



# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN LADDERS.

Specification forming part of Letters Patent No. **210,630**, dated December 10, 1878; application filed March 23, 1878.

*To all whom it may concern:*

Be it known that I, JEAN E. RICHARD, of New York, in the county of New York and State of New York, have invented a new and valuable Improvement in Portable, Extension, and Aerial Ladders; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, and to the letters and figures of reference marked thereon.

Figure 1 of the drawings is a representation of a side view of my improved ladder extended. Fig. 2 is a front view thereof extended; and Figs. 3, 4, 5, 6, and 7 are detail views.

This invention has relation to improvements in aerial and extension ladders for firemen's use and other purposes.

The nature of the invention will be fully set forth hereinafter.

In the annexed drawings, the letter A designates the base-section, and A<sup>1</sup> and A<sup>2</sup>, respectively, the second and third sections of my improved extension-ladder. The side rails of the sections are preferably of iron or steel, and the rungs of gas-pipe; but I may use other materials if I so elect. The bottom of the lower section is broadened, as shown at *a*, in order to counteract any tendency to tilting over, and its side rails are provided with adjusting-screws *b*, operated by a vise-lever, *c*, in order to provide against inequalities of the ground and to level the ladder. It is provided near its lower end with a drum, B, composed of a central section, *d*, and two side sections, *d'*, the first of which revolves loosely upon the axial shaft *e*, journaled in the side rails of the section A, and the two latter are rigidly secured thereto. The adjacent ends of the drum-sections *d d'* are provided with a flange, *e'*, having a number of registering-perforations, *i*, and the flanges *e'* of the section *d* with an angular spring-catch, *f*, one arm of which extends through one of these sets of perforations and locks the drum-sections together. At the middle of the length of the section *d* is a collar, *g*, having spaced holes *g'*, from which collar the said section tapers outward, being thickest at the said collar. The outer ends of

the sections *d'* have each a ratchet, *h*, rigidly secured thereto, with which a pawl, *h'*, upon a shaft, *h<sup>2</sup>*, extending across the section A, and having its bearings in its side rails, engages. This shaft is provided with a gear-wheel, *i'*, that meshes with a larger gear-wheel, *i<sup>2</sup>*, of the drum-shaft *e*, and is rotated by means of a crank-arm to operate the said drum. Near the upper ends of the sections A<sup>1</sup> A<sup>2</sup> are arranged the spaced guides C C', the first being at or near the extreme end of the side rails, and the latter somewhat lower down. The guides C have an opening, *j*, for the reception of the rail of the ladder-section, a slot, *j<sup>1</sup>*, in which is journaled a grooved pulley, *j<sup>2</sup>*, and an open slot, *j<sup>3</sup>*, in which the side rail of the movable section slides, the opening *j<sup>4</sup>* in its side being for the passage of the rungs of the said movable section. The guide C' has an opening, *k*, for the reception of the side rail of the lower section, two slots, *k<sup>1</sup> k<sup>2</sup>*, at each side thereof, in which are placed the pulleys *l l'*, and an open slot, *k<sup>4</sup>*, in which the side rails of the section above slide. The guides C' have projecting therefrom an arm, *m*, carrying in its end a pulley, *m'*. The movable sections A<sup>1</sup> A<sup>2</sup> are provided at their lower ends, respectively, with the pulleys *n n'*, rotating in the planes of their respective sections in metallic heel-plates *n<sup>2</sup>*. The hoisting-cords D, which are preferably of wire rope, are secured at one end to the middle section, *d*, of the drum, at each side of the collar *g*. They thence extend upward, over, and around the inner pulleys, *l'*, of the guides C', thence downward around the pulleys *n* of the section A<sup>1</sup>, thence upward between the outer pulleys, *l j<sup>2</sup>*, of the guides C C' of section A<sup>1</sup>. From this point they extend over the outer pulley, *l*, of guide C' of the section A<sup>2</sup>, thence downward under the pulley *n<sup>1</sup>* of the said section, thence upward between the inner pulleys, *l' j<sup>2</sup>*, of the guides C C', from which point they extend over a bracket, *o*, and are then rigidly secured to the ends of the rails of the upper section.

As the cords D are wound up on the drum in the act of extending the ladder-sections, the cords J, that draw down the ladder-sections, are unwound and payed out therefrom. These cords are secured to the drum-sections

$d'$ , and, after passing over the pulleys  $m'$  at the ends of the arms  $m$  of the guides  $C'$ , are secured to the upper end of the top section, as shown in Fig. 1. As the sections are lowered the cords  $D$  are unwound from the drum, and the cords  $J$ , that are preferably of wire rope, wound thereon. The bracing-cords  $J$ , being taut, prevent the ladder from sagging when set against the wall, and the hoisting-cords prevent it from bending in the opposite direction when being extended without support. When the hoisting-cords are unwound from the drum, thereby slackening them, the bracing-ropes are wound up thereon and cause the ladder-sections to descend. Should the ropes  $D$  become slack, a hand-spike is inserted into one of the sockets on the collar of the drum-section  $d$  and borne down upon, thereby causing the angular catch to slip out of one of the perforations and allowing the said section to rotate, when, the slack being taken up, the said catch drops into another perforation and locks the drum-sections together.

The arms  $m$  of the guides  $C'$  are braced together by the rods  $p$  and connected to the guide  $C$  by means of the braces  $p'$ . When space is an object—as, for instance, when the ladder is upon a truck—the arms  $m$  will be pivoted to the guide  $C'$  and the braces  $p'$ , formed of two lock-jointed sections,  $q$ . By this means the arms may be folded in upon the ladder. This construction is illustrated in Figs. 3 and 4.

While being extended, until the end of the top section rests against a wall, the ladder is supported by means of a strut,  $L$ , composed of two rails,  $r$   $r'$ , pivoted to the upper end of the lower section,  $A$ . The rail  $r'$  is rigidly secured to a metallic  $U$ -coupling,  $N$ , one of the branches of which is open, as shown at  $s$ , upon its side, so that the lower end of the post  $r$  may be received in it. When inserted, the post  $r$  is prevented from leaving the branch  $s$  by a slide-ring,  $t$ . This ring moves freely upon the post  $r$ , and may be raised or lowered at pleasure. When the post  $r$  is passed into the open branch  $s$  of the coupling  $N$ , this ring is brought down low enough to receive the said branch, and thus confine the post  $r$  in place.

Between the branches of the  $U$ -shaped foot  $N$  is a screw-threaded opening, in which is inserted an adjustable screw,  $P$ , the object of which is apparent. This screw is pointed at its lower end, and is prevented from undue penetration into the ground by stop-collar  $v$ . The upper end of the section  $A^2$  has rollers  $x$  secured thereto, that prevent the said section from being caught under a ledge or other projection of a wall.

The support  $L$  is prevented from vibrating away from the ladder-section  $A$  by means of cords secured to the rails of the said support and of the ladder.

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

1. The combination, with the shaft  $e$  and the fixed end sections  $d'$ , having flanges  $e'$ , provided with perforations  $i$ , of the rotating middle section,  $d$ , having similar perforated flanges and an angular locking-catch, substantially as specified.

2. The end guide  $C$  for extension-ladders, having slot  $j$  for the ladder-rail, open slot  $j^3$  for the sliding ladder-rail, and a slot,  $j^1$ , for a pulley, substantially as specified.

3. The lower guide,  $C'$ , for extension-ladders, having central opening,  $k$ , for the ladder-rail, lateral openings  $k^1$   $k^2$  for pulleys, open slot  $k^3$  for the rail of the sliding sections, and a brace-arm,  $m$ , having a pulley,  $m'$ , substantially as specified.

4. The combination, with the spaced guides  $C$   $C'$ , of the pivoted brace-arm  $m$  and lock-jointed brace-rod  $p'$ , substantially as specified.

5. The combination, with the ladder-section  $A$ , having guides  $C$   $C'$ , the former with outside pulleys,  $j^2$ , and the latter with inner and outer pulleys,  $l$   $l'$ , the ladder-section  $A^1$ , having foot-pulleys  $n$  and guides  $C$   $C'$ , the former with inner pulleys,  $j^2$ , and the latter with inner and outer pulleys,  $l$   $l'$ , and the ladder-section  $A^2$ , having foot-pulleys  $n'$ , of the winding-cords  $D$ , secured at one end to a drum, passing thence over the pulleys  $l$   $l'$ , thence downward around the foot-pulleys  $n$ , thence upward between the pulleys  $l$   $j^2$ , around the outer pulleys,  $l$ , of the section  $A^1$ , thence downward around the foot-pulleys  $n$  of section  $A^2$ , thence upward between the pulleys  $l'$   $j^2$  of section  $A^1$ , thence upward to the upper end of section  $A^2$ , to which they are then secured, substantially as specified.

6. In combination with the section  $A^1$  and the pivoted rails  $r$   $r'$  of the strut  $L$ , the  $U$ -shaped foot-rest  $N$ , having an adjusting-screw,  $P$ , and an open branch,  $s$ , and the slide  $t$ , confining the rail  $v$  to the rest  $N$ , substantially as specified.

7. In combination with a sectional extension-ladder,  $A$   $A^1$   $A^2$ , its drum  $B$ , and the raising-ropes  $D$ , passing in front of the said drum and secured thereto, the guides  $C$   $C'$ , having brace-arms  $m$  and pulleys  $m'$ , the brace-ropes  $J$ , secured to the end of the top section, passing over the pulleys  $m'$  downward in rear of the said drum and secured thereto, whereby the extension-ropes are wound around the drum as the brace-ropes are payed off therefrom, and the reverse, substantially as specified.

In testimony that I claim the above I have hereunto subscribed my name in the presence of two witnesses.

JEAN ELIE RICHARD.

Witnesses:

ALBERT SCHROEDER,  
TH. BRÜCKNER.