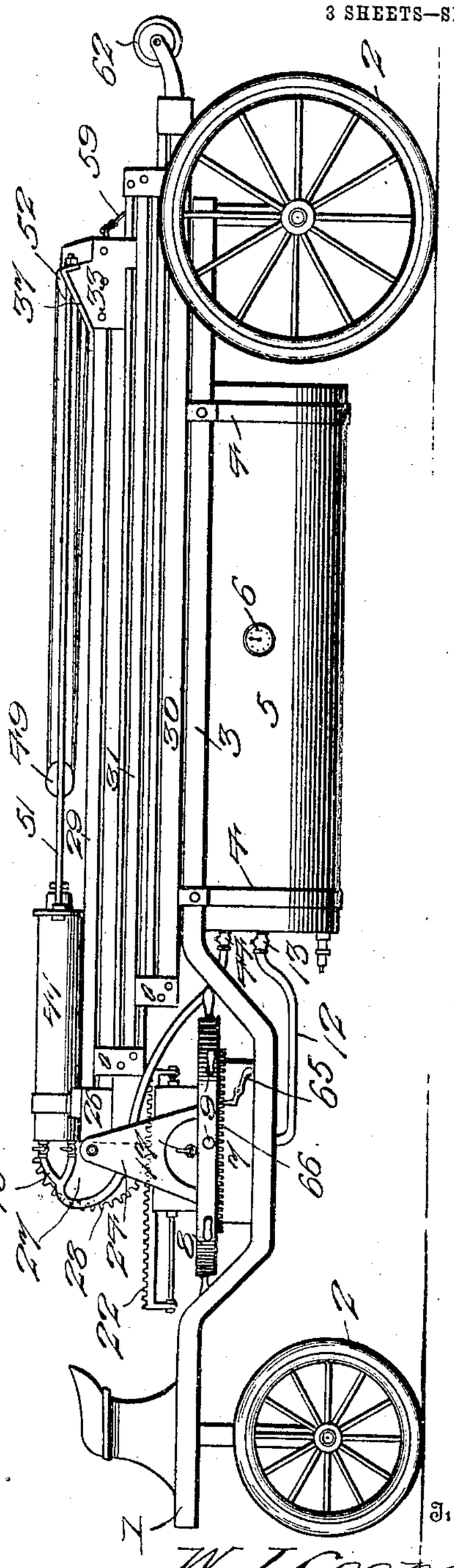


Fig. 2.



Witnesses

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3 SHEETS—SHEET 2.

Fig. 3.

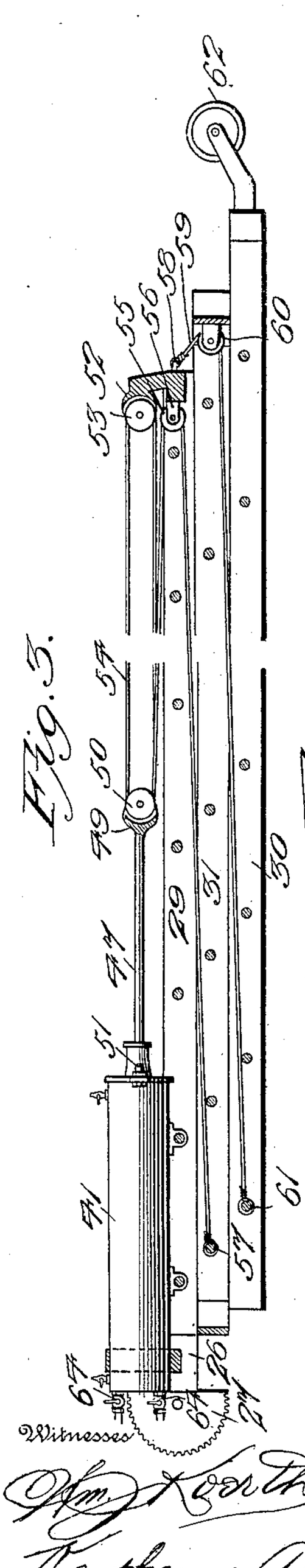


Fig. 4.

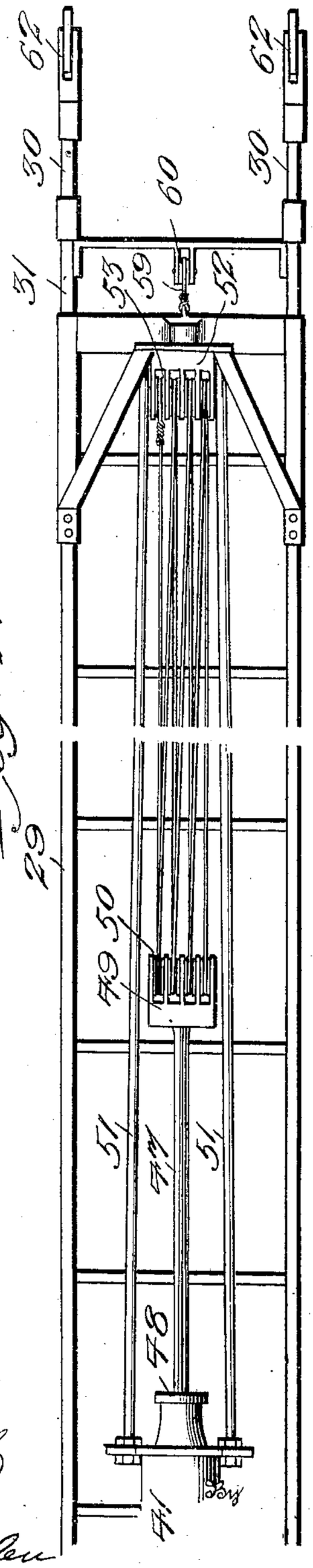
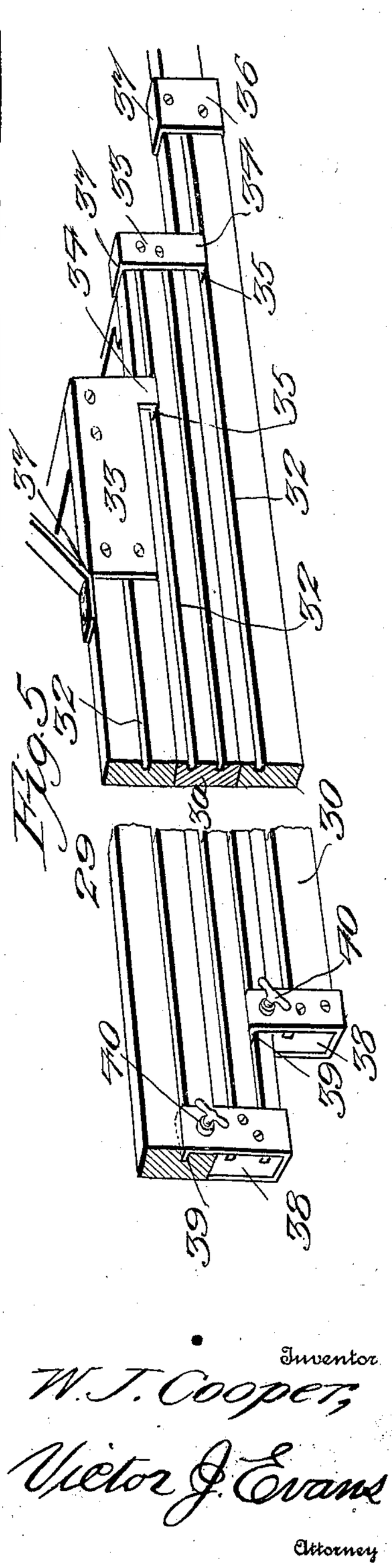


Fig. 5.



Witnesses

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3 SHEETS—SHEET 3.

Fig. 7.

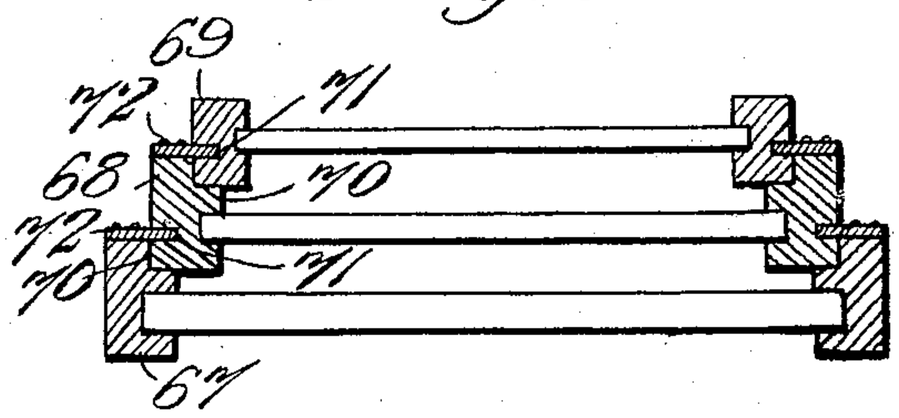

Fig. 6.

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UNITED STATES PATENT OFFICE.

WALTER J. COOPER, OF CLEVELAND, OHIO, ASSIGNOR OF ONE-HALF TO L. W. BEHRINGER.

LADDER.

No. 835,153. Specification of Letters Patent. Patented Nov. 6, 1906.

Application filed April 8, 1905. Serial No. 254,498.

To all whom it may concern:

Be it known that I, WALTER J. COOPER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented new and useful Improvements in Ladders, of which the following is a specification.

The invention relates to an improvement in ladders, relating particularly to an extension-ladder comprising slidably-connected sections.

The main object of the invention is the provision of means for automatically operating said sections to extend the ladder to the limit of its length.

Another object of the invention is the provision of a suitable storage-cylinder for compressed air from which the power may be utilized to operate the sections to control the position of the ladder.

Another object of the invention is the provision of means by which the respective sections when extended may be locked to the adjacent sections.

The invention in its preferred embodiment of details will be specifically described in the following specification with particular reference to the accompanying drawings, in three sheets, in which—

Figure 1 is a plan view of my improved extension-ladder, showing the same mounted for use in connection with the usual fire-truck. Fig. 2 is a side elevation of the same. Fig. 3 is a longitudinal section through the ladder, showing the same in folded position. Fig. 4 is a plan of the same. Fig. 5 is a detail perspective illustrating the sliding connection of the ladder-sections and the means for locking the sections together when the ladder is extended. Fig. 6 is a vertical sectional view illustrating the means for altering the elevation of the ladder. Fig. 7 is a transverse section through the ladder, illustrating a modified means for their slidable connection.

Referring particularly to the drawings, wherein like parts are indicated by like reference-numerals, my improved extension-ladder is preferably mounted for use in connection with a wheeled truck, such as a fire-truck, comprising the ordinary metal frame 1, of suitable construction, movably supported upon wheeled trucks 2.

Between the longitudinal frame-bars 3 of the frame 1 and preferably supported in hanger-straps 4 is the power-cylinder 5, adapted to contain air under pressure and of suitable size for convenient operation of the parts.

A pressure-gage 6, supported by and in communication with the cylinder, indicates at all times the working pressure within the cylinder. The side bars 3, near their forward ends, are depressed to provide a lower support for the operating parts, and a suitable base-plate 7 transversely joins the side bars at their depressed portions.

A turn-table 8 is revolubly supported upon the base-plate 7, being peripherally provided with radially-extending operating-handles 9, as illustrated. The turn-table has a central pivotal connection with the base-plate and is preferably mounted upon ball-bearings 10 for convenience in operation. The pivotal connection between the turn-table 8 and the base-plate 7 is in the form of a stud 11, preferably in the form of a pipe, projecting at its lower end below the base-plate 7 and communicating, through a flexible pipe connection 12, with the power-cylinder 5.

A valve 13 is preferably arranged in the pipe 12 to control the admission of power to the pipe 11.

Mounted centrally upon the turn-table is a cylinder 14, the base 15 of which is provided with a central transverse valve-port 16, in which is fixed a valve 17. Ports 18, in communication with the valve-ports 16, project in opposite directions therefrom and communicate with the cylinder 14 near the end walls of the latter.

A piston 19 is mounted for reciprocation within the cylinder 14 and has a longitudinally-arranged stem 20 projecting in both directions from the piston and beyond the cylinder, preferably passing through suitable stuffing-boxes 21 in the ends of the cylinder.

A toothed rack 22 is directly connected to the piston-stem 20, through the medium of depending arms 23, in such manner that the rack rests directly upon and is guided by a groove in the upper surface of the cylinder.

Ears 24 are vertically supported at diametrically opposite points on the turn-table 8, and in these ears is pivotally mounted the shaft 25, from which projects a supporting-

plate 26, designed to be directly connected to the lower end of the fixed ladder-section. Depending from the shaft 25 is a segmental or semicircular rack 27, the teeth 28 of which are arranged for operative engagement with the teeth of the rack 22.

The extension-ladder, as illustrated, comprises three sections, hereinafter termed the "fixed" section 29, the "upper" section 30, and the "intermediate" section 31. It is to be understood that the ladder may comprise any desirable number of sections, though for the purpose of convenience but three are illustrated and described. The uprights of each section are slidably connected to the uprights of the adjoining section by any suitable means, though I prefer to centrally and longitudinally groove each upright, as at 32, and secure to the upper end of the fixed and intermediate sections a guide-plate 33, having a depending lip 34 provided at its lower end with a right-angle extension 35, normally fitting within the groove 32. A binding member 36 is similarly secured to the upper end of the upper section. These plates 33 and 36, being preferably of comparatively thick metal and secured to the surface of the ladder-uprights, are arranged to provide shoulders 37, against which guide-plates 33 contact in the extension of the ladder, whereby to limit such movement. The lower ends of each of the intermediate and upper sections are provided with similar guide-plates 38, having right-angled extensions 39 to fit within the grooves 32 of the fixed and intermediate section, respectively. Each of these guide-plates 38 is provided with set-screws 40, arranged to bear upon the respective adjacent section, whereby when the ladder is elevated the set-screws may be turned to secure the sections against independent longitudinal movement. As a means for elevating the sections I provide a cylinder 41, supported directly by the lower end of the fixed ladder-section and extending longitudinally thereof. This cylinder is interiorly provided with a longitudinally-arranged port 42, communicating at its lower end, through a flexible tube 43, with the power-cylinder 5, a valve 44 in this tube controlling the admission of power to the port 42. The port 42 communicates interiorly with the cylinder only at its extreme upper end, as at 45.

A piston 46 is arranged interiorly of the cylinder 41 and is provided with a stem 47, projecting upward beyond the cylinder through a suitable stuffing-box 48. Secured to the upper end of the stem is a multiplying pulley-block 49, carrying a series (preferably four) of pulleys 50, arranged upon a single transverse shaft. Guide-rods 51 are secured to the top of the cylinder and support at their upper ends a multiplying pulley-block 52, carrying a series of pulleys 53, similar in size and arrangement to the pulleys 50. These pulleys constitute the ordinary multiplying-sheaves, by which the power of the piston is multiplied in operation, as is well understood.

An elevating-rope 54 is secured to one pulley of the upper block, passing in succession around the respective pulleys of the upper and lower block and from the last pulley of the lower block to and around a pulley 55, secured in the casting 56, arranged to support the upper pulley-block, and from this pulley rearward to the lower end of the intermediate section, where it is secured, as at 57. The casting 56, which is located at the extreme upper end of the fixed section, is formed with an eye 58, to which is secured an elevating-rope 59, which passes therefrom to and around a pulley 60, secured to the upper end of the intermediate ladder-section 31, and rearward therefrom to the lower end of the upper ladder-section, where it is secured at 61.

If preferred, the upper end of the upper ladder-section may be provided with suitable guide-rollers 62 for convenience in extending a ladder when against a building.

I also prefer to provide means for cushioning or aiding in the descent of the ladder-sections, and to this end I branch the flexible tubing 43 adjacent this connection with the cylinder 41, one branch leading to the port 42, as before described, while the other branch 63 communicates directly with the cylinder 43 beneath the piston 46, as clearly shown in Fig. 6. Valves 64 are preferably provided in each branch to control the admission of power as desired.

Assuming the parts constructed and arranged as described, the operation of my improved extension-ladder is as follows: The valve 13 is opened to admit the power, such as compressed air, from the tank 5 to the pipe 12 and through the latter to the pipe 11 and into the port 16. The valve 17 is operated to direct the air through either side of the piston 19, which operates the rack 22 longitudinally, and through the connection of this rack with the segment 27 the ladder will be elevated as a whole at any desired angle. Valves 44 and 64 are now opened to admit the air to port 42 and through the opening 45 to the cylinder 41 above the piston 46, operating to depress the piston and, through the multiplying pulley-gearing described, exert a pulling strain upon the elevating-rope 54, which tends to elevate the intermediate ladder-section 31. The upward movement of this section of course elevates the pulley 60, and as the eye 58 is stationary the upper section 30 of the ladder is also elevated. As the length of the rope 59 is about equal to the length of the intermediate ladder-section, it follows that the upper section when the intermediate section has

been fully elevated will be extended to its limit above said intermediate section. After complete extension the person mounting the ladder will on reaching the lower end of the intermediate section operate the set-screw 40, locking the intermediate section and the fixed section, and similarly operating the set-screw 40, connected with the upper section, to lock the latter to the intermediate section.

After elevation the ladder as a whole may be turned, through operation of the turn-table 8, through the handles 9, and I prefer to provide said turn-table with suitable means for locking it in adjusted position—such, for example, as a weighted pawl 65, pivotally connected to the base 7 and arranged to engage any one of the series of teeth 66, secured on the lower side of the turn-table.

In Fig. 7 I have illustrated a modified means for slidably connecting the sections of the ladder together. In this construction the successive sections 67, 68, and 69 are of gradually-decreasing widths, the uprights of each section being recessed at 70 upon their upper inner edges to receive the uprights of the adjoining section. The uprights of the upper and intermediate sections are longitudinally grooved at 71, and guide-plates 72 are secured on the upper side of the fixed and intermediate sections with their inner edges respectively engaging the grooves in the intermediate and upper sections.

In the event it is desired to cushion the descent of the ladder-sections or to aid any such descent the valve 64 and the branch 63 of pipe 43 is opened, admitting power below the piston 46, whereby the pulley-boxes are caused to move toward each other, slackening the elevating of the ropes and aiding in the descent of the sections, or both valves 64 may be opened in the degree desired, which will, in effect, cushion the rising piston, as will be evident.

The structure described provides an extension-ladder comprising any desired number of sections slidably connected and adapted for mechanical locking when extended and also arranges a convenient controlling power for the ready elevation of the sections to the completely-extended form.

Having thus described the invention, what is claimed as new is—

1. A frame, a storage-tank carried thereby, a cylinder supported by the frame and in communication with the tank, an extension-ladder pivotally supported on the frame, a piston within the cylinder, a rack supported by the cylinder and operated in the movement of said piston, and a rack carried by the extension-ladder and meshing with the rack operated by the piston, whereby said ladder may be turned on its pivotal connection with the frame.

2. A framework, a storage-tank carried thereby, a cylinder supported by the framework and in communication with the tank, an extension-ladder pivotally mounted on the turn-table, a tooth-plate connected with said ladder, a piston within the cylinder, a rack connected with said piston and guided in a grooveway formed in the cylinder, said rack being in mesh with the tooth-plate, whereby to adjust the inclination of the ladder.

3. An extension-ladder comprising a plurality of sections slidably connected together, a power-cylinder supported by one of the sections, a multiple pulley-block connected to the piston-rod of said cylinder, a second multiple pulley-block fixed to the end of said section, a sheave carried by the end of said section, and a flexible connection joining the pulley-blocks and passing over the sheave, the end of said connection being secured to the lower end of the adjacent ladder-section.

4. A supporting-frame, a storage-tank carried thereby, a main ladder-section pivotally and revolubly mounted on the frame, a cylinder fixed to said main section and in communication with the tank, a piston within the cylinder, a piston-rod connected with the piston, a multiple pulley-block carried by said rod, a second multiple pulley-block carried by the main section, a second ladder-section slidably connected to the main section, means engaging both of said pulley-blocks and the inner end of the second section, whereby the operation of the piston will move said second section relative to the main section.

5. A supporting-frame, a storage-tank carried thereby, a main ladder-section pivotally and revolubly mounted on said frame, a cylinder fixed to said main section and in communication with the tank, a piston within the cylinder, a piston-rod connected with the piston, a multiple pulley-block carried at the end of said rod, a second multiple pulley-block carried by the main section, a second ladder-section slidably connected to the main section, a sheave carried by the outer end of the main section, and a cable joining said pulley-blocks and passing over the sheave, one end of said cable being connected to the inner end of the second ladder-section.

6. An extension-ladder comprising a main section and a plurality of auxiliary sections adapted for relative sliding movement with relation to the main section and to each other, a power-cylinder supported by the main section, a multiple pulley-block movable relative to the main section under the influence of the power-cylinder, a multiple pulley-block fixed to the main section, a sheave fixed to the main section, a second sheave fixed to one of the auxiliary sections, a cable joining the pulley-blocks and passing over the sheave carried by the main section, the end of the cable being secured to the in-

ner end of the auxiliary section immediately adjacent the main section, and a second cable secured to the end of the main section and passing over the sheave on the auxiliary section, the end of the second cable being secured to the inner end of one of the remaining auxiliary sections.

In testimony whereof I affix my signature in presence of two witnesses.

WALTER J. COOPER.

Witnesses:
WM. HARTNAGEL,
JOSEPH SCHWINEL.