(No Model.)

2 Sheets—Sheet 1.

F. A. BIEHN.

FIRE LADDER.

No. 503,362. Patented Aug. 15, 1893.

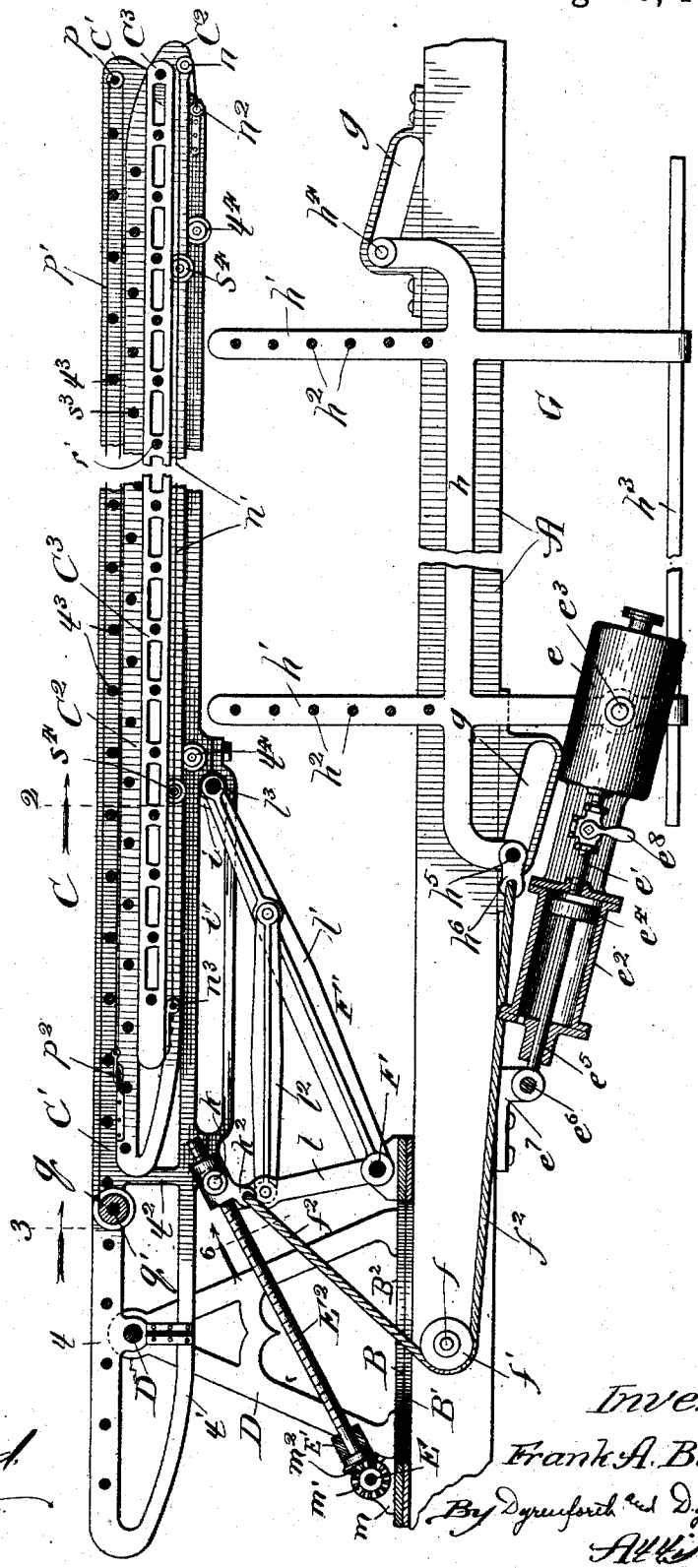

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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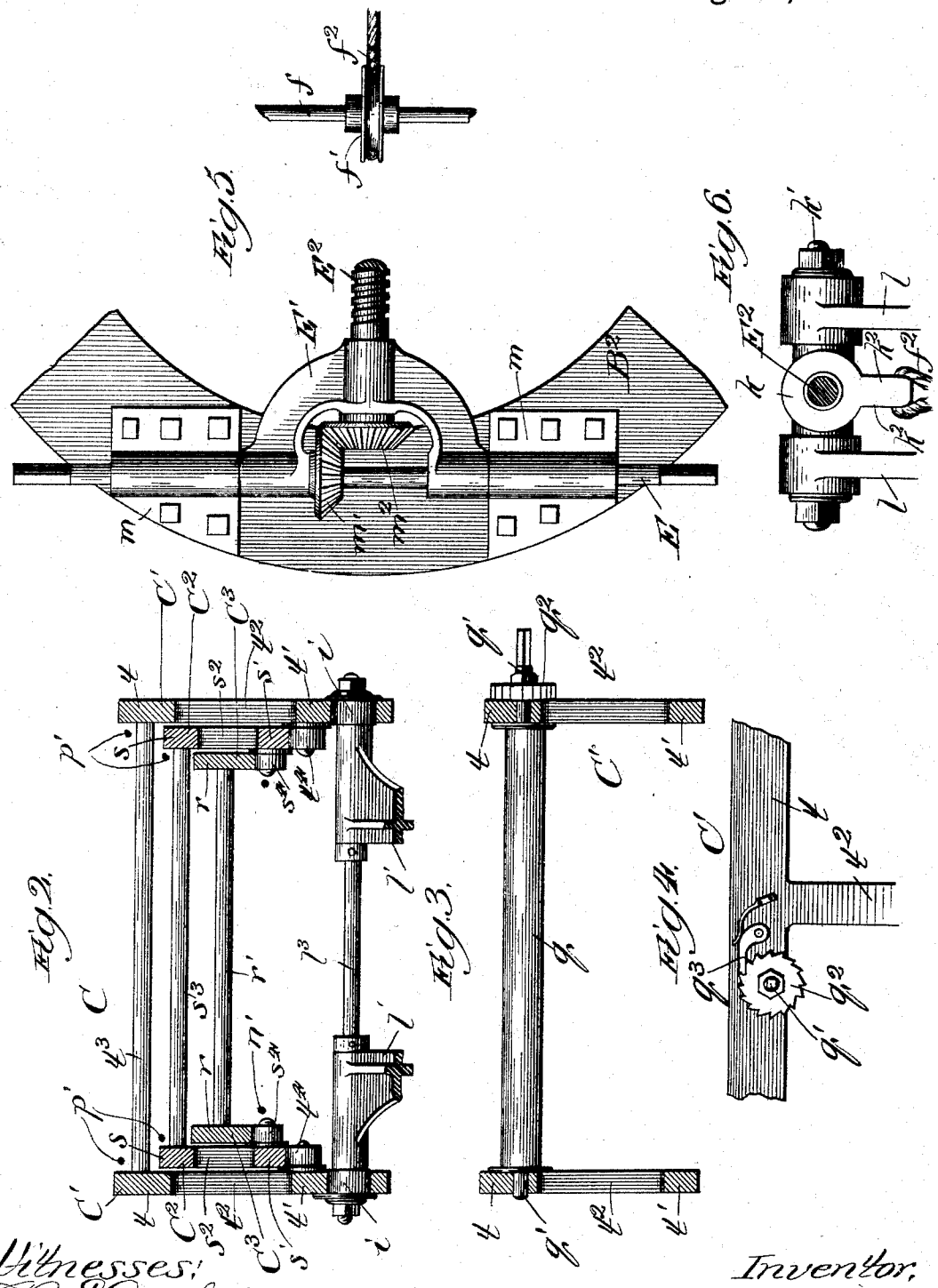

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UNITED STATES PATENT OFFICE.

FRANK A. BIEHN, OF CHICAGO, ILLINOIS.

FIRE-LADDER.

SPECIFICATION forming part of Letters Patent No. 503,362, dated August 15, 1893.

Application filed January 16, 1893. Serial No. 458,501. (No model.)

To all whom it may concern:

Be it known that I, FRANK A. BIEHN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Fire-Ladders, of which the following is a specification.

My invention relates to improvements in fire-ladders of the class in use by fire-departments, and mounted upon trucks with means for raising them to give access to the upper stories of buildings.

My objects are, first, to provide improved raising and lowering mechanism for the ladder upon the truck, whereby the raising of the ladder toward the vertical plane is rendered particularly easy and quick; and, second, to provide a ladder with two or more longitudinally movable lengths or sections, all operated to simultaneously lengthen out or extend by the rise of the lowest movable section.

In the drawings—Figure 1 is a broken, central, vertical and longitudinal section of the body-portion of a fire-ladder truck or carriage and extensible ladder mounted thereon; Figs. 2 and 3 enlarged sections taken on lines 2 and 3, respectively, of Fig. 1, and viewed in the direction of the arrows; Fig. 4, an enlarged broken view in elevation of a portion of one side of the lower ladder section at line 3 of Fig. 1; Fig. 5, an enlarged broken plan view of the upper sliding plate or turn-table, showing the operating shaft of the main raising and lowering mechanism for the ladder, as well as a portion of supplemental raising mechanism therefor; and Fig. 6, an enlarged broken section taken on line 6 of Fig. 1 and viewed in the direction of the arrow.

A is the body portion of the truck which may be mounted in the usual way upon running gear, not shown. At, preferably, the forward end portion of the truck is a turn-table B, comprising a lower annular plate B' firmly secured to the truck, and an upper annular sliding plate B^2 held against separation from the plate B^2 but capable of being readily turned thereon.

C is an extensible ladder which is shown to be formed in three sections or lengths C', C^2, C^3. The section C' has forward or upper side rails t, and rear or under side-rails t' which may be formed integral with the rails t, webs t^2 extending between the said rails, at intervals, for purposes of strength. The rails t are provided with the rounds t^3, and the rails t' with inwardly extending bearing pulleys t^4. The section C^2 extends normally in the section C' between the pulleys t^4, upon which it rests at opposite sides, and the rounds t^3. The section C^2 has sides formed with integral rails $s\,s'$ jointed by webs s^2. The rails s' rest upon the pulleys t^4 and the rails s are provided with rounds s^3. At intervals along the rails s are inwardly extending bearing pulleys s^4. The top section C^3 extends normally in the section C^2 between the pulleys s^4 and rounds s^3, and rests at its side rails r on the pulleys s^4. The section C^3 is provided with rounds r'. A drum q is mounted in the lower end portion of the section C', on trunnions q' q^2 having their bearings in the side rails t t. The trunnion q' extends beyond the respective side rail t, and is squared at its end to receive a suitable crank, not shown. At the side of the rail t the trunnion q' carries a ratchet wheel q^2, and on the said rail is a spring pawl q^3 engaging the ratchet. At the upper ends of the rails t are inwardly extending bearings p preferably in the form of sheaves. Suitable cables p' are fastened at one end upon the drum q, and extend over the bearings p to the lower end portions of the side rails s, of the section C^2, where they are securely fastened, as shown at p^2. At the upper ends of the rails s' of the section C^2 are inwardly extending bearings or sheaves n over which extend cables n' fastened at opposite ends respectively to eye pieces n^2, at the upper ends of the rails t' of the section C', and eye pieces n^3 at the lower ends of the rails r of the section C^3. When the crank is applied to the trunnion q' and the drum is turned to wind up the cables p', the section C^2 is slid longitudinally outward in the section C', and by its movement causes the section C^3 to be slid at an increased speed longitudinally outward in the section C^2. The sections of the ladder are extended, in practice, after the ladder has been raised toward the vertical plane, as hereinafter described. When extended the sections are held by engagement of the pawl q^3 with the ratchet q^2.

In all fire-ladders of which I am aware but

two lengths corresponding with the sections C′ C² are provided. By means of my improvement three, or even more, sections may be employed. The upper section is forced upward at much greater speed that the middle section, so that while my construction affords a ladder of greater length than those hitherto employed, the operation of extending it to its full length may be accomplished as speedily as where only two sections are employed.

Secured upon the plate B³ at opposite sides thereof are coincident standards D carrying a transverse shaft D′. The section C′ of the ladder is pivotally mounted near its lower end on the shaft D′ between the standards. On the plate B³ are bearings *m m* for a shaft E which extends parallel with the shaft D′, and projects beyond the said bearings, being squared at its ends, as shown, to receive a suitable operating crank, not shown. Pivotally mounted at its ends upon the shaft E between the bearings *m* is a stirrup piece E′ affording a bearing for the end portion of a screw E² which extends in a plane perpendicular to the shaft E. In the stirrup piece on the shaft E is a miter-gear *m′* engaging a miter-gear *m²* on the adjacent end of the screw. Parallel with the shaft E at the opposite side of the plate B³ is a shaft F. F′ is a bell-crank lever, double in the sense that for purposes of strength it is formed with two coincident side-frames, consisting each of a long arm *l′* and short arm *l*, and affording practically a single bell-crank lever F′ as stated. To strengthen the lever, bars *l²* extend between the respective arms *l* and *l′* near the free ends of the latter, The lever F′ is pivotally mounted at the angles between the arms *l l′* upon the shaft F. The upper ends of the arms *l* afford pivotal bearings for the trunnions *k′* of an internally threaded sleeve or screw socket *k* mounted between the said arms and provided with a transversely perforated lug *k²*. The screw E² extends through and engages the internally threaded sleeve *k*. Journaled in the free ends of the arms *l′* of the bell-crank lever F′ is a shaft *l³* carrying rollers *i;* and the rails *t′* of the ladder-section C′ are provided with elongated openings *i′* affording guides in which the said rollers *i* extend and travel. The ladder C is supported at its lower end portion upon the shaft D′, as described, and upon the rollers *i* of the bell-crank lever. To raise the ladder C, on its pivot D′, toward the vertical plane, the crank is applied to either of the squared ends of the shaft E, and the latter is turned thereby to turn the screw E². The screw is held against longitudinal movement by the stirrup E′, and as it is turned it causes the sleeve *k* to move downward thereon to swing the bell-crank lever F′ on its pivot at the shaft F. The pivotal nature of the stirrup E′ and sleeve *k* permits the screw to change direction while the bell-crank lever is being swung. The swinging of the bell crank lever causes the rollers *i* to travel in the guides *i′* and by bearing against the under side of the ladder raise the latter on its pivot. The length of the arms *l′* is such as to cause the rollers *i* to engage the ladder, initially, quite a distance, comparatively speaking, from its pivot, and the arms *l*, may in practice be about one-half the length of the arms *l′*. This construction affords a leverage which renders the ladder comparatively easy to raise, and renders the rise thereof as quick as may be desired.

A fire-ladder truck is usually provided with a frame for containing removable ladders. I provide a support G for this purpose consisting of similar side frames formed with longitudinal bars *h* and upright bars *h′*, joined by transverse rods *h²* upon which the ladders rest. Secured to the lower ends of the upright bars of each side-frame is a footboard *h³* for the firemen to stand upon while riding upon the truck. On the opposite side rails of the truck A are coincident cam guide slots *g g*, in the relative positions shown; and at opposite ends of the bars *h* are rollers *h⁴* which extend into the guide slots *g*. The frame G is supported in the truck altogether by the engagement of the wheels *h⁴* with the cam guides *g*. Extending between the forward ends of the bars *h* is a cross bar or shaft *h⁵* provided midway of its length with a perforated ear *h⁶*. The frame G is longitudinally movable in the truck a distance corresponding with the length of the cam guides *g;* in its forward movement it rises on the cams, and it falls in the backward movement thereon. Extending between the side rails of the truck is a shaft *f*, carrying at the geometrical center of the turn-table B, a sheave *f*. Fastened at opposite ends respectively to the lug *k²* on the sleeve *k*, and to the ear *h⁶* on the shaft *h⁵*, is a cable *f²*, which extends across the sheave *f′*. The cable *f²* causes the sleeve *k*, as it is moved upward on the worm-shaft to lower the ladder C, to draw the frame G forward and upward. While the ladder C is being raised the frame G will fall in the cam guides *g*, and by its weight assist in raising the ladder, thus operating as a counterbalance therefor. In practice, ordinarily, the frame G when filled with ladders will weigh over a ton, and will therefore aid materially in raising the ladder C. To still further assist in raising the ladder C, I provide supplemental raising mechanism therefor comprising compressed air actuated piston mechanism. On the frame G is a compressed-air reservoir *e* communicating through a pipe *e′* with a piston cylinder *e²*. The reservoir *e* is mounted on trunnions *e³* in bearings on the forward upright bars *h′* of the frame G, and in the cylinder *e²* is a piston *e⁴*, on the end of a stem *e⁵* which is pivotally connected with a shaft *e⁶* secured at its ends in coincident bearings *e⁷* on the side rails of the truck A. Interposed in the pipe *e′* is a cock *e⁸* which may be turned to direct compressed air from the reservoir *e* to the cylinder *e²*,

against the piston e^4, or it may be turned to shut off communication between the said reservoir and cylinder and vent the cylinder. The reservoir may be filled with compressed air at the engine house. When it is desired to raise the ladder C, the cock e^8 is turned to direct compressed air into the cylinder, and the pressure of the air against the piston tends to force the frame G backward and downward, thus augmenting the strain upon the cable f^2 and lending further material aid in raising the ladder C. When the ladder C is to be lowered the cock e^8 should be turned to vent the cylinder e^2.

My improvements described render the operation of raising and extending the ladder C particularly easy and quick to accomplish, and as it is possible to make the mechanism very strong and durable, without causing it to be unduly cumbersome, there can be no danger of accident in its use.

While I prefer to construct my improvements as shown and described, the construction may be modified in the matter of details without departing from the spirit of my invention as defined by the claims.

What I claim as new, and desire to secure by Letters Patent, is--

1. The combination with a fire-ladder and truck upon which the ladder is pivotally mounted at its lower end-portion, of means upon the truck for raising the ladder on its pivot, and counterbalance mechanism for the ladder on the truck, comprising a movable frame for ladders mounted in guides on the truck, and connected with the ladder to lower in its guides as the ladder is raised, substantially as described.

2. The combination with a fire-ladder and truck upon which the ladder is pivotally mounted at its lower end-portion, of main raising mechanism on the truck for the ladder, and supplemental raising means for the ladder on the truck comprising a compressed air reservoir, a cylinder, a piston in the cylinder, and means for directing compressed air from the reservoir against the piston to move the latter, the cylinder and piston being connected respectively with the said truck and ladder, whereby movement of the piston under the expansive force of the compressed air will tend to assist the operation of the said main ladder raising mechanism, substantially as described.

FRANK A. BIEHN.

In presence of—
J. N. HANSON,
W. N. WILLIAMS.