No. 726,682. PATENTED APR. 28, 1903.

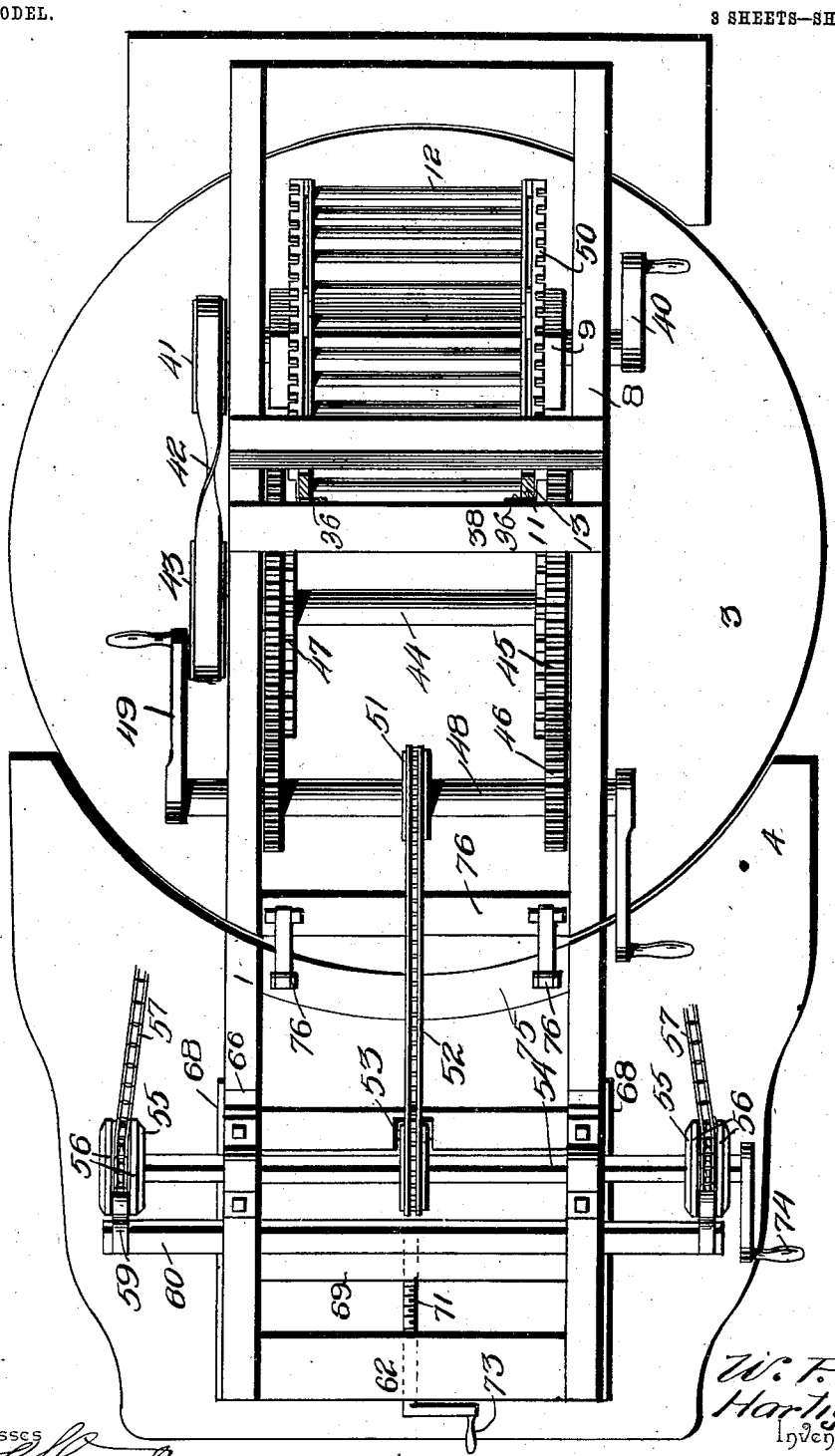
W. P. HARTIGAN.

EXTENSION LADDER.

APPLICATION FILED JUNE 10, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.



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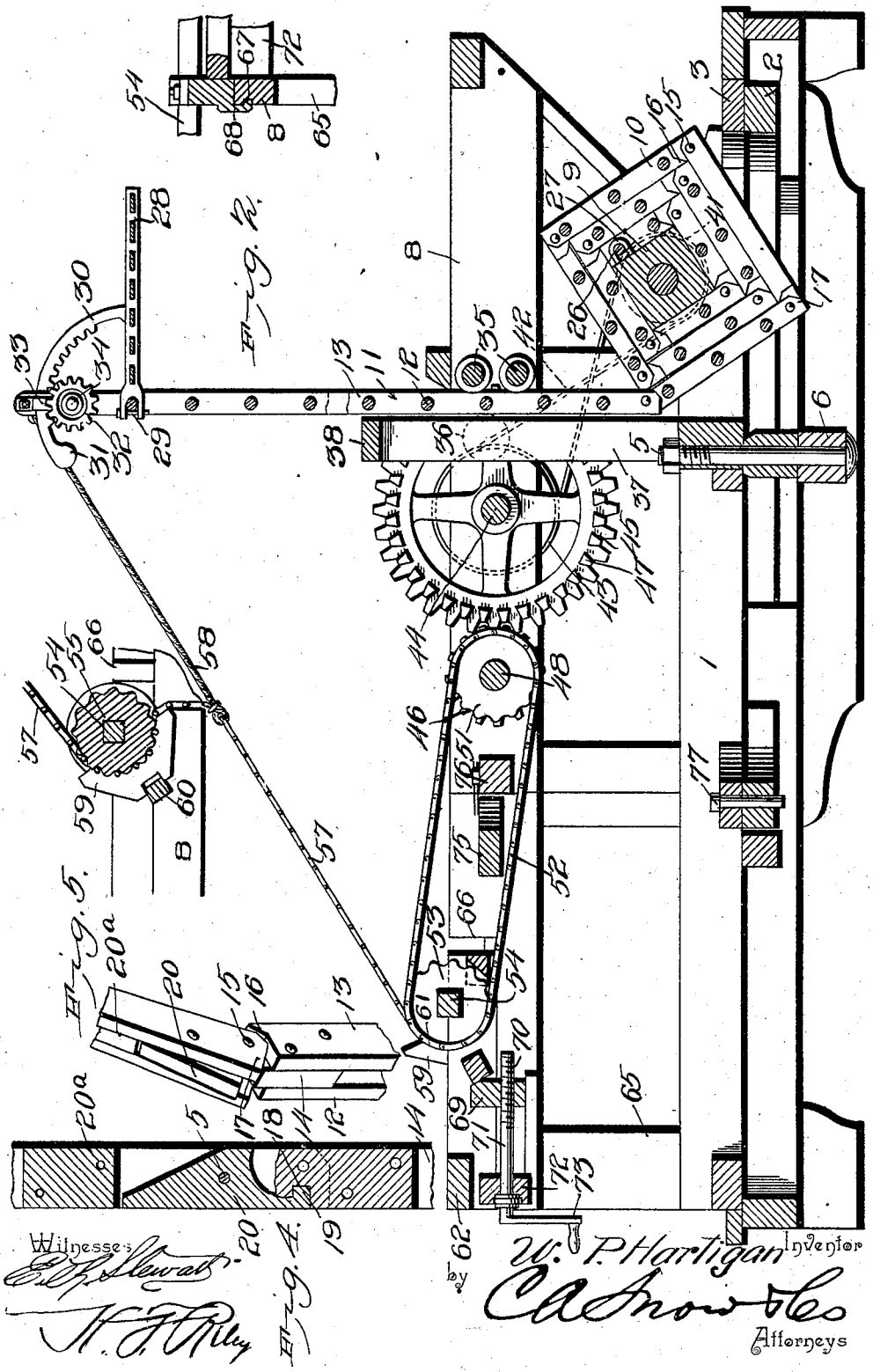
NO MODEL. 3 SHEETS—SHEET 2.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3.

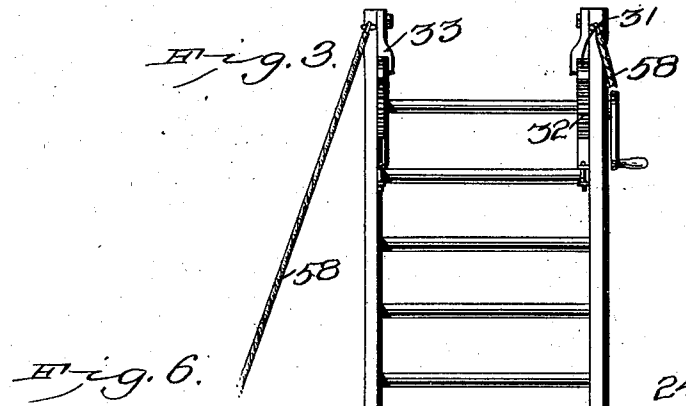


Fig. 7.

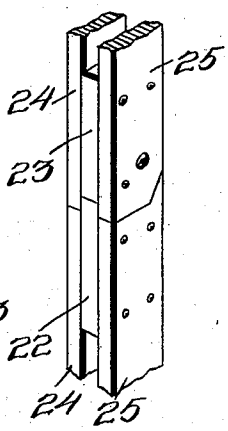
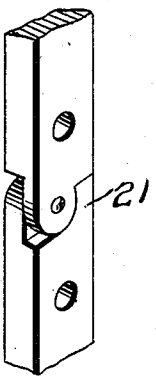
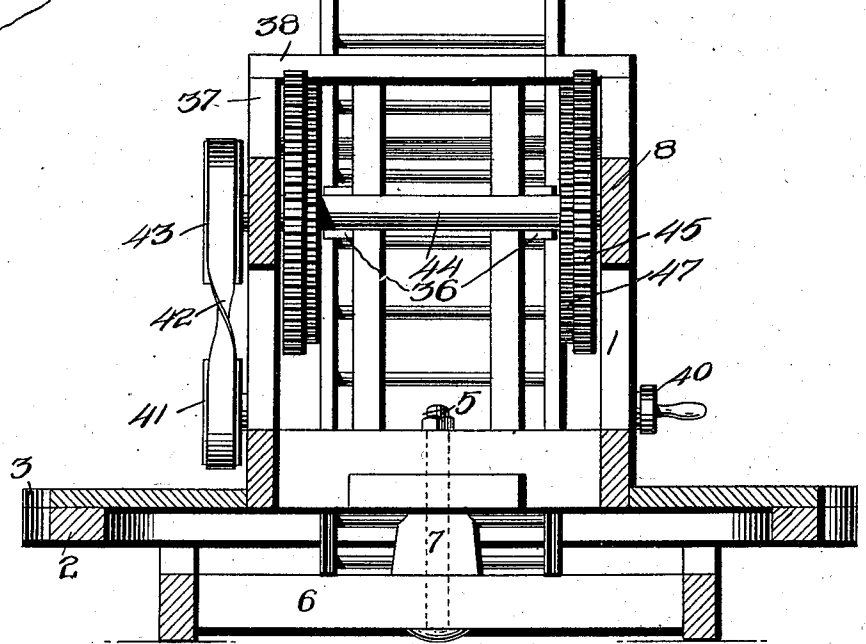


Fig. 6.





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UNITED STATES PATENT OFFICE.

WILLIAM P. HARTIGAN, OF LEXINGTON, VIRGINIA.

EXTENSION-LADDER.

SPECIFICATION forming part of Letters Patent No. 726,682, dated April 28, 1903.

Application filed June 10, 1902. Serial No. 111,054. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM P. HARTIGAN, a citizen of the United States, residing at Lexington, in the county of Rockbridge and State of Virginia, have invented a new and useful Extension-Ladder, of which the following is a specification.

The invention relates to improvements in extension-ladders.

The object of the present invention is to improve the construction of extension-ladders and to provide a simple and comparatively inexpensive one designed, primarily, for use by fire departments and mounted upon a suitable truck to enable it to be readily hauled to a fire, and adapted to be readily operated to elevate firemen and hose, and capable of rotation to arrange its platform or support in the desired direction.

The invention consists in the construction and novel combination and arrangement of parts hereinafter fully described, illustrated in the accompanying drawings, and pointed out in the claims hereto appended.

In the drawings, Figure 1 is a plan view of an extension-ladder constructed in accordance with this invention. Fig. 2 is a longitudinal sectional view. Fig. 3 is a transverse sectional view. Figs. 4 and 5 are detail views illustrating the construction of the means for hinging the sections of the extension-ladder and for locking them in alinement. Figs. 6 and 7 are detail views illustrating other forms of hinges. Fig. 8 is a detail view illustrating the construction of the grooved sprocket-wheels and the guards. Fig. 9 is a detail view illustrating the manner of mounting the sliding frame.

Like numerals of reference designate corresponding parts in all the figures of the drawings.

1 designates a main frame designed to be mounted on a suitable truck or to be otherwise provided with suitable wheels for enabling the extension-ladder to be readily hauled to a fire similar to the ordinary apparatus used at present by fire departments. The main frame is provided with a circular track 2, and it has pivoted to it a rotary turn-table 3, which in practice will be supported by suitable antifriction devices to enable it to be readily rotated for a purpose hereinafter described. The base of the main frame is composed of side bars and suitable connecting-bars, and it is provided with a suitable platform 4, as shown, and the turn-table has its upper face arranged flush with the upper face of the platform of the main frame. The pivot 5, which may be of any desired construction, is arranged at the center of the turn-table and is suitably mounted on a cross-bar 6, which is provided with a central block or support 7, through which the said pivot passes. The turn-table has mounted upon it an approximately oblong frame 8, composed of upper and lower side bars, uprights, or posts and suitable connecting-bars, which may be arranged as illustrated in the accompanying drawings, but which may be of any other desired construction. In practice the main frame and the turn-table frame will be constructed of flanged metal or other suitable material which will afford the desired strength and at the same time render the apparatus sufficiently light to enable it to be readily handled.

Mounted within the frame 8, near the outer end thereof, is a rotary polygonal drum 9, preferably rectangular in cross-section and adapted to receive foldable sections 10 of an extension-ladder, which is composed of the said foldable sections 10 and an outer section 11, which may be of any desired length and which is adapted to be folded down upon the top of the frame when the hinges hereinafter described, which connect the lower end of the outer section with the adjacent folding section 10, are located at the top of the frame 8. In Fig. 2 of the drawings, for convenience of illustration, the lower end of the outer section 11 of the ladder is extended downward below the top of the frame. The outer section of the extension-ladder is composed of continuous side bars and connecting-rungs, and the inner foldable sections, which are adapted to be wound around the drum and which are of different lengths to accommodate themselves to the adjacent links when the same are folded, as shown in Fig. 2, are composed of rungs and side bars 12 and 13, arranged in pairs and spaced apart, as clearly shown in Fig. 5, to receive the means for hinging the sections 10. Each section 10 is provided at one end with leaves or plates 14,

secured between the bars 12 and 13 of the section upon which it is mounted and projecting between the bars 12 and 13 of the adjacent section and perforated for the reception of a pivot 15, which passes through the leaf or plate 14 and the bars of the adjacent section, whereby the parts are hinged together. The bars 12 and 13, between which the leaf or plate is fixed, are recessed to form projecting stops 16, and the ends 17 of the bars of the adjacent section are beveled or cut away to fit the recesses and to engage the stops 16 to prevent the sections from swinging outward out of alinement. The stops limit the swing of the sections and permit the same to fold. The projecting portion of the leaf or plate 14 is provided at the outer edge with a recess 18, which is adapted to be engaged by a lug 19 of a pivoted locking device 20, mounted between the side bars of the section to which the leaf or plate 14 is pivoted and adapted to be oscillated to carry the lug into and out of the recess 18. The side bars are spaced apart adjacent to the ends 17 by means of blocks 20^a, which prevent the side bars from binding against the pivoted locking device. The pivot of the locking device is preferably arranged between the ends thereof, as clearly shown in Fig. 4, and the inner end of the locking device is adapted to be depressed or forced inward to disengage the lug 19 from the recess 18. As the sections of the latter are raised by the means hereinafter described they are rigidly locked in alinement by the pivoted locking devices 20. Instead of hinging the sections together, as just described, they may be connected by an ordinary rule-joint 21, as illustrated in Fig. 6 of the drawings. Also the side bars of the sections may be connected by a leaf or plate 22, constructed substantially the same as the leaf or plate 14, with the exception that the notch or recess is omitted and the locking device is not employed, the spacing-block 23 being arranged close to the leaf or plate, as clearly shown in Fig. 7. The ends of the side bars 24 and 25 are constructed similar to the side bars 12 and 13.

The innermost or lowermost section of the extension-ladder is suitably hinged to the drum, preferably by arranging the end rung 26 in suitable bearings 27, as clearly shown in Fig. 2 of the drawings. The ladder is provided near its top with a platform 28, hinged at its inner end to one of the rungs and adjustably connected with the ladder by the means hereinafter described, whereby it is adapted to be secured at any desired angle. The side bars of the platform, which may be constructed of any suitable material, are preferably bifurcated to receive the rung and are secured to the same by suitable fastening devices 29. The platform is supported between its ends by curved rack-bars 30, pivoted at their lower ends to the platform and provided at their inner edges with teeth and having stops 31 at their upper ends to limit the downward movement of the platform. The teeth of the curved rack-bars mesh with pinions 32, and they are held in such engagement by suitable guides 33, consisting of blocks mounted upon the inner faces of the side bars of the outer section of the ladder at points above the rack-bars and provided at their lower ends with suitable recesses, which receive the rack-bars, as clearly shown in Fig. 3 of the drawings. The pinions 32 are mounted upon a transverse shaft 34, having a crank-handle at one end, by means of which the pinions may be readily rotated to adjust the platform, and the latter is locked in its adjusted position by means of a pawl and ratchet or other suitable locking device.

The ladder is guided in its vertical movement by means of a pair of outer transverse rolls 35 and inner rollers 36, which are mounted on suitable uprights 37, and the latter are connected at their upper ends with the sides of the frame by a cross-bar 38. The transverse rolls are preferably enlarged adjacent to the side bars to receive the same, as clearly shown in Fig. 3, and they extend entirely across the frame, being journaled in suitable bearings of the same. The inner rollers are mounted on pins or stub-shafts, and the ends of the bar 38 are secured to brackets or blocks 39 of the sides of the frame.

The drum is provided at one end with a crank-handle 40, arranged on the exterior of the frame and adapted to enable it to be readily rotated to wind up the folding sections to the desired tension should there be any slack. The other end of the drum is provided with a pulley or wheel 41, which is connected by a crossed belt 42 with a pulley or wheel 43 of a transverse shaft 44, and the latter carries a pair of gear-wheels 45, located at opposite sides of the frame and meshing with pinions 46 and provided at their inner faces with laterally-projecting teeth 47. The pinions 46 are mounted upon a shaft 48, which is preferably provided at each end with a crank-handle 49, but which may be operated by a single crank-handle, if desired, for raising and lowering the ladder. The gear-wheels 45 have their side teeth meshing with teeth 50, extending outward from the side bars 13 of the foldable sections and forming rack-bars. A pawl and ratchet or any other suitable means may be employed for locking the ladder at any desired elevation. The gear-wheels are adapted to be readily rotated by the crank-handles 49 of the shaft 48 and the extension-ladder may be readily raised or lowered, and when lowered the outer section is adapted to be swung downward to a horizontal position. The shaft 48 also has keyed or otherwise secured to it a sprocket-wheel 51, which is connected by a sprocket-chain 52 with a similar sprocket-wheel 53 of a counter-shaft 54. The counter-shaft 54 is provided at its ends with grooved sprocket-wheels 55, provided with sprocket-teeth arranged in peripheral grooves

and located between side flanges 56, formed by the said grooves. The grooved sprocket-wheels receive sprocket-chains 57, which are connected at their upper ends by cables 58 or other flexible connections with the upper ends of the side bars of the outer section of the ladder and forming, with the same, guys for supporting or bracing the said ladder. The grooved sprocket-wheels are rotated simultaneously with the gear-wheels, and the flexible guys are paid out simultaneously with the raising of the ladder. The sprocket-chains 57 are retained in mesh with the grooved sprocket-wheels by guards 59, mounted on a transverse bar 60 and consisting of plates extending into the grooves of the sprocket-wheels and provided with curved recesses 61, conforming to the configuration of the sprocket-wheels. The bars 60 are suitably secured to a sliding frame 62, upon which the transverse counter-shaft 54 is mounted. The guards effectually prevent the sprocket-chains from accidentally getting out of mesh with the grooved sprocket-wheels.

The supporting-frame is provided with an upright portion 65, composed of upper and lower side bars, posts, or supports and suitable connecting-bars, and the upper side bars, which are recessed or cut away at 66 to receive the sliding frame, are provided at their outer faces with horizontal grooves 67, which are engaged by inwardly-extending portions of approximately L-shaped flanges 68, which depend from the sides of the sliding frame. The sliding frame is composed of side bars, a connecting end bar, and an intermediate connecting-bar 69, having a threaded opening for the reception of a threaded portion 70 of a rod or screw 71, which is mounted on an end bar 72 of the main frame. The screw or rod is provided at its outer end with a crank-handle 73 and is adapted to be rotated to move the sliding frame inward and outward to tighten the sprocket-chain. The counter-shaft, which carries the grooved sprocket-wheels, may be operated independently of the gearing for raising and lowering the ladder, and it is designed to be provided with suitable means, such as a pawl and ratchet, for securing it in its adjusted position, and it has a crank-handle 74 at one end for rotating it. The upper ends of the sprocket-chains 57 are detachably secured to the lower ends of the cables by any suitable means, and they are adapted to be uncoupled to fold the outer section, or rather after the outer section has been folded. The upwardly-extending portion 65 of the frame is provided with a curved bar 75, arranged adjacent to the frame of the turn-table, and it is engaged by suitable catches 76, mounted on the frame of the turn-table and adapted to secure the same in alinement with the main frame. The catches are adapted also to release the turn-table to permit the latter to be partially rotated to extend the platform to either side of the apparatus, and it may be secured in such adjustment by means of a lower locking-pin 77, mounted in a perforation of the turn-table and adapted to engage perforations of the track of the main frame. The perforations may be arranged at intervals, as will be readily understood, and the guys may be arranged to extend across the apparatus when the turn-table has been rotated, and at least one guy will be in position for firmly supporting the ladder.

It will be seen that the extension-ladder is simple and comparatively inexpensive in construction, that it is adapted to be readily raised and lowered, and that the apparatus may be easily handled in the same manner as the ordinary apparatus of a fire department.

What I claim is—

1. In an apparatus of the class described, the combination of a frame, an extension-ladder composed of an outer section and a series of folding sections hinged together and similarly connected to the outer section and provided with pivoted locking devices located at the hinged joints and rigidly holding the sections in alinement and adapted to be swung out of engagement with the sections to release the same, means for raising and lowering the ladder, and means for bracing the ladder, substantially as described.

2. In an apparatus of the class described, the combination of an extension-ladder composed of sections having rungs and provided with side bars arranged in pairs, leaves or plates secured between the bars at one end of each section and pivoted between the bars of the adjacent section and provided with recesses, and locking devices provided with lugs engaging the recesses of the leaves or plates and pivotally mounted between the side bars of the adjacent section and capable of movement independently of the sections, substantially as described.

3. In an apparatus of the class described, the combination of an extension-ladder composed of sections having rungs and provided with side bars arranged in pairs and having abutting shoulders, leaves or plates fixed between the side bars at one end of each section and pivoted between the side bars of the adjacent section and provided with recesses, locking devices provided with lugs for engaging the recesses of the leaves or plates and pivotally mounted between the side bars of the adjacent section and movable independently of the sections, and spacing-blocks located between the side bars of such section, substantially as described.

4. In an apparatus of the class described, the combination of a frame, a drum mounted on the frame and provided at one end with a crank-handle and having a wheel or pulley at the other end, an extension-ladder provided with sections hinged together and having racks and arranged to be wound upon the drums, a transverse shaft provided with gear-wheels having teeth arranged to mesh with the racks, a pulley or wheel mounted on the

transverse shaft, a belt connecting the pulleys or wheels, for simultaneously raising the ladder and unwinding the same from the drum, and means for operating the shaft, substantially as described.

5. In an apparatus of the class described, the combination of a frame, a drum, an extension-ladder composed of sections hinged together and provided with racks arranged longitudinally of the ladder, gear-wheels provided with teeth meshing with the racks for raising and lowering the extension-ladder, and means for operating the drum and the gear-wheels, substantially as described.

6. In an apparatus of the class described, the combination of a main frame having a circular track, a turn-table mounted on the track and provided with a frame, an extension-ladder carried by the turn-table, means for raising and lowering the extension-ladder, a shaft mounted on the main frame and provided with sprocket-wheels, guy-lines provided with sprocket-chains meshing with the sprocket-wheels, and gearing for connecting the shaft with the means for raising and lowering the ladder, substantially as described.

7. In an apparatus of the class described, the combination of a frame, an extension-ladder, means for raising and lowering the same, guy-lines provided with sprocket-chains, grooved sprocket-wheels receiving the sprocket-chains, guards extending into the grooves of the sprocket-wheels and retaining the sprocket-chains in mesh with the same, and means for operating the sprocket-wheels, substantially as described.

8. In an apparatus of the class described, the combination of a main frame, a turn-table mounted on the main frame, an extension-ladder carried by the turn-table, gearing for raising and lowering the extension-ladder and mounted on the turn-table, a shaft, a sliding frame mounted on the main frame and carrying the said shaft, sprocket-gearing connecting the shaft with the gearing for raising and lowering the ladder, means for adjusting the sliding frame, sprocket-pinions mounted on the shaft, guy-lines having sprocket-chains connected with the sliding frame and meshing with the sprocket-pinions, and guards retaining the sprocket-chain in mesh with the sprocket-pinion, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

WILLIAM P. HARTIGAN.

Witnesses:
J. P. MOORE,
E. L. CONNER.